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The Who.I.Am study : Identity formation and motor competence in adolescents

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THE WHO.I.AM STUDY: IDENTITY FORMATION AND MOTOR COMPETENCE IN ADOLESCENTS

by

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Author's declaration

I declare that this thesis does not incorporate without acknowledgement and material previously submitted for a degree or diploma in any university of higher education, and that to the best of my knowledge it does not contain any materials previously published or written by another person except where due reference is made in the text.

Signature:_____ Date: _____

Amanda May Timler

Statement of contributors

Amanda Timler is the primary author of this thesis including all research articles presented in Chapters 3-7. This thesis is her own work, and has been written to provide her with a higher degree in research. The candidate is also a co-author on some additional publications relevant to, but not forming a part of, this thesis.

Professor Beth Hands is the primary supervisor of this thesis. She has been cited as the last author on all but one primary research article that makes up this thesis. She was also a co-author on additional publications relevant to the thesis. Her expertise and guidance has helped put together the findings of this thesis.

Associate Professor Fleur McIntyre is the co-supervisor of this thesis and has been a co-author on all the primary research articles that make-up this thesis. She was also a co-author on additional publications that are relevant, but not a part of, this thesis. Her knowledge on motor competence has helped in the completion of this thesis

Dr. Marja Cantell contributed to the development of the Adolescent Motor Competence Questionnaire (AMCQ) and is a co-author on the primary research article relating to its development (Chapter 3). She led the cultural adaptation of the AMCQ in the Netherlands (AMCQ-NL), and is the last author on the paper reporting its findings '*Cross-cultural Dutch adaptation of the Adolescent Motor Competence Questionnaire (AMCQ) and preliminary exploration of its psychometric properties*', currently in preparation. She has also provided mentorship for this thesis as she was selected by the Collaborative Research

Network to visit Australia in November, 2014. She has contributed to the presentation on the AMCQ presented at the DCD-11 international conference in Toulouse France and presented a poster on the psychometric properties of the AMCQ-NL at the DCD-12 international conference in Perth, Western Australia.

Dr. Susan Crawford contributed to the development of the AMCQ and is a co-author on the primary research article discussing its development (Chapter 3). Her international expertise in questionnaire development led to her involvement with this thesis.

Dr. Kirstin Goth is the original developer of the Assessment of Identity health in Adolescence (AIDA) questionnaire. She provided guidance on the culture-adapted translation for AIDA Australia and clarification on new test items. Kirstin assisted in providing German population norms from AIDA and compared them to the results of AIDA Australia to establish its psychometric properties. Kirstin is the last author on the AIDA Australia primary article (Chapter 4).

Associate Professor Caroline Bulsara assisted in analysing the qualitative adolescent interview data (Chapter 5). She is a co-author on this article as her expertise in qualitative research provided guidance on the methodology (explanatory mixed methods design) as well as the reporting of the results in this paper.

Dr. Elizabeth Rose is a co-author on two primary research articles for this thesis (Chapter 5 and 6). Her expertise in self-perceptions and motor competence was imperative to helping the primary author better understand and explain identity health.

Abstract

Our sense of identity is an emergent concept that develops over the lifespan in response to many factors, however the adolescent phase is the most critical. During adolescence, some factors that influence identity are level of parent and peer support, environmental stresses and the ability to form personal interests and goals. These factors influence the health of one's identity in both positive and negative ways, which may differ between males and females. Therefore, identity health refers to an individual's capacity to develop a positive sense of self and to integrate their self within a number of valuable social settings. One factor that has not previously been examined in relation to the health of identity is the influence of an individual's motor competence. During adolescence, the associated social-emotional challenges of low motor competence (LMC) such as reduced peer support, social immaturity, or limited peer interaction may be more harmful than the initial difficulties associated with LMC experienced during childhood. The purpose of this thesis, therefore, was to examine whether levels of motor competence, parent's awareness of motor competence and self-perceptions influenced the health of an adolescent's identity.

LMC during adolescence is often under recognised as a cause for concern as many parents, teachers and clinicians are unaware of the significance of this condition. Furthermore, few assessments of motor competence have been specifically developed for this age range. To address this need, the first paper of this thesis describes the development and evaluation of the Adolescent Motor Competence Questionnaire (AMCQ) with a small sample of 38 adolescents. Evidence of reliability and concurrent validity with the McCarron

Assessment of Neuromuscular Development (MAND; McCarron, 1997) was established. In the second paper, a Principle Component Analysis (PCA) of the AMCQ data for 160 adolescents (64.4% males, M_{age} = 14.44 years, *SD* = 0.75) was undertaken. Four factors representing Physical Activities and Sports, Activities of Daily Living, Public Performance and Peer Comparison were identified. A second order analysis yielded just one factor with contributions from all first order factors which provided evidence of construct validity of the AMCQ (Chapter 3).

To examine the complex construct of identity health, a cultural adaptation of the Assessment of Identity Development in Adolescents (AIDA, Goth et al., 2012) questionnaire, developed simultaneously in Germany and Switzerland, was completed and reported in the third paper (Chapter 4). The main test results with a sample of 126 (67.5% boys, *M* = 14.6 years, *SD* = 0.9) indicated that the 58-item version was suitable for use among Australian adolescents.

Motor competence (AMCQ scores) and its relationship to the health of an adolescent's identity (AIDA scores) was examined in the fourth paper using a sequential mixed method design (Chapter 5). The quantitative (N = 160) results revealed males had higher motor competence scores, while females had less healthy identity scores compared to males. The LMC adolescents had less healthy identity scores compared to the high motor competence (HMC) adolescents. Interviews with 17 adolescents were used to interpret these quantitative results. Five main themes emerged; Peer Support, School Experiences, Personal Changes, Future Planning and Communication. Overall,

the HMC males had the healthiest identities, LMC males and HMC females experienced similar identity challenges, while the LMC females experienced the greatest difficulties regarding the health of their identity. The LMC females felt greater pressure to reach their future goals and experienced more fragmented friendships.

A parent's awareness of their child's motor competence may also influence other areas of their adolescent's life. Therefore, the level of agreement between a parent report questionnaire [Developmental Coordination Disorder Questionnaire, 2007 (DCDQ-07; Wilson et al., 2009)] and the adolescent self-report questionnaire (AMCQ) was examined in the fifth paper (Chapter 6). The results from 133 parent and adolescent dyads (66.2 % males, M_{age} = 14.49 years, *SD* = 0.79) revealed a high proportion of agreement, primarily due to the number of HMC case-agreements. Parents identified more males (11) than females (9) with LMC, whereas more female adolescents (22) self-reported LMC compared to males (18). These findings suggest self-report assessments during adolescence may be a more sensitive measure of motor competence, especially for females compared to a parent report measure.

In the sixth and final paper, adolescent self-perceptions (N = 160) across a range of domains (Self-Perception Profile for Adolescence [SPPA], Harter 2012b) were examined to determine if they mediated the relationship between motor competence and adolescent identity health (Chapter 7). For the total sample regardless of motor competence or gender, self-perceptions of social competence, physical appearance, close friendships and global self-worth mediated this relationship. For the HMC group (*n* = 108), self-perceptions of

physical appearance and global self-worth played a mediating role, and although not significant, social competence, and behavioural conduct positively influenced this relationship. When the sample was separated by motor competence (high and low) and gender (male and female) no significant relationships among any of the self-perception domains were seen. However perceptions of close friendships were important for the LMC group (n = 52) and for males (n = 103). In addition, for the males, perceptions of global self-worth were important for their identity health. No self-perceptions mediated this relationship for the females (n = 57). Overall, the results from these six papers indicate that the health of an adolescent's identity differs depending on their level of motor competence and gender.

To conclude, a multi-dimensional framework of four factors was designed to examine the relationships between an adolescent's level of motor competence, identity health, individual self-perceptions, and parental support. This framework was used to consider the relationship between any two variables (such as motor competence and parent support) to see if one component changed as a result of another. It was found that all variables were higher for those with HMC (males and females). A male's identity health was stronger with an increasing level of motor competence, however this relationship was not evident among females. Greater perceived close friendships improved identity health among adolescents with LMC, both males and females. Finally, level of motor competence influenced identity health among the LMC males but not the LMC females. Overall the LMC group experienced greater setbacks towards their identity health such as finding

appropriate social support which was due to their level of motor competence and ability to participate in age appropriate activities such as sports.

Together these results highlight that the health of identity during adolescence is influenced by gender, motor competence and parental support. The negative impact of LMC on identity health during adolescence suggests that greater support and understanding from parents, teachers and peers is needed for this group, especially for the LMC females.

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I have really enjoyed my PhD journey over the last three and a half years. This opportunity could not have come at a better time for me as I was looking for a new challenge. This experience has allowed me to grow, and become more confident in my research skills, teaching and lecturing. I am so blessed to have met both of my supervisors, Beth and Fleur to guide me through this journey.

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my computer and for your extra efforts around the house so I could relax has made the past three and a half years a lot less stressful. You have always provided me with good food and wine (on the odd occasion too much wine), however you always remind me to slow down and try not to stress over the small stuff. Your sense of humour and reminding me to have fun has helped me over the past three years! Thank you for constantly reminding me that I have the best job in the world! This PhD was a team effort on both of our parts. I feel that you have invested just as much time into its success and completion as I have, and now we have done it! I cannot wait to see where this experience takes us. Thank you for sharing this journey and a future life experiences with me. I cannot thank you enough! I love you! Xx

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Glossary

Identity

Identity is made up of biological, social and cognitive characteristics of an individual (Crocetti, Erentaite, & Zukauskiene, 2014) and is connected by two constructs of continuity (a sense of self) and coherence (sense of belonging within the social context; Goth, Foelsch, Schluter-Muller, & Schmeck, 2012).

Coherence – is the 'sense of identity' as it relates to social engagements, social attention and a sense of belonging (Goth et al., 2012). It is also referred to as the Me-self (James, 1892) and defined through social roles (Brewer, 1991).

Continuity – develops through experiences that become relevant within one's self. It refers to an individual's uniqueness and their sense of self (Goth et al., 2012) and is also known as the I-self (James, 1892) and personal identity (Brewer, 1991).

Identity-health - can range from healthy to less healthy. It is dependent upon whether an individual experiences a positive or negative sense of self, is able to recognise their personal strengths and limitations and is able to integrate these into different social settings.

Identity-integration – is the resolution of an identity crisis as commitments to personally desired decisions and social interactions have been made by an individual (Goth et al., 2012). These individuals have a coherent

sense of self and form strong relationships with significant others. Other synonyms are ego identity, identity achiever and identity health.

Identity-diffusion – is when an individual experiences a low sense of self and does not seek out who they want to be, they often avoid making identity decisions (Goth et al., 2012). Other synonyms are diffused identity, less healthy identity.

Motor skill competence

Motor skill competence is the mastery of physical skills and movements that lead to the enjoyment of physical activity (Gallahue & Ozmun, 2006).

Actual motor competence - is an individual's capability to master motor skill competence which includes being able to perform both fine and gross motor skills (Gallahue & Ozmun, 2006).

Developmental Coordination Disorder (DCD) - is a neuromuscular disorder defined by the Diagnostic and Statistical Manual of Mental Disorders (fifth edition; DSM-5) through four diagnostic criteria (1) where impairments in coordination and motor tasks are lower than expected for an individual's chronological age, (2) motor skills significantly interfere with activities of daily living (ALDs), (3) the onset of symptoms occurs during early development and (4) motor difficulties are not better explained by intellectual disability or visual impairments (American Psychiatric Association [APA], 2013). Synonyms include motor impairment, suspected motor difficulties, low motor competence and poor motor coordination.

High motor competence (HMC) – is the ability to master physical movement tasks (including fine and gross motor) with ease (Gallahue & Ozmun, 2006).

Low motor competence (LMC) – is a difficulty efficiently completing physical movement tasks (Gallahue & Ozmun, 2006) such as physical activity and sports participation and ADLs.

Perceived motor competence – is an individual's personal belief and awareness of their own capability towards their mastery of physical skills such as gross and fine motor tasks (Harter 1993; 2012a).

Self

The self consists of personal thoughts and feelings that include cognitive and social constructs, which have been conceptualised as: the I-self and me-self (Harter, 2012a).

I-self – is considered the subjective self and is a stable construct allowing for individuals to remain the same over time (Harter 1999; James, 1980). The I-self is also associated with a stable identity as both constructs help to make up an individual's personal goals, talents, commitments, roles and relationships (Goth et al., 2012).

Me-self – is the objective self which refers to one's knowledge and how they engage within their social context (Jung, Pick, Schluter-Muller, Schmeck & Goth 2013). The me-self helps to form a coherent sense of self through the inclusion of the social environment (Harter 1999; James, 1980).

Self-perception – is an individual's personal knowledge about the self (Harter, 1993). It is influenced by an individual's own actions that are represented by one's past, present and future (Cantell, 1998).

List of abbreviations

AAC-Q	Adolescent and Adult Coordination Questionnaire
AIDA	Assessment of Identity Development in Adolescence
ADC	Adult Developmental Coordination Disorder/Dyspraxia Questionnaire
ADLs	Activities of Daily Living
AMCQ	Adolescent Motor Competence Questionnaire
ANOVA	Analysis of Variance
APA	American Psychiatric Association
BOT-2	Bruininks-Oseretsky Test of Motor Proficiency, Second Edition
CSQ	Co-ordination Skills Questionnaire
FMS	Fundamental Movement Skills
FDQ-9	Functional Difficulties Questionnaire- 9 items
HMC	High Motor Competence
IH	Identity Health
DCD	Developmental Coordination Disorder
DCDQ	Developmental Coordination Disorder Questionnaire

DCDQ’07	Developmental Coordination Disorder Questionnaire 2007
DSM-IV	Diagnostic and Statistical Manual of Mental Disorders (Fourth Edition)
DSM-IV-TR	Diagnostic and Statistical Manual of Mental Disorders (Text Revision Fourth Edition)
DSM-5	Diagnostic and Statistical Manual of Mental Disorders (Fifth Edition)
ICC	Intra-class Correlation Coefficient
LMC	Low Motor Competence
MABC-2	Movement Assessment Battery Checklist (Second Edition)
MAND	McCarron Assessment of Neuromuscular Development
MC	Motor Competence
SPPA	Self-Perception Profile for Adolescence
SMD	Suspected Motor Difficulties

List of publications and presentations

Publications forming part of this thesis

(Published manuscripts are in Appendix E)

Chapter	Papers	Status
Chapter three	**Timler, A.,** McIntyre, F., Cantell, M., Crawford, S. & Hands, B. (2016). The development and evaluation of the psychometric properties of the Adolescent Motor Competence Questionnaire (AMCQ) for Adolescents. *Research in Developmental Disabilities*, 59, 127-137. Doi: http://dx.doi.org/10.1016/j.ridd.2016.08.005.	Published
Chapter three	**Timler, A.,** McIntyre, F., & Hands, B. (2018) Factors contributing to Australian adolescents' self-report of their motor skill competence. *Journal of Motor Learning and Development,* Doi: http://doi.org/10.1123/jmld.2016-0069.	Published
Chapter four	**Timler, A.,** McIntyre, F., Hands, B. & Goth., K. (2017). *The psychometric properties of the Assessment of Identity Development in Adolescence (AIDA) Australia*. Manuscript in preparation.	In preparation
Chapter five	**Timler, A.,** McIntyre, F. & Hands, B. (2017) Identity health, a comparison between high and low motor competence adolescents: A mixed method study. *Journal of Adolescent Research* Manuscript submitted for publication.	Under review
Chapter six	**Timler, A.,** McIntyre, F. & Hands, B. (2018). Adolescent self-report motor assessments may be more realistic than those of their parents.' *British Journal of Occupational Therapy,* 1-7, Doi: 10.1177/03022617743681	Published
Chapter Seven	**Timler, A.,** McIntyre, F. & Hands, B. (2017) Exploring the influence of self-perceptions on the relationship between motor competence and identity in adolescents *BMC Pediatrics.* Manuscript submitted for publication.	Under review

Additional publications relevant to, but not forming part of this thesis

(Published manuscripts are in Appendix F)

Appendix	Papers	Status
✓	**Timler, A.,** McIntyre, F., Cantell, M., Crawford, S. & Hands, B. (2015) Abstracts: 11th International Conference on Developmental Coordination Disorder (DCD-11) Developmental Coordination Disorder and other neurodevelopmental disorder: A focus on comorbidity, *Journal of Comorbidity, 5* (23), 32-109 DOI: 10.15256/joc.2015.5.52.	Published
	Zwiers, K., **Timler, A.,** Hands, B., McIntyre, F., Crawford, S., & Cantell, M. (2017). *Cross-cultural Dutch adaptation of the Adolescent Motor Competence Questionnaire (AMCQ) and preliminary exploration of its psychometric properties*. Manuscript in preparation.	In preparation
	Grace, T., **Timler, A.** & Hands, B. (2017). *Fitness and motor coordination in a cohort of Australian adolescents*. Manuscript in preparation.	In preparation

Scientific conference presentations and posters and industry presentations related to this thesis

(Full presentations are in Appendix G)

Type	Presentations	Presented
International Presentation	**Timler, A.,** McIntyre, F., Cantell, M., Crawford, S. & Hands, B. (2015). *The development and evaluation of the Adolescent Motor Competence Questionnaire (AMCQ).* Presented at the Developmental Coordination Disorder Conference 11.	Toulouse, France. July 2nd – 4th, 2015.
International Presentation	**Timler, A.,** McIntyre, F., Bulsara. C., Rose. E., & Hands, B. (2017). *The development of a healthy identity is compromised in adolescents with LMC: The who.i.am study*. Presented at the Developmental Coordination Disorder Conference 12.	Perth, Western Australia (WA). July 5th – 8th, 2017.
International Poster	**Timler, A.,** McIntyre, F. & Hands, B (2017). *Is self-report versus parent report similar for adolescent's motor competence?* Presented at the Developmental Coordination Disorder Conference 12.	Perth, WA. July 5th – 8th, 2017.
International Poster	Zwiers, K., Cantell, M., **Timler, A.,** McIntyre, F., Crawford, S. & Hands, B. (2017). *Cross-Cultural Dutch Adaptation of the Adolescent Motor Competence (AMCQ-NL) and Exploration of its Psychometric Properties.* Presented at the Developmental Coordination Disorder Conference 12.	Perth, WA. July 5th – 8th, 2017.
Industry presentation	**Timler, A.,** McIntyre, F., Cantell, M., Crawford, S. & Hands, B (2014) Examining how identity formation might differ between adolescents with high and low levels of motor competence Presented at Brain, Behaviour and Mental Health Conference.	Perth, WA May 16th, 2014.
Industry presentation	**Timler, A.,** McIntyre, F & Hands, B (2014) Tool development and validation: Adolescent Motor Competence Questionnaire. Presented at the University of Notre Dame School of Health Sciences Higher Degree Research Presentation Series.	Perth, WA November 7th, 2014.

Industry presentation	Carey-Hill, W. & **Timler, A.** (2014) Knowledge Translation. Presented at the University of Notre Dame School of Health Sciences Higher Degree Research Presentation Series.	Perth, WA November 7th, 2014.
Industry presentation	**Timler, A.,** McIntyre, F., Cantell, M., Crawford, S. & Hands, B (2015) The development and evaluation of the Adolescent Motor Competence Questionnaire (AMCQ) with cross cultural comparisons with the Netherlands. Presented at the University of Notre Dame School of Health Sciences Research Seminar Series.	Perth, WA December 4th, 2015.
Industry presentation	**Timler, A.,** McIntyre, F. & Hands, B (2016) PhD update: The who.i.am study. Presented at the University of Notre Dame School of Health Sciences Research Seminar Series.	Perth, WA October 14th, 2016.
Industry presentation	**Timler, A.,** McIntyre, F. & Hands, B (2016) Who am I? Five minute presentation, presented at the University of Notre Dame Health Research Symposium.	Perth, WA December 8th, 2016.

CHAPTER ONE: Introduction

Who.i.am

'People say I'm a hipster, because of my music taste and fashion sense, however, I would also like to broaden my musical skills and make my own music at some stage. I don't really like to define myself as one particular group, rather just being who I am.'

(**15-years-old, HMC male**)

Introduction

An individual's sense of self and identity are thought to influence their motivations, the way they think and make sense of themselves and others, their actions and how they control and regulate their feelings (Leary & Tangney, 2012; Ryan & Deci, 2012). The stability and the development of a healthy identity is affected by biological, cognitive and social interactions (Cantell, 1998; Crocetti et al., 2014). In addition, changes in cultural and environmental (schools or work place; Marcia, 1966) contexts may impact identity health and its development across the lifespan. Together these factors and contexts drive a person's internal thoughts, guide future decisions, influence intrinsic motivation and shape daily habits and routines (Arnett, 2000; Harter, 2012a). Therefore the health of an adolescent's identity can range from healthy to less healthy and is dependent upon whether an individual experiences a positive or negative sense of self, is able to recognise their personal strengths and limitations and is able to integrate these into different social settings.

The most crucial phase for the development of a healthy identity occurs during early (12- to 14-years-old) to middle (15- to 17-years-old) adolescence, which is heavily influenced by individual decision-making (Cantell, 1998; Crocetti et al., 2014), and when childhood identifications are questioned (Becker et al., 2014; Brinthaupt & Lipka, 2002; Erikson, 1968). Adolescents now explore their identities in an 'online' social world making it challenging for them to understand who they are, as their role models and value systems are largely influenced by public exposure, social media and the internet (de Vries, Peter, de Graaf, & Nikken, 2016). Decisions which influence their identity are also affected by their social-emotional and psychological well-being (Phillips

& Pittman, 2007; Vleioras & Bosma, 2005), importance placed on personal interests (Goth et al., 2012; Kroger, 2007) and in particular, parent and peer acceptance (Doumen, et al., 2012; Harter, 2012a; McLean, & Jennings, 2012). Social support from family and peers (Kroger, 2007; Owens, Robinson, & Smith-Lovin, 2010) is important as it guides decisions around which experience(s) should become a priority and become engrained within the self (Duriez, Luyckx, Soenens, & Berzonsky, 2012; Harter, 1999, 2012a) and helps to establish identities unique from their parents (McLean & Jennings, 2012). Therefore, the health of an adolescent's identity is ultimately reliant on both their personally valued beliefs and their social experiences in different contexts (Brewer, 1999).

Although these psychosocial factors and social contexts have previously been explored with regards to identity formation, little is known about the influence of motor competence on adolescent identity. It may be important to consider an adolescent's level of motor competence as research findings have shown that it influences involvement in age appropriate activities, level of peer support and sense of self through both positive and negative personal beliefs and experiences (Cairney, Hay, Faught, Mandigo, & Flouris, 2005; O'Dea & Connell, 2016). It is therefore possible that level of motor competence may also influence their identity health. However, research examining the relationship between motor competence (high or low) and identity health is lacking.

Adolescents with low motor competence (LMC) are a high risk group for a range of health issues as they are less physically active (Rivilis et al.,

2012), more socially isolated (Hill, Brown, & Sorgardt, 2011; Payne, Ward, Turner, Taylor, & Bark, 2013) and experience lower self-perceptions across a range of domains (Rose, Larkin, Parker, & Hands, 2015; Skinner & Piek, 2001). Previously, only one qualitative study involving adolescents with LMC sought to identify what factors influenced their identity (Lingam, Novak, Emond, & Coad, 2013). The identity of the 11 adolescents was heavily influenced by their daily experiences (many negative), the type of strategies they used to overcome difficulties at school (such as peer bullying or challenging classroom tasks) and at home. A sense of belonging was more likely to be achieved if they developed a social group which valued their strengths (Lingam et al., 2013). The authors recommended further research around identity formation in this population is needed (Lingam et al., 2013). Other important influences on identity health and level of motor competence may also include an adolescent's self-perceptions and their parent's awareness of their motor competence and how it may influence their identity. However no previous research was found that examined these factors in relation to level of motor competence. Finally, the influence of these factors might differ between males and females as males place a higher value on their ability to participate in vigorous physical activities such as team sports whereas females tend to engage in more sedentary, cooperative activities such as creative hobbies or hanging out with friends (Tatlow-Golden & Guerin, 2017). Therefore, understanding the relationship between motor competence and identity health and these additional influences may be important.

Purpose

The purpose of this study was to examine if an adolescent's motor competence, level of parental awareness and support and self-perceptions influences the health of their identity. Of particular interest, was to examine differences between high and low levels of motor competence and between males and females.

To address this purpose adolescents aged between 12-and 16-years of age were recruited for a series of studies. The first stage involved the development of an adolescent motor competence questionnaire (AMCQ) and the cultural adaptation of an identity health measure (AIDA). Adolescents self-reported their motor competence, identity health, and self-perceptions (SPPA) across a range of domains. A subsample of these adolescents participated in one-on-one or small group interviews to gather more in-depth information around identity health and the influence of their motor competence. Parents completed a questionnaire on their child's motor competence (DCDQ'07). The results were compared to the adolescents AMCQ responses.

Thesis aims and research questions

The health of one's identity may be negatively affected in adolescents who are particularly vulnerable due to higher exposures to stressors that cause angst and anxiety (Cairney, Rigoli, & Piek, 2013; Losse, et al., 1991). A low level of motor competence or poor coordination is one such stressor (Skinner & Piek, 2001). However, no study has been identified that has examined the extent an adolescent's level of motor competence, both high and low, influences the health of their identity. Therefore, the primary research question of this study is:

How does identity health differ between adolescents with high and low motor competence?

Three secondary research questions are:

A) *Does identity health differ between male and female adolescents with high and low motor competence?*

B) *Is there congruency between what parents interpret and how adolescents view their own level of motor competence?*

C) *Do self-perceptions mediate the relationship between motor competence and identity health in adolescents?*

Significance of the study

As mentioned above, only one qualitative study to date has examined the relationship between level of motor competence and identity (Lingam et al., 2013). The authors interviewed adolescents with LMC who felt that the most critical element that impacted their identity was their level of social support. They identified several gaps in the understanding of the impact of motor competence on identity health (Lingam et al., 2013). For example, to date no one has explored how identity health might differ between adolescents with high and low motor competence. In addition, it is unknown whether the relationship between motor competence and identity health differs between males and females, level of parent's awareness of their motor competence or whether an adolescent's self-perceptions across a range of domains are important. A model representing the relationship between these four factors forms the conceptual framework for the who.i.am study (Figure 1.1) with the

main focus placed on the relationship between motor competence and identity health. For example, an adolescent's motor competence may directly influence identity health through their ability to participate in physical activities, while their self-perceptions and parent's awareness of their child's motor competence may also influence this relationship in either positive or negative ways.

An individual's self-perceptions across a range of domains is considered in the framework as previous research has identified that individual self-perceptions are influenced by adolescent motor competence level (Rose et al., 2015). A parent's recognition of LMC during adolescence may also be important as it affects their child's social-emotional development (Kirby, Edwards, & Sugden, 2011b). A number of studies have independently examined motor competence in relation to parental support (Missiuna, Gaines, Soucie, & McLean, 2006; Missiuna, Moll, Law, King, & King, 2006). However there is a paucity of research examining parental awareness of motor competence during adolescence.

The series of papers described below address these gaps in motor competence and identity health research. These include:

- the need for a self-report motor competence questionnaire suitable for 12- to 18-year-olds;
- the identification of key factors that differ according to level of motor competence among Australian adolescents;
- the influence of level of motor competence on the health of identity;
- parental awareness of their adolescent's motor competence and;

- the influence of individual self-perceptions on the relationship between motor competence and identity health.

Thesis overview

This thesis comprises eight chapters. In Chapter Two, the key literature surrounding self, identity and identity health as well as level of motor competence is reviewed. In Chapters Three to Seven, a series of primary research studies (3 are published, 2 are under review and 1 is in preparation) relating to the who.i.am motor competence framework are presented (Figure 1.1).

In Chapter Three, two papers examining motor competence are included (Figure 1.1). The first paper *'Development and evaluation of the psychometric properties of the Adolescent Motor Competence Questionnaire (AMCQ) for Adolescents'* describes the steps taken to develop and evaluate a self-report motor competence questionnaire for 12- to 18-year-olds. The second paper *'Factors contributing to Australian adolescents' self-report of their motor skill competence'* examines the factors that contribute to Australian adolescents' awareness of their motor competence.

The third paper examining identity health is presented in Chapter Four '*The assessment of adolescent identity health in Australia: An investigation of the suitability of the Assessment of Identity Development in Adolescence (AIDA) Australia'*. This describes the cross-cultural adaptation of the AIDA questionnaire, originally designed for Swiss-German adolescents. In Chapter Five, the fourth paper '*The influence of motor competence and gender on identity health in adolescents: A mixed method study'* focuses on examining

the primary research question as well as the secondary research question A (gender differences and identity health). The fifth paper in Chapter Six '*Adolescent self-report motor assessments may be more realistic than those of their parents''* addresses the secondary research question B, Parent support. In Chapter Seven, the sixth paper *'Exploring the influence of self-perceptions on the relationship between motor competence and identity in adolescents'* addresses the secondary research question C, Self-perceptions. Finally, in Chapter Eight, the key findings of the thesis are reviewed and discussed in relation to the conceptual framework (Figure 1.1).

The uni-directional arrows in Figure 1.1 show the direct association between one variable on another. For example, in regards to the primary research question, it is predicted that motor competence will have a direct effect on identity health. The bidirectional arrows indicate that the relationship between the two variables are interchangeable.

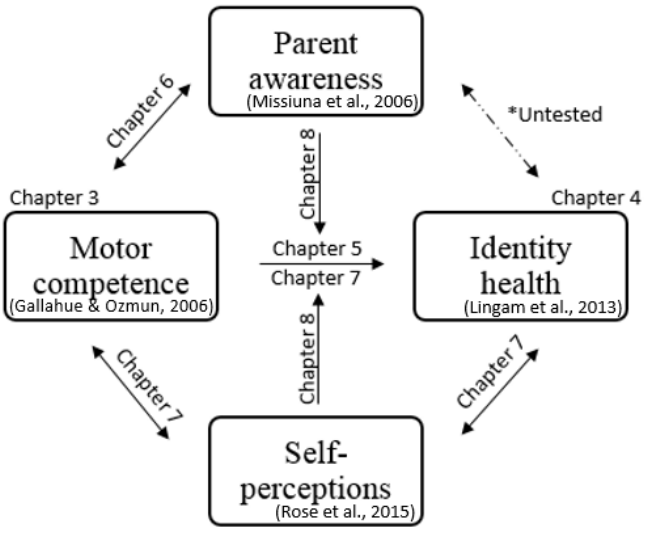

Figure 1.1. The who.i.am motor competence framework and relevant chapters

Note: Chapter 5 addressed the primary research question and secondary research question A, Chapter 6 addressed the secondary research question B, and Chapter 7 addressed the secondary research question C. Chapter 8 will discuss the relationships between all four factors.

Delimitations

Inclusion criteria for recruitment of participants

- Aged between 12- and 18-years;
- Speaks English as their first language;
- Has cognitive and linguistic skills sufficient to comprehend and answer questionnaire items;
- Resides in Western Australia.

Exclusion criteria

- Not diagnosed with another neurological disorder which may affect motor skill such as autism, cerebral palsy, learning difficulties, or muscular dystrophy;
- Has a non-English speaking background as these individuals may not be able to respond to the survey questions.

CHAPTER TWO: Review of the literature

Figure 2.2. Word frequency from adolescents (17 interviews) describing what identity health means to them (The full results are presented in Chapter 5)

In this chapter relevant literature related to the self and identity is presented followed by an historical overview of past and present theoretical and measurable outcomes for identity. Factors that influence the health of identity are described. Finally, the relationship between level of motor competence and identity health is examined.

Self

Over time, the construct of 'self' has been explained by theorists in many different ways. William James first defined 'Self' in 1890 as two distinct categories; the 'Me' and the 'I' (James, 1892). The 'Me,' is also referred to as the '*Object'* which describes three individual characteristics around the self, including personal belongings (material me), social situations (social me) and core sense of self (spiritual me; James, 1892). More recently, researchers have defined the Me-self as a sense of coherence (Gergen, 1991; Goth et al., 2012a) that incorporates an individual's personal knowledge of their physical, social and psychological abilities (Harter, 1999, 2012a; Leahy, 1990).

James (1892) referred to the "I' as the '*Subject'* as it is an individual's personal thought of who they are in relation to their life experiences. James (1892) suggested this to be a person's mind or soul. More recently others have defined the I-self as the stable component which includes emotional thoughts (sense of agency), an individual's unique characteristics (through distinctness and clarity) and perceptions of their past, present and future (continuity; Cantell, 1998; Harter, 1999; 2012a; Leahy, 1990). Therefore, the self is defined as two entangled components inclusive of one's personal thoughts (I-self) and knowledge (Me-self; James, 1892).

Cooley (1902) conceptualised the '*looking glass self*'' as the relationship between interpersonal relationships and societal influences. Cooley (1902) felt one's personal belief was influenced by others views of them which then informed their future decisions. Mead (1934) defined the self as a social construct that emerges through collective experiences as harmony must exist between an individual's total self, and reflective of their social experience. Later, Erikson (1968) described the self as distinctly social in nature through the processes of personal growth, synthesis and experiencing identity crises. Brewer (1991) proposed that a person develops multiple self's which expand and contract across time and in a variety of social settings.

The self is all encompassing as within the self is one's personal and social identities (Figure 2.3). However, authors have sought to clarify the many self-related terms including identity, as many are still used interchangeably (Leary & Tangney, 2012). This may be because they are created through personal experience and memories (Harter, 2012a; Oyserman, Elmore, & Smith, 2012). The most consistent difference between the self and identity is that identity develops through a number of psychosocial factors that can be changed on the spot and may also vary according to the social environment (Brinthaupt & Lipka, 2002), while the sense of self is a more stable construct over time and includes overall thoughts such as '*What kind of person am I?* or '*How good am I?*' (Oyserman et al., 2012; Schwartz, Luyckx, & Vigtnoles, 2011). Therefore an individual's sense of self encompasses their identity.

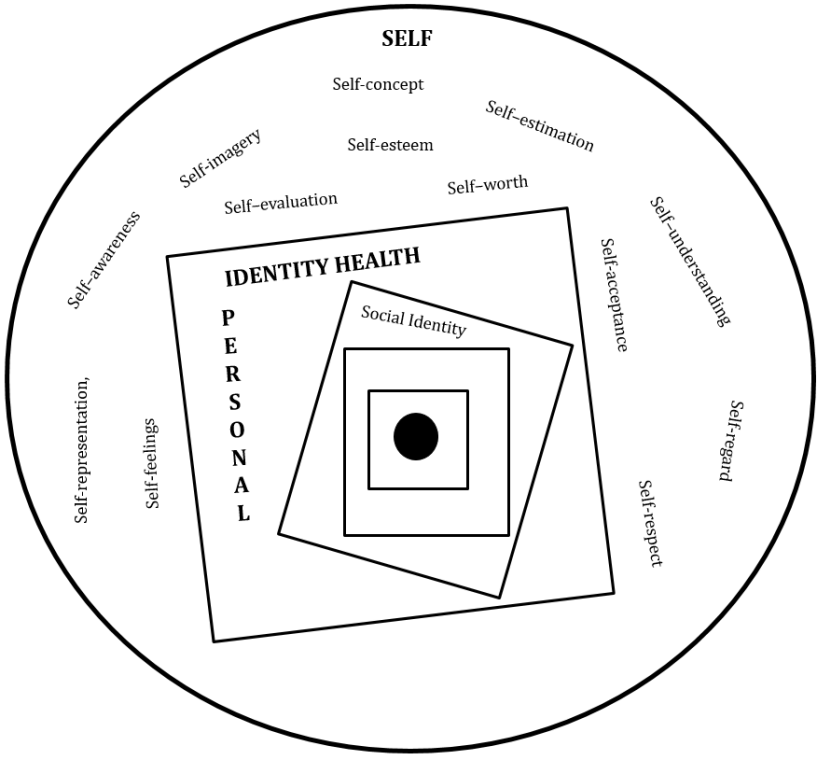

Figure 2.3. The terminology regarding the concepts of the self and identity

Identity

Identity, which is part of the self is defined as one's personal traits, characteristics, and social relations including roles and group memberships that define '*who am I?*' (Crocetti et al., 2014). During adolescence additional identity questions emerge such as: '*What are my life goals?*' and '*What is my place in the world?*' (Crocetti et al., 2014; Schmeck, Schluter-Muller, Foelsch, & Doering, 2013). Therefore, identity is driven by external elements including social roles and personal identifications such as family (parent or child), sexual or cultural roles, while the self is defined through more personal descriptions such as 'friendly' or 'talkative' (Schwartz et al., 2011). For example from birth everyone is given a name that becomes a part of their identity (Schwartz et al., 2011). The concept of identity incorporates both personal and social aspects that then helps to form an overall coherent sense of self (Osyerman et al., 2012). The overall sense of self

incorporates identity which is then separated into personal and social identities. Personal identities are individual expressions of daily experiences that are either separate or linked to a role (Leary & Tangney, 2012). Role identities develop around comprehensive social units such as employment and social clubs (Brewer, 1991) and are recognised by a social audience (Schwartz et al., 2011). Deaux (1993) agrees social identities integrate into an overarching personal identity and sense of self. Together, personal and social identities help to inform one's future aspirations and makes sense of their past, present and future experiences (Cantell, 1998).

Theories and measures of identity development

A number of theorists and quantitative measures have sought to define and describe the development of identity.

Erikson: Identity crisis

In 1950, Erikson described identity through three interactive elements: biological factors, psychological needs (interests and defences) and cultural environment. Erikson (1950) developed the '*Theory of Psychosocial Development*' which outlined eight important life stages, with the success of each stage leading towards a healthy personality and identity. The fifth stage: '*Identity versus Role Confusion'* was specifically designed for adolescents between 12- to 18-years of age as they experience a series of identity crises which are important for them to develop their sense of self and identity (Erikson, 1950). Erikson (1950) felt this was the most critical life stage as adolescents begin to develop their independence through decisions about the future such as employment, relationships, family, belonging to a society,

personal achievements or questioning their place in the world (role confusion; Erikson, 1950, 1968). During Erikson's (1968) career he defined identity through two characteristics; exploration (searching for personal information such as alternative lifestyles) and commitment (deciding which option(s) fit best through personal goals or possible self; Duriez, et al., 2012; Harter, 1999; Marcia, 1966) to differentiate between healthy or pathological personalities (Kroger, 2007; Schmeck et al., 2013). This was informed by experiencing a number of identity crises (Erikson, 1968).

An identity crisis is a period when an adolescent's past experiences are not corresponding to the views of their immediate environment (Erikson, 1968). Erikson (1968) proposed adolescents resolve or avoid a series of identity crises as they mature within their social environment. An adolescent can resolve a crisis if adequate social support is available (parental and peer; Grotevant & Cooper, 1985) and they being to feel competent and comfortable about who they are (Erikson, 1968; Leary & Tangney, 2012; Marcia, 1966). Therefore adolescents use their sense of self and personal interests to inform future goals and talents. During adolescence a key turning point occurs when an identity crisis has been resolved which provides meaning and purpose to life such as making occupational decisions which lead to a healthy personality (Erikson, 1968; Kroger, 2007; Waterman, 1982). Erikson's (1968) conceptualisation of identity shaped the foundation for further identity-related research.

Marcia: Identity status

Marcia (1966) incorporated Erikson's (1950) identity characteristics of commitment and exploration to quantify identity and differentiated between

four distinct identity statuses: achievement (high commitment and high exploration), moratorium (low commitment and high-exploration), foreclosure (high commitment and low explorations) and diffusion (low commitment and low exploration; Marcia, 1966).

Identity achievement is defined as resolving a crisis through establishing commitments, developing problem solving skills and realistic levels of aspiration (Marcia, 1966). Adolescents become 'identity achievers' when their environment is no longer overwhelming as they experience high self-esteem, low levels of anxiety, and continue to make positive decisions even if they do not coincide with their parents (Marcia, 1966; Waterman, 1982). Unfortunately, if an individual does not commit to personal decisions then they will re-enter or return to moratorium (Erikson, 1950).

A moratorium is an identity crisis where adolescents are actively seeking out who they want to be, by exploring or committing to goals that develop their personality (Marcia, 1966). A moratorium becomes integrated if meaning is given to commitments and social experiences (Marcia, 1966; Waterman, 1982).

Foreclosure is when an individual has never experienced an identity crisis as high value is placed on pre-established family expectations, authority, obedience, and guidance (Marcia, 1966). Foreclosed adolescents consequently experience greater stress and a lower sense of self compared to identity achievers as they do not form separate identities from their parents (Marcia, 1966). These adolescents move into a moratorium if commitments become

meaningless or into achievement if new possibilities are considered (Waterman, 1982).

Identity diffusion is an unresolved identity crisis (Erikson, 1950; Marcia, 1966) and develops due to a low sense of self (Meeus, van de Schoot, Keijsers, & Branje, 2012) as individuals are unable to identify with personal traits or career options, nor form lasting relationships (Erikson, 1968; Kernberg, 2004; Marcia, 1966). Adolescents who experience identity diffusion can move into a moratorium phase if serious contemplation of previous life decisions occurs or to a foreclosure phase if adolescents form quick commitments that are not personally valued or not completely thought through (Waterman, 1982). Marcia's (1966) identity statuses led to the development of the Ego Identity Status Paradigm to measure occupation and ideology beliefs among late adolescence, which later was redeveloped to also assess identity status in adults and younger adolescents.

Berzonsky: Identity styles

Berzonsky (1989, 2011) conceptualised that individuals develop an identity style based on how they seek, process, evaluate and structure information relevant to the self by engaging with or avoiding future decisions (Duriez et al., 2012). Berzonsky (2011) identified three identity styles: informational, normative and diffuse-avoidant.

The informational orientation style is similar to identity achievement or moratorium (Maria, 1966) as individuals are evaluating personally relevant information that form commitments (Bosch & Card, 2012; Duriez et al., 2012) and personal goals, values and moral standards (Berzonsky et al., 2013).

Informational orientated adolescents are able to cope with a range of experiences, are empathic and analytical about their sense of self (Berzonsky, 1999) and open to new ideas (Bosch & Card, 2012). They are reflective of their experiences (Berzonsky, 1992) and explore a wide range of personal choices that may become integrated or personally valued (Duriez et al., 2012). This informational orientation style is most common among women, however men who use this style are more problem focused and are able to cope with stress (Berzonsky, 1992).

Normative orientation style describes individuals who place high value on their personal goals and expectations of significant others (Berzonsky, 2008) as they tend to follow traditions and rely on closure (Bosch & Card, 2012). These individuals have stable attributes, are conscientious, disciplined and form strong personal commitments (Berzonsky, 2004). However, they are less open minded in exploring new ideas or changing their views, and avoid unwanted information that may threaten their identity (Berzonsky et al., 2013; Duriez et al., 2012). They are more likely to internalize their thoughts and feelings (Berzonsky, 2004), which is similar to a foreclosure status as they value authority and avoid going outside of their comfort zone (Marica, 1966).

Lastly, diffuse-avoidant orientation style refers to those individuals who procrastinate, avoid identity decisions, and do not explore a range of social situations (Bosch & Card, 2012). Adolescents with this style lack problem solving skills, have lower levels of personal control and high impulsive behaviours (Berzonsky, 2011). They often experience a fragmented view of themselves, over react to social situations and define themselves in terms of

their reputation, popularity and impression made on others (Berzonsky et al., 2013;Crocetti, Rubinni, Berzonsky, & Meeus, 2009; Duriez et al., 2012). These individuals develop coping strategies to avoid immediate distress (Berzonsky, 1992) are less mature, often experience negative peer relationships or academic achievement, and often experience higher drug and alcohol problems and anxiety/depression (Vleioras & Bosma, 2005) which is more common among males (Berzonsky, 1992).

Berzonsky (1989, 2011) developed the Identity Style Inventory (ISI) measure which has been used in many research studies (Bersonsky, 1992, 1999; 2004; 2008; Crocetti et al., 2014; Crocetti et al., 2009; Dumas, Ellis, & Wolfe, 2012; Duriez et al., 2012; Phillips & Pittman 2007; Vleioras & Bosma, 2005). Today, the importance of examining both social constructs of identity (Erikson, 1968; James, 1950) and personality impairments of identity (Kernberg, 1981, 2004; Marica, 1966) to differentiate between healthy and troubled adolescents has expanded the field of identity research (Goth et al., 2012).

Goth: Continuity versus coherence

Goth et al. (2012) developed a theoretical framework that included factors around the self, psychological and social functions (Jung et al., 2013; Kassin, Castro, Arango, & Goth, 2013) to evaluate identity on a continuum ranging from a healthy or integrated to less-healthy, diffused identity. Identity integration, formerly referred to as identity achievement (Marcia, 1966) is a healthy representation of one's self as individuals engage with their social surroundings (Goth et al., 2012). Therefore, identity integration develops through a range of experiences such as engaging with peers and personally

desired hobbies, feelings of happiness (Phillips & Pittman, 2007; Vleioras & Bosman, 2005), and a stable sense of self over time (Brewer, 1991; Erikson, 1968; Harter, 2012a; Kroger, 2007). This is demonstrated by an individual's level of maturity (Klimstra, Hale, Raaijmakers, Branje, & Meeus, 2010), autonomy, motivation towards achieving personal goals (Duriez, et al., 2012; Goth et al., 2012; Kassin et al., 2013) and the formation of lasting relationships with significant others (Brewer, 1991; Tanti, Stukas, Halloran, & Foddy, 2011).

Individuals who do not form an integrated identity may develop identity diffusion which occurs when identity crises have not been resolved (Erikson, 1950). Identity diffusion can lead to a spectrum of dysfunctional behaviours as youth neglect to negotiate adult roles, and responsibilities which may even lead to a personality disorder (Ryan & Deci, 2012; Schmeck et al., 2013). Individuals with a diffused identity lack a sense of self, and cannot clearly define personal values and beliefs (Goth et al., 2012) which may result in lower levels of happiness (Doumen et al., 2012; Jung et al., 2013; Phillips & Pittman, 2007; Vleioras & Bosman, 2005), an inability to form lasting relationships (Doumen et al., 2012; Kassin et al., 2013; Meeus et al., 2012), and a weak sense of community (Dumas et al., 2012; Fergus & Zimmerman, 2005; Meeus et al., 2012). Evidence suggests that adolescents with additional environmental stressors may form a more diffused identity compared to those without (Jung et al., 2013). Therefore the health of one's identity is influenced by one's sense of self and belonging within a social context. Goth et al. (2012) defines these concepts as: continuity (sense of self: '*stabilizing roles vs. lack of social roots'*) and coherence (sense of belonging: *'autonomy vs. suggestibility'*).

Continuity is one's sense of self and represents the *Subjective*, 'I-self' which consists of remaining stable and the same over time (Goth et al. 2012; Harter 2012a; James, 1950). When continuity is high, a healthier identity develops through having trust within the self, having stable thoughts, setting goals and timeframes, investing and committing to personal hobbies and social relationships and acknowledging personal accomplishments (Goth et al., 2012; Jung et al., 2013). In comparison, discontinuity is described as a low perception of one's self including negative thoughts and feelings which may lead to identity diffusion (Goth et al., 2012).

Coherence refers to one's sense of belonging, defined as the *Objective,* 'Me-self' (James, 1950; Jung et al., 2013) and forms through understanding social behaviours such as social cues and developing independent, but assertive relationships (Goth et al., 2012). Therefore an individual's sense of coherence is one's clear view of them self in relation to their social world (Goth et al., 2012) even if pain or discomfort is felt within the social context (Harter, 2012a). Alternatively, if negative personal views are reinforced socially (incoherence; Goth et al., 2012; Harter 2012a), then an individual may experience contradiction, indecisiveness, poor motives, and disorganised thoughts (Jung et al., 2013) leading towards a less healthy, diffused identity. Goth et al.'s (2012) hybrid framework led to the development of a self-report measure titled: the Assessment of Identity Development in Adolescence (AIDA) to examine the health of an adolescent's identity on a continuum from health to less healthy.

Health of identity

Erikson (1950) described the development of identity as a slow process that synthesizes and exchanges childhood experiences into new understandings of adult values and beliefs. Identity health does not have a fixed end point as it is a fluid construct that moves from high to low or low to high (Meeus, Iedema, Helsen, & Vollebergh, 1999). The confidence in one's ability to deal with and resolve identity crises such as career decisions or personal beliefs including world views (ideology or political) contribute to the health of one's identity (Fergus & Zimmerman, 2005; Goth et al., 2012; Jackman & MacPhee, 2015). The way an adolescent negotiates this emotionally fragile stage also determines the health of their identity during this phase. A person with a healthy identity is able to form lasting relationships and personally valued commitments that fit within the context of their society (Erikson, 1950; Goth et al., 2012).

Factors influencing identity health during adolescence

During adolescence, identity development escalates around 12-years of age and slows down at around 22-years of age (Kroger, 2007). Changes during adolescence have been described in early, middle and late phases. Marcia (1966) describes early adolescence (12- to 14-years-old) as a period of disorganization when many experience physical (puberty, maturation and growth spurts), cognitive (hormonal development, abstract reasoning, and sexual interests) emotional (moodiness; Brinthaupt & Lipka, 2002; Kroger, 2007), social (developing new peer relationships and re-negotiations of parent relationships; Cantell, 1998; Crocetti et al., 2014), personal (Harter, 2012a), developmental (new neurological pathways develop in the brain; Diamond,

2000) and environmental changes (Perry & Pauletti, 2011). Peers become more important than parents as they begin to model similar behaviours such as physical activity participation, eating behaviours, fashion choices and social activities (Hands & Larkin, 2002, Harter, 2012a; Mehta & Strough, 2010). Many lack a sense of individual competence, interests, and personal ability (Damon & Hart, 1982; Harter, 2012a) and explore their identity within the safety of close peers (Brinthaupt & Lipka, 2002).

During middle adolescence (15-to 17-years) physical and biological changes slow as the majority have reached their full adult height (Kroger, 2007). Many begin to develop adult-like roles as they are legally allowed to work, and can obtain a driver's license (Kroger, 2007) which leads to feelings of independence, however they still have an unstable sense of self as they question whether they are still a child or an adult (Cantell, 1998; Goth et al., 2012; Harter, 2012a). This is the first time many are able to express their new adult body through social support, sexuality, gender roles (Kroger, 2007), intimate relationships (Adler & Alder, 1995; Brinthaupt & Lipka, 2002) and renegotiating their role in the family structure (Guan & Fuligni, 2016; Mclean & Jennings, 2012). Late adolescence (18-year-olds and older) is a reflective period where thoughts emerge around employment and parenthood through an autonomous sense of self and an awareness of individual strengths and limitations (Harter 2012a; Kroger 2007). This is when belonging to a particular group becomes less important and significant memories are primarily shared with close friends and family which refine the health of one's identity and sense of self (Brinthaupt & Lipka, 2002; Kroger, 2007).

Context and environment

The context and environment in which adolescents engage with others may impact their willingness to participate in age appropriate activities that develop their sense of self. This may be influenced by a number of external factors such as the socio-cultural environment of their family (for example the parents' physical activity levels; Barnett, Dawes, & Wilmut, 2013), social stresses (internalising behaviours; Cairney et al., 2013; Mancini, Rigoli, Cairney, Roberts, & Piek, 2016) and peer support (Payne et al., 2013). Some adolescents may enjoy competitive arenas such as sports that showcase their physical skills whereas others may avoid these environments to escape publically displaying their poor physical abilities to their peers (O'Dea & Connell, 2016; Ryska, 2003). This may be related to their perceived motor competence which may also affect their identity health (Lingam et al., 2013).

During adolescence peer interactions are important as many wish to become a member of a desirable in-group (Brewer, 1999; Brewer & Gardner, 1996). Brewer and Gardner (1996) suggest in-group relationships have positive influences for adolescents as they share common group identities which allow them to blend in with their peers, which allows them to form their identity within the safety of close friendships. Adolescents who are part of an in-group are generally liked more by their peers than the out-group members, even when nothing is known about the personalities of the out-group members (Brewer & Gardner, 1996). This social attraction makes it difficult for adolescents who are marginalized or viewed as different to form positive social identities (Brewer, 1991; Brewer & Gardner, 1996; Brewer & Weber, 1994). The importance of developing peer relationships influences an adolescent's level of

happiness (Cheng & Furnham, 2002) and reduces loneliness (Doumen et al., 2012). The level of social attraction may also influence an adolescent's willingness to participate in socially desirable activities such as games and weekend sports (Piek, Baynam, & Barrett, 2006) and therefore establish healthy physically active lifestyle behaviours (Haga, Gisladottir, & Sigmundsson, 2015).

Parents also play an important role during adolescence as they help their child negotiate their future goals such as employment and academic pursuits (Guan & Fuligni, 2016) and encourage them to mature and engage in personally desirable achievements which help to form their own unique identity (Kroger, 2007; McLean & Jennings, 2012). During adolescence, developing meaningful commitments and strong relationships with significant others is dependent upon prior parental relationships (Goth et al., 2012; Jung et al., 2013). Open and honest communication with parents assists adolescents to engage and form meaningful relationships with others (Guan & Fuligni, 2016; Klostermann, Connell, & Stormshak, 2016). In addition, parent's awareness of their adolescent's strengths and weaknesses such as academic ability or physical abilities may assist in the development of a healthier identity and personal resources.

Personal factors

There are also a number of personal factors that influence identity health. These include an individual's personal attributes in certain domains (Harter, 2012a), cognitive and emotional development (Kroger, 2007), personal perceptions of their social engagements with peers (Tatlow-Golden, & Guerin, 2017), level of

motor competence (Lingam et al., 2013) and personal interests and abilities. One important personal factor to consider is an adolescent's self-perceptions in certain areas or domains such as sporting competence and social interactions such as school dances, and how they interact in these settings may influence their identity health (Crocker & Major, 1989; Harter, 2012a). The perception of themselves is influenced by their perceived competence and level of success experienced when completing or engaging in particular tasks. Adolescence is a period when high levels of emotional fluctuations influence decision making (Kroger, 2007) and childhood perceptions and beliefs influence daily routines such as occupational pursuits or physical activity related participation (Arnett, 2000; Harter, 2012a). Therefore another important personal factor to consider is motor competence.

The role of motor competence

The development of fundamental movement skills begins from a very young age (Gallahue & Ozmun, 2006; Kroger, 2007). However, by the age of 7-to 10-years more complex motor skills requiring strength (jumping, hanging, climbing), endurance (running, riding, swimming) and power (hopping, kicking and throwing) are gained through physical activity participation and daily play (Haga et al., 2015; Hands & Larkin, 2002). When children reach 11-to 13-years of age, they begin to make conscious decisions about physical activity participation (or avoidance) as a greater focus is placed on developing proficient complex motor skills that require form, accuracy, control, cognitive ability, and strategic game decisions (Gallahue & Ozmun, 2006; Okely, Booth, & Patterson, 2001).

Those with LMC experience difficulties developing proficient motor skills, and as a consequence are less physically active and fit (Hands, Parker, Rose, & Larkin, 2015; Rivilis, et al., 2012). Some of these children and adolescents may receive a diagnosis of Developmental Coordination Disorder (DCD; APA, 2013) if they also experience difficulty performing many aspects of daily living including self-care activities (Cantell, Smyth, & Ahonen, 1994; Kirby, Edwards, & Sugden, 2011a; Losse et al., 1991) and have no other diagnosis of a movement related disorder. On average, 5-10% of young children may be diagnosed with DCD, some may outgrow the condition (Hands, Licari, & Piek, 2015), however between 50-70% continue to experience motor difficulties into adolescence (APA, 2013; Kirby et al., 2011a) and adulthood (Kirby, Edwards, Sugden, & Rosenblum, 2010; Kirby, Williams, Thomas, & Hill, 2013).

Adolescents with LMC experience difficulty mastering new complex tasks (Missiuna, Moll, King, Stewart, & Macdonald, 2008) as their basic motor skills developed during childhood may not be proficient (APA, 2013; Gallahue & Ozmun, 2006; Missiuna et al., 2008). These adolescents (either diagnosed with DCD, or unrecognised) may be slow or inaccurate when performing gross motor tasks such as ball skills or fine motor skills such as handwriting, using scissors or kitchen utensils (APA, 2013; Kirby et al., 2011a, 2011b). New challenges include self-care activities (shaving for males and putting on make-up and brushing one's hair for females; Kirby et al., 2011b), learning to drive and even managing the demands of holding down a job (APA, 2013; Missiuna et al., 2008). Adolescents with LMC may also be limited in participating in household responsibilities such as dinner preparation, experience difficulty

maintaining friendships and family relations, struggle with joining community sports and are often unable to complete executive functioning activities involving concentration and the learning of new tasks (O'Dea & Connell, 2016). These daily stressors at home, school or the work place may contribute to social-emotional frustrations including angst and anxiety (Hill et al., 2011; Rigoli, Piek, & Kane, 2012), influence academic achievements (Kirby et al., 2011b), and ultimately affect employment and quality of life satisfaction into adulthood (Kirby et al., 2013; Tal-Saban, Ornoy, & Parush, 2014b).

An adolescent's level of motor competence is very important as it affects their ability to participate in sports (Cairney, Hay, Veldhuizen, Missiuna, & Faught, 2010; Hands & Larkin, 2002), social opportunities (O'Dea & Connell, 2016; Payne et al., 2013) self-perceptions (Rose et al., 2015; Skinner & Piek, 2001) and ultimately the development of their identity (Lingam et al., 2013). For example, those with LMC may devalue their athletic competence or be less motivated to participate in sports or games (Bardid et al., 2016; Crocker & Major, 1989; Rose et al., 2015), which may result in them withdrawing from social situations (Skinner & Piek, 2001) and hesitate trying new activities (Fitzpatrick & Watkinson, 2003). Adolescents with LMC often experience additional environmental stressors and develop internalizing behaviours such as anxiety and depression (Cairney et al., 2013; Rigoli et al., 2012). Rose and colleagues (2015) found self-perceptions of social acceptance, scholastic competence and romantic appeal were influenced by motor competence. Those with higher motor competence had higher perceptions of their global self-worth, athletic competence, scholastic competence and romantic appeal compared to those with lower motor competence. Only one study investigating

identity formation in adolescents with LMC has been reported. Lingam et al. (2013) interviewed adolescents with DCD about their identity and identified five themes; '*How I see my life'*, '*Things I find hard'*, '*Making my life easier*', '*How others see me'*, and '*How I see my future'*, with an overarching theme '*We are all different.'* These findings suggest the factors influencing the formation of identity among those with LMC may be different to their peers with HMC, and that peer support was particularly important (Lingam et al., 2013). Therefore, further research regarding identity health, motor competence and level of social support is warranted.

Social and peer support

Adolescents with LMC often experience low social support (O'Dea & Connell, 2016; Payne et al., 2013) which may create new personal challenges as they shy away from participation in order to avoid exposing their physical inadequacies (Fitzpatrick & Watkinson, 2003; Kirby et al., 2011b). They may develop coping strategies such as volunteering for non-active roles such as team manager or score keeper, or using distracting mechanisms such as humour (Fitzpatrick & Watkinson, 2003). Others work persistently hard to achieve the same level of proficiency as their peers (Missiuna et al., 2008) or find excuses to avoid physical activity such as physical education classes (Fitzpatrick & Watkinson, 2003) which results in fewer opportunities to develop strong social networks (Payne et al., 2013; Rivilis et al., 2012). Their inability to participate leads to many adolescents being part of the out-group (Brewer, 1991; Brewer & Gardner, 1996), which results in social isolation (Piek et al., 2006) peer victimization or bullying (Campbell, Missiuna, & Vaillancourt, 2012; Missiuna et al., 2008; Piek, Barrett, Allen, Jones, & Louise, 2005).

From childhood onwards, many with LMC experience behavioural and emotional problems such as poor support and may develop conduct problems (Green, Baird, & Sugden, 2006), with some even developing psychiatric conditions (in particular affective/mood disorders; Hellgren, Gillberg, Bagenholm, & Gillberg, 1994). A consequence is a lower sense of self (Rose et al., 2015), anxiety and depression (Pratt & Hill, 2011) or mood impairments which persist into adulthood (Hill & Brown, 2013). However, Lingam et al. (2013) found that those with LMC who experienced positive social support felt a sense of belonging, and social acceptance was the second largest indicator of their self-worth (Skinner & Piek, 2001). For example, when classroom instructions were clarified by their peers rather than the teacher, or when siblings with HMC acted as teachers or mentors their school performance improved (Payne et al., 2013).

Parent's awareness

Less is known about parents' perceptions of their adolescent's motor competence. Summers, Larkin, and Dewey (2008a) interviewed parents about their 5-to 7-year-old child's motor difficulties and found self-maintenance tasks such as dressing, bathing, oral care and eating were the most difficult activities to manage within the family home. Parents laid out clothing for their children with DCD as progress during morning routines was slow and limited their leisure activities such as watching television (Summers, Larkin, & Dewey, 2008b). Parents felt their child with DCD was happiest during the weekends and holidays as it was more relaxing (Summers et al., 2008a), and many participated in individual activities such as martial arts or swimming (Summers et al., 2008b) rather than competitive team sports. Soriano, Hill, and Crane

(2015) surveyed parents after their child aged anywhere from 6 to 18 years received a DCD diagnosis and found parents' experiences were affected by stress from the diagnostic process, manner of the professional diagnostic process, level of post-diagnostic support and time to receive a diagnosis.

Some parents may be unaware that motor difficulties in their child are a concern, and could be diagnosed with DCD, as many have difficulty receiving answers when they visit many health professionals (Missiuna et al., 2006; Missiuna et al., 2008; Soriano et al., 2015). Some receive a different diagnosis as symptoms may be similar to other developmental disorders such as Autism Spectrum Disorder (ASD), learning difficulties or Attention Deficit Hyperactivity Disorder (ADHD; Loh, Piek, & Barrett, 2011; Van Damme, Sabbe, van West, & Simons, 2015). As a result, many adolescents with LMC remain undiagnosed, as by this age many have adopted coping mechanisms to mask their difficulties from their parents, teachers or peers (Fitzpatrick & Watkinson, 2003) in order to fit in (Hill et al., 2011; Missiuna,Gaines, & Soucie, 2006).

Some parents may recognise their adolescent has LMC, however place their concerns on the 'back burner' as they have developed ways to manage their child's difficulties by completing daily tasks for them (Kirby, Sugden, Beveridge, & Edwards, 2008; Missiuna et al., 2006), or they worry more about their adolescent's poor social skills rather than their motor difficulties (Kirby et al., 2011b). Parents may feel they are assisting their child to manage their motor difficulties when in fact they are removing their independence and development of identity which may cause additional frustrations for the

adolescent (Rigoli, Piek, Kane, & Oosterlaan, 2012). It is also possible that a parents recognition of motor competence, social support and self-perceptions may differ between males and females (Miyahara & Piek, 2006).

Gender

Gender is another important factor to consider when examining identity health as males and females often prefer to participate in separate activities and value different domains when developing their sense of self (Tatlow-Golden & Guerin, 2017). For example, Rose et al. (2011) found that 14-year-old male self-perceptions were higher for athletic competence, physical appearance and romantic appeal domains compared to females who had higher self-perceptions around behavioural conduct and close friendships. During adolescence, females often experience greater emotional challenges when developing their identity compared to males who are able to differentiate between identity roles and multiple selves more easily (Harter 2012a; Osyerman et al., 2012). Males often prefer physical activities as they place importance on competition, a chance to win, and hang out with friends (Hands et al., 2015) and they feel greater pressure to form social groups within organised sports (Cairney et al., 2005). Females generally prefer non-competitive activities such as creative hobbies as they are able to develop close friendships and emotional support (Harter, 2012a; Tatlow-Golden & Guerin, 2017).

In conclusion, the health of an adolescent's identity is multifaceted and influenced by a number of factors including individual self-perceptions, level of parent's awareness and level of motor competence. In the following chapters, six papers will examine how these factors influence the health of an

adolescents' identity in relation to the who.i.am motor competence framework (Figure 2.4).

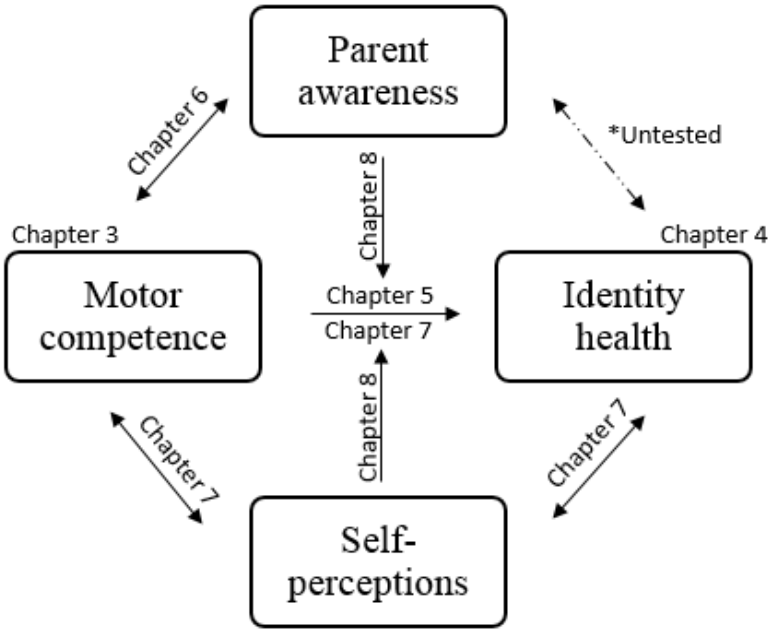

Figure 2.4. The Who.i.am motor competence framework

CHAPTER THREE: Development and evaluation of the psychometric properties of the Adolescent Motor Competence Questionnaire (AMCQ) for adolescents, & Factors contributing to Australian adolescents' self-report of their motor skill competence.

In this chapter, two primary studies are presented. One is published (full PDF – appendix E) and the other is in press.

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Development and evaluation of the psychometric properties of the Adolescent Motor Competence Questionnaire (AMCQ) for Adolescents

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ABSTRACT

Background: There are no valid and reliable self-report measures designed to identify level of motor competence and suspected motor difficulties among 12–18 year old adolescents.
Aim: This paper reports the development and evaluation of a self-report questionnaire (Adolescent Motor Competence Questionnaire; AMCQ) to address this need.
Method: The project proceeded in 3 phases; (A) item development, (B) content evaluation, and (C) examination of reliability and validity of the final questionnaire. Each phase was informed by criteria A and B in the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5), comments from a sample of 10 adolescents aged between 12 and 18 years with a range of movement skills, key informants and international experts. A convenience sample of 38 adolescents completed the final version of the AMCQ. The McCarron Assessment of Neuromuscular Development (MAND) was used to investigate concurrent validity.
Results: The final version of the AMCQ comprised 26 items scored using a 4 point Likert scale with a maximum score of 104. Analyses revealed the questionnaire has an acceptable internal consistency (0.902) and 7 day test-retest reliability (0.956). A moderate positive correlation between the AMCQ and the MAND of 0.491 ($p < 0.002$) provides some evidence of concurrent validity.
Conclusion: The development of the AMCQ was exploratory in nature and has the potential to be a reliable and valid tool for measuring motor competence in Australian adolescents.

What this paper adds

This paper reports the development of a new measure, the Adolescent Motor Competence Questionnaire (AMCQ), designed to identify suspected motor difficulties in adolescents aged between 12 and 18 years. The protocol used to develop the questionnaire allowed for a large pool of items to be developed and evaluated. The inclusion and exclusion of these

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Development and Evaluation of the Psychometric Properties of the Adolescent Motor Competence Questionnaire (AMCQ) for Adolescents

Abstract

Background: There are no valid and reliable self-report measures designed to identify level of motor competence and suspected motor difficulties among 12 to 18 year old adolescents. **Aim:** This paper reports the development and evaluation of a self-report questionnaire (Adolescent Motor Competence Questionnaire; AMCQ) to address this need. **Method:** The project proceeded in 3 phases; (A) item development, (B) content evaluation, and (C) examination of reliability and validity of the final questionnaire. Each phase was informed by criteria A and B in the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5), comments from a sample of 10 adolescents aged between 12 and 18 years with a range of movement skills, key informants and international experts. A convenience sample of 38 adolescents completed the final version of the AMCQ. The McCarron Assessment of Neuromuscular Development (MAND) was used to investigate concurrent validity. **Results:** The final version of the AMCQ comprised 26 items scored using a 4 point Likert scale with a maximum score of 104. Analyses revealed the questionnaire has an acceptable internal consistency (0.902) and 7 day test-retest reliability (0.956). A moderate positive correlation between the AMCQ and the MAND of 0.491 ($p < .002$) provides some evidence of concurrent validity. **Conclusion:** The development of the AMCQ was exploratory in nature and has the potential to be a reliable and valid tool for measuring motor competence in Australian adolescents.

Introduction

Adolescents with Developmental Coordination Disorder (DCD) are unable to perform motor tasks with the same level of proficiency as most of their peers (Kirby et al., 2011a). This impacts on the performance of many activities of daily living (ADLs) including self-care, and participation in recreation and sporting activities (Kirby et al., 2011b). Common synonyms used in the literature for DCD include low motor competence (LMC), motor difficulties, motor impairment, poor coordination and suspected motor difficulties (SMD). For many years, it was thought that DCD was primarily evident during childhood with a prevalence between 5 -10% (APA, 2013). However, a number of studies have reported that between 50-70% of those identified during childhood still experience motor difficulties into adolescence (Cantell, Smyth, & Ahonen, 2003; Losse et al., 1991) and adulthood (Kirby et al., 2008). Consequently, for the first time the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5; APA, 2013) included central features and information about adolescents and adults with DCD.

Given its impact on many aspects of an individual's health and well-being it is important to identify those with SMD as early as possible. Unfortunately, motor difficulties often go undetected and many children enter adolescence without any recognition of their condition. Adolescence is a particularly important phase of development for a number of reasons. Many health-related behaviours, such as participation in physical activity and sports are important social occasions (Cairney et al., 2010; Hands & Larkin, 2002; Okely et al., 2001; Raz-Silbiger et al., 2015), and for those with SMD, sedentary activities become preferred over physical activities (Cairney et al., 2010; Hands

& Larkin, 2002; Raz-Silbiger et al., 2015). They avoid participating in physical activity opportunities, such as community sports, which reduces their opportunities to socialize which may impact their peer relationships (Fitzpatrick & Watkinson, 2003; Kirby et al., 2010) and lead to social isolation (Piek et al., 2006; Poulsen, Ziviani, & Cuskelly, 2007). In addition, peer victimization or bullying may lead to increased anxiety and depression (Pratt & Hill, 2011). Many families, teachers and even health professionals are unaware of the condition, consequently many adolescents remain undiagnosed and do not access support networks that could provide information, advice and a sense of belonging (Lingam et al., 2013). A timely identification of motor difficulties before adulthood is therefore important for minimizing these negative consequences, gathering support, building self-confidence and assisting in negotiating future pursuits such as employment opportunities.

At present, clinical tests or parent questionnaires are primarily used to identify adolescents with SMD. The most common clinical tests for adolescents are the Bruininks-Oseretsky Test of Motor Proficiency, Second Edition (BOT-2) which accommodates 4- to 21-year-olds (Bruininks & Bruininks, 2005), the Movement Assessment Battery for Children, Second Edition (MABC- 2) designed for 3- to 16-year-olds (Henderson, Sugden, & Barnett, 2007) and the MAND (McCarron, 1997) suitable for 3.5-year-olds to young adult. Given the cost to purchase test kits, train testers and implement the assessment (generally between 20-30 minutes) these tests are not suitable for large studies (Hands et al., 2015). One alternative is to use a valid and reliable questionnaire which is cheaper to print or purchase, generally does not require tester training, is easier to administer to large groups, and may identify individuals in need of support

and intervention (Clark, Thomas, Khattab, & Carr, 2013). The most widely used questionnaire is the Developmental Coordination Disorder Questionnaire (DCDQ'07; Wilson et al., 2009) which is designed for parents of children aged between 5-to 15-years. However, this is not ideal for adolescents as parents may try to report on aspects they may not fully understand nor be aware of. For example, adolescents may experience negative social interactions, such as bullying or teasing by peers but they refrain from telling parents as it may become worse once parents get involved (Missiuna et al., 2008).

Self-report questionnaires enable adolescents to report on their own movement abilities (Missiuna et al., 2006; Tal-Saban, Ornoy, Grotto, & Parush, 2012). To date, three questionnaires have been published for older adolescents and adults. The Adult Developmental Coordination Disorders/Dyspraxia Checklist (ADC) was based on the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV; American Psychiatric Association, 1994). It is a 40 item questionnaire designed for 17- to 42-year-olds and distinguishes between DCD, at risk DCD and no DCD (Kirby et al., 2010). It requires participants to report on current movement difficulties, as well as movement history. The psychometric properties of the ADC showed good internal consistency, construct and concurrent validity and discriminant validity. The Functional Difficulties Questionnaire-9 items (FDQ-9; Clark et al., 2013) is an adult questionnaire developed for 18-to 65-year-olds using the guidelines from the International Statistical Classification of Diseases and Related Health Problems 10 revision (ICD-10; World Health Organisation, 2007) and the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (DSM-IV-TR; American Psychiatric Association [APA], 2000). The

FDQ-9 used three different samples ranging from 257 to 30 participants to establish initial psychometric properties which reported an acceptable internal consistency, construct validity, diagnostic accuracy and an identified cut-off score. Finally, the Adolescents and Adults Coordination Questionnaire (AAC-Q; Tal-Saban et al., 2012) was based on criteria A and B from the DSM-IV-TR (APA, 2000). It is a 12 item questionnaire developed for 16- to 35-year-olds and had acceptable internal consistency, construct validity and discriminant validity. The development of the AAC-Q used data from a large sample of 2,379 adolescents (aged between 19-to 25-years) and identified diagnostic cutoff scores to identify DCD for both clinical and research use (5^{th}–15^{th} percentile, 1.00-1.65 *SD*). Evidence of concurrent validity was not reported for the FDQ-9 or the AAC-Q.

None of these questionnaires have been specifically developed for adolescents aged between 12 and 18 years. An important time for motor difficulties to be recognised as they experience many social, behavioural and emotional challenges during this time. In addition, ADLs and sports participation are often different from those undertaken by older adults. These issues have been noted in the DSM-5 (APA, 2013). For example, during adolescence a high importance is placed on self-image (e.g. getting ready to go out, putting on make-up) and participation in after school and weekend sporting opportunities. Criterion B also mentions daily activities such as dressing, engaging in new games and using classroom tools (scissors or rulers) that may impact differently on an adolescent (APA, 2013).

The purpose of this paper is to report on the development and evaluation of a self-report questionnaire, the Adolescent Motor Competence Questionnaire (AMCQ; Timler, McIntyre, Cantell, Crawford, & Hands, 2015) to identify SMD in 12- to 18-year-olds. It is not considered to be an exclusive diagnostic tool for DCD as it was not possible to include items relating to criteria C and D from the DSM-5 which refer to intellectual disabilities or visual impairments. Although this questionnaire can contribute to a diagnosis, a clinical test and expert advice is also needed. A range of items involving age-appropriate functional tasks, ADLs, common motor skills and informed by the DSM-5 were considered (APA, 2013; Kwan, Cairney, Hay, & Faught, 2013).

Methods and Results

The development of the questionnaire proceeded in three phases. An overview of the steps taken to develop the AMCQ and the number of items included or excluded in each phase is shown in Figure 3.1. This project was approved by the Human Research Ethics Committee of the University of Notre Dame in Perth, Western Australia.

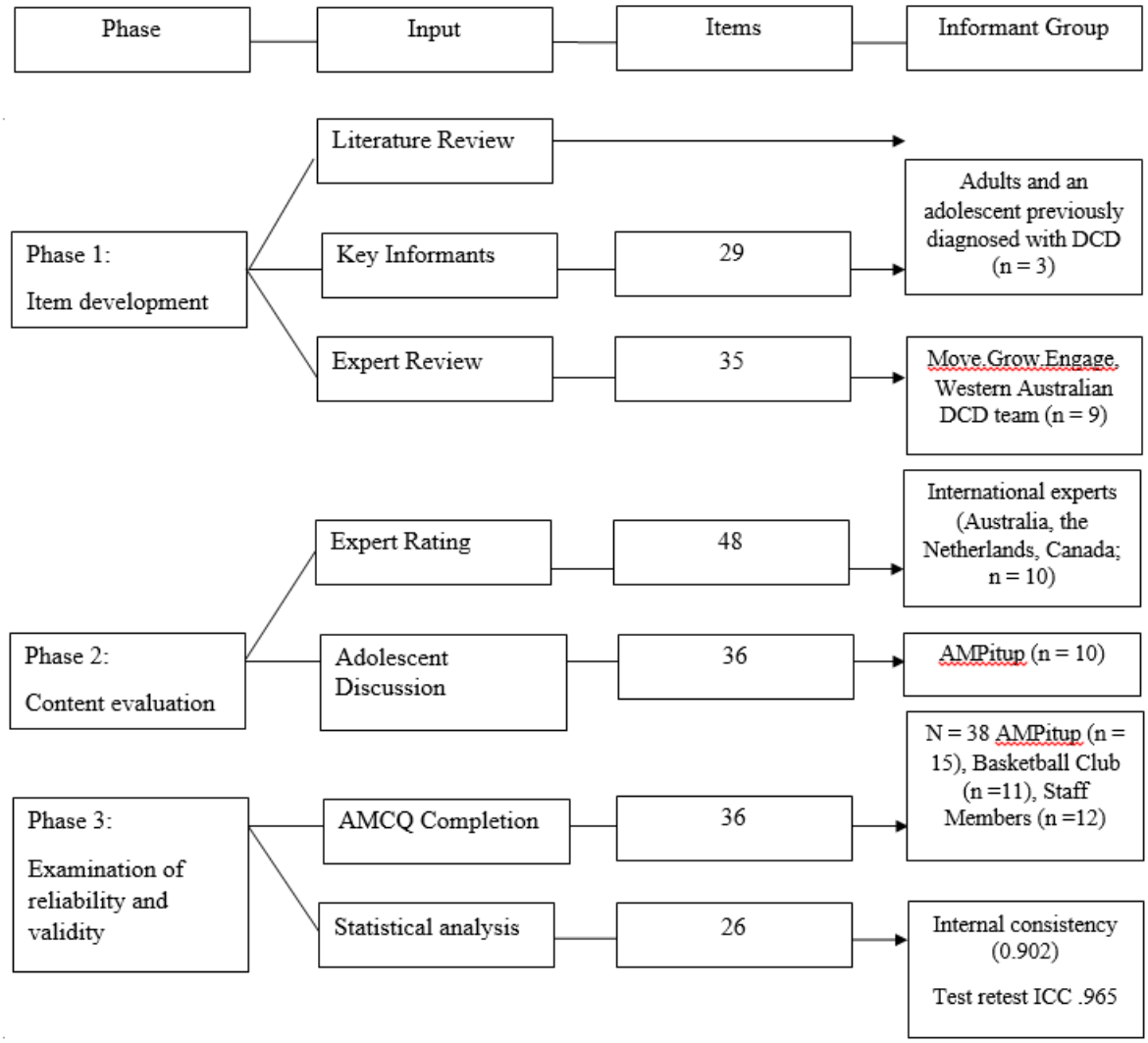

Figure 3.1. The inclusion and exclusion of items during the three phases undertaken to develop the AMCQ

Phase 1: AMCQ content development

Item development of the AMCQ used a mixed method approach to maximise ecological and content validity (Onwuegbuzie, Bustamante, & Nelson, 2010; Polit & Beck, 2006; Wilson, Emslie Hazel, Alderman, & Burgess, 2010). Potential test items were initially identified by an extensive literature search using the search terms; DCD, motor competence, motor difficulties, adolescents

and adults. Both qualitative and quantitative studies were examined to identify questionnaires related to motor competence (Clark et al., 2013; Kirby et al., 2011b; Tal-Saban et al., 2012; Wilson et al., 2009), and the language and terminology typically used by adolescents (Barnett et al., 2013; Fitzpatrick & Watkinson, 2003; Kirby et al., 2011b). Given the diagnostic criteria of DCD described in the DSM-5 (APA, 2013), items were included that reflected a range of skills involving aspects of sports, schooling, self-care, ADLs, and fine or gross motor tasks typical of adolescents (APA, 2013; Cousins & Smyth, 2003; Fitzpatrick & Watkinson, 2003; Kirby et al., 2011b; Losse et al., 1991; Missiuna et al., 2008). An initial 29 items were developed (see Figure 3.1) using a Likert scale response format of Never (1), Sometimes (2), Frequently (3), and Always (4; see Table 3.1). In order to avoid response bias, fourteen of the 29 items were reverse scored. The four point Likert scale was chosen rather than an odd numbered response (such as 5 points) to avoid a neutral, undecided midpoint (Lynn, 1986; Polit & Beck, 2006).

Table 3.1. *Sample items from the ACMQ*

Questions	Never	Sometimes	Frequently	Always
I PREFER TO PARTICIPATE IN INDIVIDUAL SPORTS (SUCH AS SWIMMING, MARTIAL ARTS, ATHLETICS) RATHER THAN TEAM SPORTS (SUCH AS FOOTBALL AND NETBALL) (+)				
I CAN RIDE A BICYCLE				
I FIND IT HARD TO USE A FORK OR A KNIFE WHEN EATING A MEAL (+)				
MY HAND WRITING IS FAST ENOUGH TO KEEP UP WITH THE REST OF THE CLASS				
I BREAK OBJECTS ACCIDENTLY MORE OFTEN THAN MY FRIENDS (+)				
I HAVE TROUBLE LEARNING NEW OUTDOOR GAMES (+)				
I CAN CATCH A BALL CONSISTENTLY				
I WOULD RATHER BE A SPECTATOR THAN PARTICIPATE IN THE SPORTS GAME (+)				
I CAN EASILY FLOSS BETWEEN MY TEETH				
I HAVE TROUBLE LEARNING NEW OUTDOOR GAMES (+)				
I CAN USE SCISSORS TO NEATLY CUT OUT A PICTURE FROM A MAGASINE				

* (+) means that the items is positively worded, and has been reverse scored

Three key informants (2 adults and an older adolescent) who had been diagnosed with DCD, reviewed each item using personal insight based on their lived experience. Consequently, another six items were added and additional examples for some items included, such as, putting on makeup, doing up zip-lock bags, and using a can opener (see Figure 3.1). These 35 items were subsequently reviewed by nine experts (psychologists, academics, and members of Western Australian DCD research collaboration team Move.Grow.Engage who have all specialised in the area of DCD) for language,

terminology, user-friendliness, ecological and content validity and to ensure a balance of tasks that represented both Criteria A and B from the DSM-5 (APA, 2013). A further 13 items were subsequently included resulting in 48 items. These items involved social versus competitive sports, shying away from social events such as dances, feeling neat and tidy on social occasions, keeping up with friends while walking or running, preferring not to participate in physical education classes, or confusion between right and left sides of the body.

Phase 2: Content validation and item assessment

Content validation of the 48 items was undertaken by an international panel of 10 experts (psychologists, epidemiologists, physiotherapists and academics who specialised in the area of DCD) from Australia, the Netherlands and Canada. Each rated the relevance of each item on a scale of 1 (not relevant) to 4 (highly relevant) to derive a Content Validity Index (CVI) for each item. This was calculated by dichotomizing the items into relevant and not relevant (Polit & Beck, 2006) by grouping those that scored a 3 or 4, and those that scored a 2 or 1. The number of experts who rated an item as relevant was divided by the total number of experts to create a CVI for each item ranging from 0.01 to 1.0. Eight items scored total agreement (CVI = 1.0) and 14 items received 9 out of 10 agreement (CVI = 0.9). Twelve items with a CVI of 0.6 or below were eliminated (Polit & Beck, 2006) resulting in 36 items (see Figure 3.1). The eliminated items included: feeling uncomfortable when running, using a computer rather than a pen and a paper to write, running as fast as friends, facing challenges when multitasking, participating in recreational verse competitive sports, feeling neat and tidy on social occasions, keeping the bedroom organised and tidy, naming right and left sides, shying away from

social events like school dances, avoiding compulsory school activities like sports carnivals, spending leisure time on their own rather than with friends, and flinching when a hard or fast ball is thrown.

Informal, one-on-one interviews and small group discussions to consider these 36 items were undertaken with 10 adolescents (6 boys and 4 girls) diagnosed with DCD and aged between 12 and 18 years (mean age = 14.89 years). They were recruited through AMPitup, a physical fitness program for adolescents with DCD (http://movegrowengage.com.au/). The participants sat with the primary researcher and discussed each item considering comprehensibility and age-appropriateness. They provided further suggestions for items and in some cases rephrased them to be more age-appropriate (e.g. *I can walk as fast as my friends* changed to *I can keep up with my friends when walking)*.

Phase 3: Reliability and validity of the AMCQ

In this phase the internal consistency, test-retest reliability, and concurrent validity of the 36-item AMCQ was examined and a preliminary cut score for the identification of SMD identified. A convenience sample of 38 Australian adolescents with a range of motor competence was recruited (Table 3.2). To ensure some experienced motor difficulties, 15 diagnosed with DCD were recruited from AMPitup, others were children of university staff members (n = 12); of unknown motor competence ability, and a local basketball sporting club (n = 11) considered to have higher motor competence skills. Ages ranged from 12- to 17- years, (M_{age} = 14.18 years, *SD* = 1.43; 74% male, 26% female). The inclusion criteria also specified English as the first language and no other

diagnosed movement-related disability such as ASD, cerebral palsy, learning difficulties or muscular dystrophy.

Table 3.2. *Descriptive statistics [M,(SD)] of the participants involved in Phase 2 of AMCQ development*

	Total *N* = 38 (28 males) M,(*SD*)	SMD (≤85) *n* = 23 (16 males) M,(*SD*)	TD (>85) *n* = 15 (12 males) *n* = 3 females) M,(*SD*)	Group Difference (*p*)
Age (yrs)	14.18,(*1.43*)	13.87,(*1.18*)	14.67,(*1.67*)	.093
NDI	96.92,(*24.91*)	114.36,(*14.30*)	71.33,(*10.46*)	.001
AMCQ	82.71,(*11.62*)	87.39,(8.77)	75.53,(*12.04*)	.001

SMD = Suspected motor difficulties; TD = typically developing; NDI – Neuromuscular Developmental Index (M = 100, SD = 15); AMCQ – Adolescent Motor Competence Questionnaire (total score = 104)

Participants completed the 36 item AMCQ and the MAND at the same test occasion (McCarron, 1997). The time of completion for the AMCQ was less than 10 minutes (average 4.53 minutes). The MAND was administered by Exercise and Sports Science professionals with over 10 years' experience in identifying motor difficulties. The MAND is a standardised assessment tool that is widely used to identify mild to severe motor disability (McCarron, 1997). It comprises five fine and five gross motor items, which involve both qualitative and quantitative components, and takes about 25 minutes to administer. Raw scores are standardized and summed to derive a Neuromuscular Development Index (NDI; *M*=100, *SD*=15). NDI scores between 85-70 indicate mild motor disability and below 70 indicates a severe motor disability. Evidence of reliability, and content, construct, predictive and concurrent validity is provided by McCarron (1997). Its concurrent validity, as indicated by sensitivity and positive predictive value for identifying 5- to 11-year-olds with SMD, was assessed as good when compared with BOTMP-SF (Bruininks, 1978) by Tan,

Parker and Larkin (2001). McCarron (1997) has reported test-retest reliability coefficients of 0.99. In Australia, the MAND has been used as a measure of motor coordination in children (Brantner, Piek, & Smith, 2009; Hands, Kendall, Larkin, & Parker, 2009), and adolescents (Hands, Larkin, Parker, Straker, & Perry, 2009; Hands, Larkin, & Rose, 2013; Hands et al., 2015; Hands et al., 2015; McIntyre, Chivers, Rose & Hands, 2015; Rose et al., 2015). To date, however, no studies have reported evidence of validity with an adult sample.

In the current study, based on the MAND NDI scores, the sample comprised a broad range of motor competence; 23 (61%) had no motor disability (>85), 10 (26%) had a mild disability (85-70) and five (13%) had a severe motor disability (<70). The total scores of the AMCQ ranged between 62 and 102 (total possible score 26 to 104). Significant group differences for both the NDI and AMCQ scores were found between the adolescents identified not to have SMD (typically developing group; TD; >85) and the SMD group (≤85; Table 3.2).

Test-retest reliability

Eighteen of the 38 participants completed the 36-item AMCQ version seven days after the initial administration. A 7 day test-retest interval was used as this time frame is most commonly used by others (Polit, 2014). Unfortunately, due to missing responses and non-applicable options for some items, only 26 of the 36 items in the final version of the AMCQ were able to be included in the analysis. The intra-class correlation coefficient (ICC; two-way mixed model, absolute-agreement) between the total scores for these items was .956 (95% confidence interval: .888 to .983; $p<.001$), which is above the recommended

minimum standard of 0.7 (Terwee et al., 2007). A Kappa coefficient for each item ranged between 0.90 - 0.17. The item with the lowest score related to flossing between teeth. There was no significant difference between the total AMCQ scores between Occasion 1 (M = 87.94, SD = 10.34) and Occasion 2 scores (M = 88.82, SD = 10.05; t (16) = -1.22, p < .001).

Internal consistency

Cronbach's alpha was calculated to examine the internal consistency of the 36-item AMCQ. The best fit was determined through the inclusion and exclusion of test items to achieve an acceptable alpha of >0.7 (Cronbach & Meehl, 1955). Ten items with a corrected item-total correlation of less than 0.3 (Pallant, 2013) were removed resulting in 26 items (see Table 1 for a sample of items) with a high internal consistency (α = .902). Fifteen items are reverse scored. The removed items related to movement skills such as driving a manual car, being tired when physically active, food preparation skills and self-care skills such as shaving.

Preliminary cut score for identifying suspected motor difficulties

A potential cut point to identify adolescents with SMD was derived based on the total score for the final 26-item AMCQ version (Crawford, Wilson, & Dewey, 2001; Riggen, Ulrich, & Ozmun, 1990). Using the NDI from the MAND (McCarron, 1997) as the criterion measure, the decision of agreement proportion (represented as a C-value in Table 3.3) was calculated for a range of cut scores from the AMCQ (80-85). The average total score (out of 104) for those participants with an NDI of <85 was used to inform this range of cut scores. A relatively conservative preliminary score of 83 was identified as the

most valid cutoff score (Table 3.3), as it showed the highest discrimination accuracy based on the sensitivity (true-positive rate) and specificity (true-negative rate) data (Safrit & Wood, 1995). The sensitivity of the AMCQ was consistent in classifying 80% [a / (a + c)] of adolescents identified with SMD by the MAND (see Table 3.3). The specificity of the AMCQ was lower with 70% [d / (b + d)] of adolescents identified as TD by the MAND, and classified as TD by the AMCQ (see Table 3.3). Nineteen of the 38 participants (a + b; 50%) scored <83 on the AMCQ (Table 3.4). The overall proportion of agreement between the two tests was 74% {[(a + d) /total sample] x 100}. Of the 38 adolescents, 15 (a + c) were classified as having SMD based on the NDI (score <85), and 12 of those cases were also identified by the AMCQ (AMCQ score <83). Three adolescents were classified with SMD by the MAND and not by the AMCQ. Seven adolescents were classified with SMD by the AMCQ and not by the MAND.

Table 3.3. *Table of derived cut scores, sensitivity and specificity*

Cut score	C-value	Sensitivity	Specificity
80	68%	53%	78%
81	69%	60%	74%
82	71%	73%	72%
83	74%	80%	70%
84	71%	80%	65%
85	68%	87%	56%

*C-Value represents the total proportion of agreement between the AMCQ and the NDI score from the MAND

Concurrent validity

The total score for the AMCQ was compared with the NDI from the MAND to examine concurrent validity. The MAND is a widely used standardised test designed to assess motor competence. Figure 3.2 depicts the line of best fit and the 95% confidence limits between the scores for these two measures. It reveals a moderate positive correlation (r = .491, $p < .002$) between the two scores, with

only the score for one participant slightly outside the lower limit of 95. The positive correlation demonstrates that the higher the NDI (>85 = TD), the higher the total score on the AMCQ (>83 = TD). The TD group had a significantly higher AMCQ score (M = 87.39, SD = 8.77) than the SMD group (M = 75.53, SD = 12.04; t(36) = -3.5, $p < .001$).

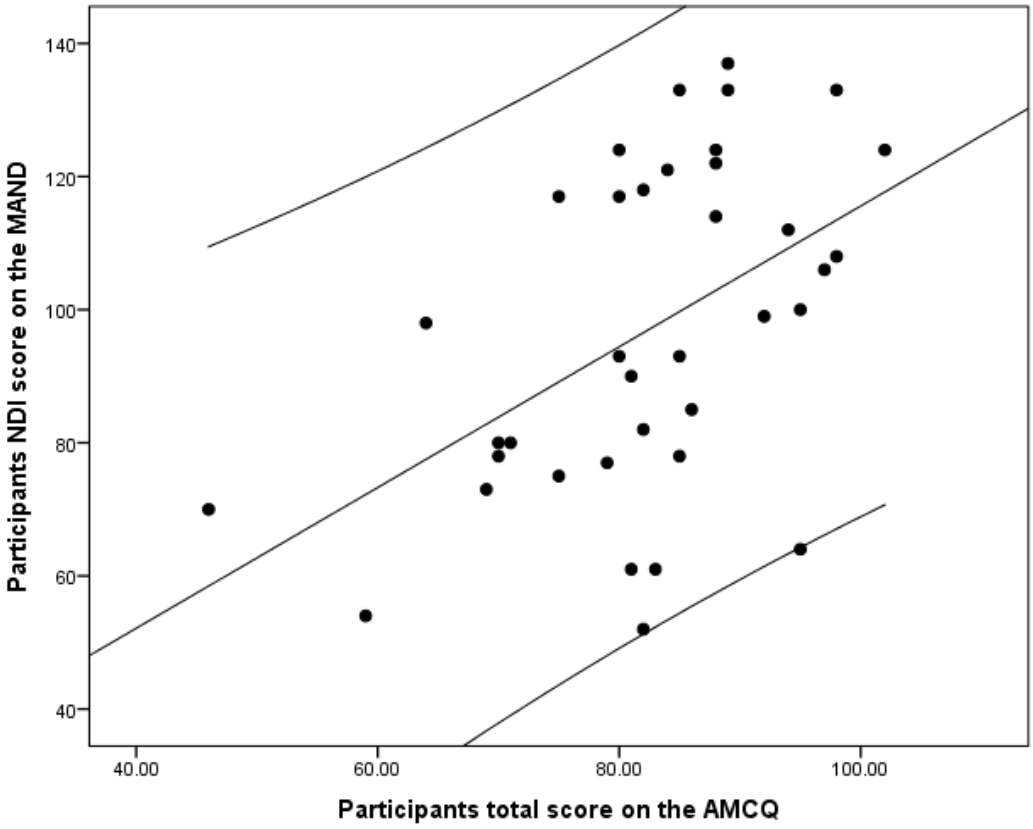

Figure 3.2. The distribution of the samples total score of the AMCQ (total score= 104) and the NDI (< 85 mild to severe difficulty >85 no motor difficulty) score from the MAND, based on the line of best fit and 95% confidence intervals.

To further investigate the ability of the items to discriminate between levels of motor competence, the mean scores for each item were ranked based on the mean score differences between the TD group and SMD group (Figure 3.3). These ranged from -0.23 (item 18) to +0.96 (item 20). The three items that were significantly different between the TD and SMD groups related to individual over team sports (item 2, $p = .008$), speed of writing (item 17; $p = .002$) and flossing teeth (item 20; $p = .002$).

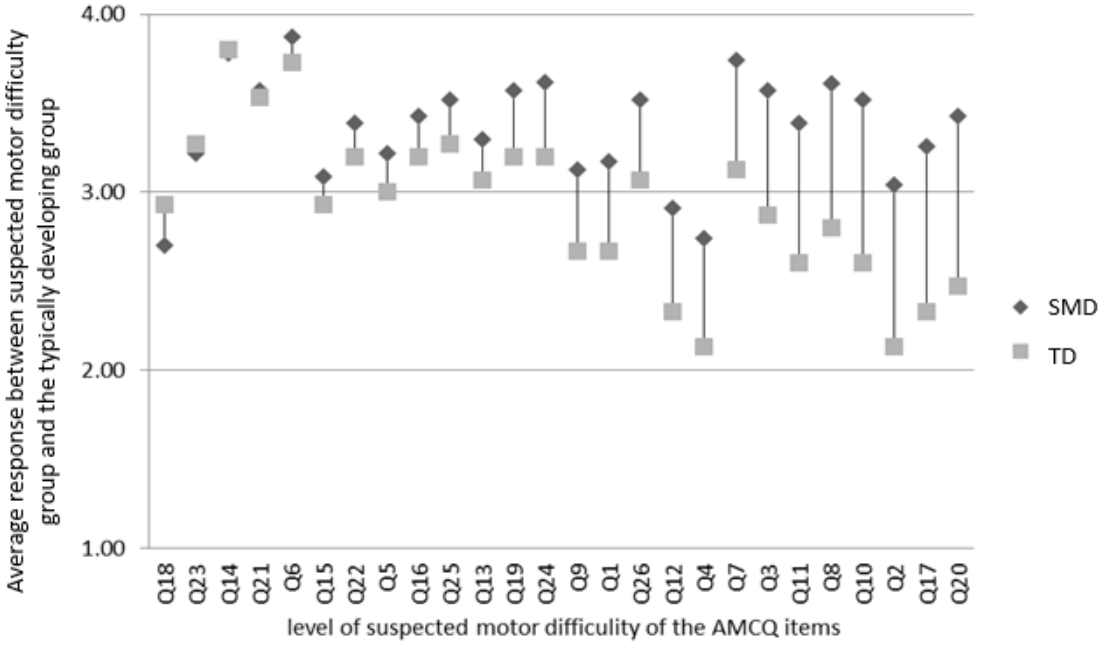

Figure 3.3. Mean AMCQ scores for the suspected motor difficulty (SMD; NDI< 85) and the typically developing (TD; NDI>85) groups. Items are sequenced based on the mean difference between the TD group. 1 = never and 4 = always.

Discussion

The development of the AMCQ was exploratory in nature and followed a robust process. It was undertaken over three phases and the results indicate that the 26 item questionnaire has the potential to be a valid and reliable measure for adolescents to self-report on their level of motor competence. The development of the AMCQ was examined in a number of ways to ensure the ecological presence of the condition was captured (Wilson et al., 2010) and that the criteria for the diagnosis of DCD were considered. The time to complete the questionnaire was acceptable. It took adolescents less than 10 minutes to complete thereby minimising response fatigue that may cause poor motivation or loss of attention (Moser & Kalton, 1971). Other adult and older adolescent questionnaires also reported similar completion times of up to 10 minutes (Kirby et al., 2010; Tal-Saban et al., 2012).

The items considered for inclusion were drawn from a number of sources. These included the range of motor skills used as exemplars in the DSM-5 (APA, 2013), suggestions from adolescents with SMD, and experts from the field. The consultation process to validate the content was similar to that followed by other developers of motor difficulty questionnaires (Kirby et al., 2010; Tal-Saban et al., 2012). Consequently, items relating to sport, academics, fine and gross motor skills and ADLs, personal care, peer comparisons and co-occurring characteristics were included. Assumptions are often made that items measuring motor competence in children can simply be modified in a variety of ways to accommodate an older age group (Hands et al., 2015). However, during the validation process we found this was not the case and the inclusion or exclusion of items are discussed below. The final version of the AMCQ is able to discriminate between adolescents with and without SMD as evidenced by the significant difference between both NDI and AMCQ scores for the SMD and TD groups (Table 3.2).

Physical activities such as kicking, catching and throwing a ball (Clark et al., 2013; Tal-Saban et al., 2012; Wilson et al., 2009; van der Linde et al., 2014), jumping (Wilson et al., 2009), participating in extreme sports, dancing, riding a bicycle (Tal-Saban et al., 2012), or participating in team games (Clark et al., 2013; Kirby et al., 2010) have been included in other questionnaires as they are considered to be difficult for those with SMD. Therefore, the AMCQ also includes items involving ball skills such as kicking (item 4), catching (item 8) and throwing (item 1) as well as static (on one foot; item 24) and dynamic balance (walking on a narrow straight line; item 25). Such tasks are important for both younger children and adolescents (APA, 2013). The mean scores for

all of these items in the AMCQ clearly distinguish between the SMD group and the TD group (Figure 3.3). On the other hand, items more relevant to adolescence and not childhood related playing ball games like team sports (APA, 2013).

Difficulties with fine motor skills such as utensil or scissor use, learning a musical instrument, threading a needle or hammering a nail (Clark et al., 2013; Kirby et al., 2010; Wilson et al., 2009; van der Linde et al., 2014) are also common for individuals with motor difficulties. Consequently, most motor assessment questionnaires include items related to handwriting (van der Linde et al., 2014), fast or legible writing (Kirby et al., 2010; Tal-Saban et al., 2012; Wilson et al., 2009), quality of the hand writing (Clark et al., 2013) and appropriate tension while writing (Wilson et al., 2009). Such items are very relevant given slowness or inaccuracy of handwriting may be experienced throughout the lifespan (Bo et al., 2014; Kirby et al., 2008; Prunty, Barnett, Wilmut, & Plumb, 2014), and may impact on academic productivity and achievement of future goals (APA, 2013). Therefore, The AMCQ also included handwriting items about ease of reading (item 12) and speed of writing (item 17) as well as the use of scissors (item 11) and flossing between teeth (item 20). These latter two items attracted some of the largest mean differences in scores between the SMD and TD groups and may be of particular relevance among adolescents (Figure 3.3).

Personal and self-care is a central feature of criterion B of the DSM-5 (APA, 2013) and need to be considered when assessing motor difficulties. For example, one parent report questionnaire included items related to washing

hands, drying after a shower, and putting on socks (DCDDaily-Q; van der Linde et al., 2014) while another designed for adults included difficulty tying shoelaces, fastening buttons, doing zips, and shaving or putting on make-up (ADC; Kirby et al., 2010). The AMCQ included items about getting ready to go out (item 7) and speed of changing clothes (item 22). These items were suggested by the target group so are probably more age-appropriate in content and wording than the wording in other questionnaires.

DCD is often diagnosed concurrently with other developmental disorders such as ASD, learning difficulties or ADHD (Loh et al., 2011; van Damme et al., 2015). When examining item content of other questionnaires used with this age group, it appeared some items related to symptoms associated with these co-occurring conditions rather than DCD. Examples include organizational skills (Clark et al., 2013; Tal-Saban et al., 2012), finding new buildings or things in the bedroom, ability to sit still (Kirby et al., 2010), not fatigue, and slouching (Wilson et al., 2009). In the first phase, items that strongly related to possible co-occurring disorders (facing challenges while multitasking, keeping the bedroom neat and tidy), were included however the only item that remained in the final version related to confusion between right and left sides (item 16). This highlights the value of discussing and validating the content of questionnaire items with the target audience rather than only parents or academics. For example, in this study, the adolescents advised that they did not value neat and tidy bedrooms as it was a space for personal expression.

The AMCQ has several unique features. It includes items about perceptions of sports participation as many adolescents avoid participating in activities that expose their weaknesses and highlight their difficulties, even from a young age (Cairney et al., 2010; Fitzpatrick & Watkinson, 2003; Kwan et al., 2013; Raz-Silbiger et al., 2015). For example, being a spectator (item 10), learning new games (item 26) and the preference for participation in individual sports over team sports (item 2) are coping strategies adopted by adolescents with motor difficulties. Fitzpatrick and Watkinson (2003) found adolescents with motor difficulties still wanted to participate in physical activities for social reasons so they often volunteered for jobs such as organizer or team manager. Adolescents with motor difficulties reflecting on their childhood reported that learning new motor tasks was difficult (Missiuna et al., 2008) and that fear of failure was the greatest barrier to participating in new activities as they grew older (Barnett et al., 2013; Fitzpatrick & Watkinson, 2003). As with the fine motor items, scores for items relating to peer comparison in sports participation had greater mean differences between the SMD group and the TD group (Figure 3.3). Most adolescents develop their friendship groups primarily based on the socializing opportunities associated with sports participation (Missiuna et al., 2008; Payne et al., 2013). Such peer-related items are important to include with this age group yet have been overlooked in other questionnaires. It is possible that during later adolescence and into adulthood, peer relationships are developed around more sedentary social activities as they enter the workforce or later education (Kirby et al., 2011a; Kirby et al., 2011b).

Surprisingly, the SMD group had similar or more positive mean scores than the TD group for three items (items 14, 18, 23; Figure 3.3), although none were significantly different. Responses to Item 18 (nervous about coming last in a running race) suggest that the TD group experience greater feelings of nervousness about their performance when running than the SMD group. This could be because the SMD group know they are not going to perform well, as they have experienced coming last for most of their school life. It could also be that participation in running races during athletic carnivals becomes optional in secondary school, and the SMD group choose not to participate. Rose et al. (2015) found that many adolescents with motor difficulties withdrew from physical activities involving social comparison. Barnett, Cliff, Morgan, and van Beurden (2013) reported that a common motivator for individuals with SMD to participate in sport or physical activity was related more too social engagement than competition. Another item relating to breaking objects accidently more than friends (item 23) also attracted similar scores. This is surprising as the AMPitup participants consulted in the second Phase considered this item reflected their poor co-ordination. However, the result could reflect a number of strategies put in place by the adolescent and/or his family to minimise breakages (Summers et al., 2008a). Finally, both groups scored similarly for Item 14 (difficulty using a fork and knife) which suggests that adolescents with SMD used utensils in a way that masked their motor difficulties, or their difficulty was accepted by the family, and this activity was not an issue (Fitzpatrick & Watkinson, 2003; Missiuna, et al., 2008). It is also possible that as the item did not adequately describe what was considered acceptable practice (e.g. not using a shovelling technique). These three items

were retained in the AMCQ as the internal consistency measure remained high. However, their inclusion may be reconsidered after analysing data from a larger sample.

A consideration of the content of excluded items also contributes to a better understanding of the impact of motor difficulties during adolescence. These related to difficulties using video game controllers, keeping up with friends while walking and tiring easily when being physically active. Unfortunately, these could be experienced by many unfit, low active, yet typically developing adolescents. Other items excluded related to fine motor skills such as using a vegetable peeler, possibly because adolescents with SMD avoided these tasks when helping with meal preparation. Finally, items that were mainly relevant for older adolescents such as shaving or learning to drive were removed.

Study limitations and strengths

Given this was an exploratory study, the sample size used to derive the preliminary cut score was small and therefore a limitation. Further research involving a larger sample may confirm the most valid cut score for identifying those with motor difficulties. At the same time, further evidence of the concurrent validity of the tool could be gathered by simultaneously assessing motor competence using the MAND. This study also had a number of strengths. The wide range of methods used for item generation and content validation, including consultation with local and international experts, and individual interviews and discussions with the target audience resulted in a rich selection of potential items. The in-depth discussions with the adolescents ensured the content and wording of each item captured the ecological presence of motor

competence difficulties in this age group. The preliminary results reported here provide evidence of internal consistency, test-retest reliability and concurrent validity. It is the first self-report questionnaire developed to assist in identifying young adolescents with SMD.

Conclusion

The AMCQ has the potential to assist in future research and is a useful addition to the range of tools used to assess motor competence. Further research is needed to explore possible clinical applications of the questionnaire, for example to examine if a childhood diagnosis of DCD is still present during adolescence or to identify the extent of SMD in adolescents with other developmental disabilities such as ASD, ADHD or learning disabilities. Responses from the AMCQ will provide information to researchers about adolescent's perceptions of their SMD and may also be useful for families and health professionals to better understand the condition in this age group.

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Factors Contributing to Australian Adolescents' Self-Report of their Motor Skill Competence

Abstract

An adolescent's motor skill competence can affect areas such as sports participation, social activities and future academic or employment decisions. The Adolescent Motor Competence Questionnaire (AMCQ) is a 26-item questionnaire that uses a four point Likert response (never, sometimes, frequently, always) to assess motor-related activities during adolescence. This study aims to provide evidence of the construct validity using Principle Component Analysis (PCA) and to identify factors that contributed to Australian adolescent self-reported motor competence. A final aim was to determine whether individual item responses differed between males and females. The AMCQ was completed by 160 adolescents (M_{age} = 14.45 *SD* = .75, 12 to 16). The PCA using varimax rotation extracted four factors (Eiqenvalue of 1.21 or above) explaining 52% of variance and representing Participation in Physical Activity and Sports, ADLs, Public Performance, and Peer Comparison. Overall males reported higher AMCQ scores compared to females. Females responded negatively (sometimes/never) to all items particularly those on Physical Activity and Sports and Public Performance. Males who responded negatively had lower AMCQ scores than the females. These findings indicate male and female adolescents may judge their motor competence on different factors, which should be considered when planning physical activity interventions. (Number of words: 200)

Introduction

Factors that contribute to an adolescent's judgement or perception of their competence differ across settings or domains such as academic capability, social engagement, athletic prowess, physical appearance, and close friendships (Harter, 2012a). One domain of particular importance during adolescence is level of motor competence. Harter (2012a) describes motor competence as an adolescent's perceived athletic ability and preference to participate in sports and physical activity such as outdoor games. An adolescent's perceived judgement of their motor competence may influence their ability to participate in ADLs and socially desirable activities such as sports and recreational activities (Okely et al., 2001; Ullrich-French & Smith, 2009) and is influenced by cultural and societal norms (Harter, 2012a; Rose et al., 2011). For example, Timler and colleagues (2016) found Australian adolescents' level of motor competence affected their participation in sports and social occasions, the way they compared themselves to their peers, completed school-based activities such as handwriting and other fine motor tasks as well as many ADLs. The impact of differences in proficiency of motor performance may be driven by cultural influences such as the value placed on sporting prowess (Hagger, Asci, & Lindwall, 2004).

In Australia, a high value is placed on participating in physical activity and sporting achievements, therefore it is likely that an adolescent's perceived motor competence may be closely linked to their actual motor competence (Stodden et al., 2008) which influences their willingness to be involved in physical activity, as well as their level of self-esteem, self-confidence and even social support (Harter, 2012a; Phillips & Pittman, 2007; Vannatta, Gartstein,

Zeller, & Noll, 2009). The consequences for those adolescents who experience or perceive themselves to have poor coordination or a lower motor competence, is that they are less likely to join in school or community sporting opportunities and potentially risk lower psychosocial outcomes such as self-concept (Harter, 2012a), social support (Barnett et al., 2013), goal orientation (Moreno-Murcia, Sicilia, Cervello, Huescar, & Dumitru, 2011) and self-efficacy (Cairney et al., 2005). Some may volunteer for sedentary roles such as spectator, team organizer, team manager or score keeper (Fitzpatrick & Watkinson, 2003; Missiuna et al., 2008). Others may prefer participating in individual sports (Timler, McIntyre, Cantell, Crawford, & Hands, 2016) or choose to withdraw from all physical activity opportunities (Fitzpatrick & Watkinson, 2003). Consequently this may affect social support mechanisms (family, sporting, school and issues related to health systems) and even lead to health issues such as higher stress and anxiety (Campbell et al., 2012; Missiuna, et al., 2006).

An additional factor to be considered is gender difference (Cliff, Okley, Smith, & McKeen, 2009; Reed, Metzker, & Phillips, 2004; Ziviani, Poulsen, & Hansen, 2009), as the level of participation in physical activity and the importance they place on their motor competence differs between males and females throughout their lifespan (Cairney et al., 2005; Hands et al., 2009; Hands et al., 2015; Hill et al., 2011; Piek et al., 2006). For example, males usually participate in a variety of sporting activities throughout their lifespan as this provides them with many social opportunities. Females tend to participate in physical activity during childhood which tends to become less important during adolescence and into adulthood (Hands, Parker, Larkin, Cantell, & Rose, 2016). Regardless of level of motor competence, males

usually place greater importance on their motor competence and participate in more high intensity physical activity such as sport (Cairney, Kwan, Hay, & Faught, 2013; Hands et al., 2015), while females often participate in less vigorous activity as they place greater importance on looking presentable and being physically attractive (Harter, 2012a; Vannatta et al., 2009). For example, Hands et al. (2015) found 14-year-old males rated involvement in physical activity as important as it gave them a chance to compete, to win, and spend time with friends. On the other hand, the 14-year-old females felt physical activity prevented them from doing other things that they liked (Hands et al., 2015).

During this emotionally fragile phase of adolescence it is important to develop a better understanding about what factors contribute to an adolescent's judgement of their own motor competence (Harter, 2012a; Hill et al., 2011; Kroger, 2007; Timler et al., 2016). Apart from involvement in sports and recreational activities and ADLs, it is unclear what other influences contribute to an adolescent's judgement of their motor competence. Few measures have been designed to gather this information. One such tool is the AMCQ which is designed for 12 to 18 year olds and has evidence of internal consistency, test-retest reliability and concurrent, but not construct validity with this age group. The aims of this study, therefore, were to use PCA to provide evidence of the construct validity of the AMCQ and secondly to identify factors that contributed to Australian adolescent self-reported motor competence. A final aim was to determine whether individual item responses differed between males and females.

Method

Participants

A sample of 160 Australian adolescents (103 males, M_{age} = 14.44 years, *SD* = 0.75) completed the Adolescent Motor Competence Questionnaire (AMCQ). They were recruited through personal contacts (n = 6), an adolescent movement clinic (n = 4), community sporting clubs [Australian Rules Football League (AFL; n = 69), netball (n = 6) and basketball clubs (n = 7)] and local schools [independent (n = 60) and government (n = 8)]. The inclusion criteria specified adolescents to be aged between 12- and 16-years; have English as their first language, good linguistic and cognitive ability sufficient to comprehend questions and no other diagnosed disability such as cerebral palsy, learning difficulties or muscular dystrophy. This project was approved by the Human Research Ethics Committee of the University of Notre Dame in Perth, Western Australia.

Measures

The Adolescent Motor Competence Questionnaire (AMCQ; Timler et al., 2016) is a self-report motor competence questionnaire developed for adolescents between the ages of 12- and 18-years of age. It consists of 26 items examining the ecological presence of motor tasks and functional ADLs and was informed by the DSM-5 criteria for Developmental Coordination Disorder (DCD; APA, 2013). Participants respond on a 4-point Likert scale of Never (1), Sometimes (2), Frequently (3), and Always (4). The maximum AMCQ score is 104, with a higher score indicating a higher level of motor competence. A score of 83 and below indicates suspected motor difficulties. To account for response bias,

fifteen items are negatively worded. These are reverse scored for the analyses to Never (4), Sometimes (3), Frequently (2) and Always (1). The questionnaire was originally designed in consultation with adolescents diagnosed with DCD to ensure the items discriminated between high and low motor competence. The questionnaire has evidence of concurrent validity against the MAND (McCarron, 1997), test re-test reliability (intra-class correlation coefficients = 0.956), internal consistency (α = 0.902; Timler et al., 2016) and can be completed in less than 10 minutes.

Procedures

Data collection took place over a two year period. The questionnaire and written consent forms were distributed to personal contacts (n = 6), an adolescents movement program (n = 4), and sporting clubs [one AFL club (140), two basketball clubs (50) and one netball club (20) were approached and agreed to participate]. The questionnaire and consent form responses were collected two weeks later (response rate 92 returned /210 distributed = 44%). Additional clubs including scouts, a sailing club, a performing arts theatre, and a photography club were contacted in regards to the study, however these clubs did not agree to assist in the recruitment process. Two music schools distributed flyers to age appropriate participants, although no one agreed to participate. The primary researcher also contacted the Occupational Therapy Association in Perth Western Australia for potential participants, however no response was received.

Students in years 9, 10 and 11 attending schools in the Perth metropolitan were also contacted. A total of 34 government (34/137 schools in

Perth = 25%), 54 Independent (54/62 schools in Perth = 87%) and 9 Catholic (9/25 schools in Perth= 36%) schools were contacted within the metropolitan area. However, only five government and seven independent schools agreed to assist in recruiting participants. Potential participants who indicated an interest in being involved were then provided with consent forms and questionnaire, which they could complete online or as a hard copy. Schools that opted for hard copies obtained written consent before the adolescents completed the AMCQ during an allocated class (response rate 38 returned /65 = 58%). One Independent school handed out hardcopies of the questionnaires and consent form with a paid-reply envelope so participants could complete and place both items in the mail at a time convenient for them (response rate 30 returned /140 = 21%). Online completion enabled teachers and year group coordinators to email parents about the study (n = 19 completed). This method was adopted for six schools. The overall response rate was 39% (Total of 160 returned /415). Adolescents were able to complete the questionnaire and online consent form at a time convenient to them.

Data Analysis

SPSS version 23 (SPSS Inc., Chicago, IL, USA) was used to analyse the data. Descriptive statistics were derived for the total sample, males and females. The data were tested for normality, and the skewness (+/-1) and kurtosis (+/-1) values indicated that parametric tests could be used for analyses (Pallant, 2013). Firstly, a Principal Component Analysis (PCA) of the participant's responses was conducted using varimax rotation to examine construct validity and how many factors would emerge from the 26 items. This was chosen as PCA is a form of factor analysis that is commonly used during scale development and

evaluation (Pallant, 2013). A second order analysis was completed to examine if one higher order factor occurred. The factors were named according to the best representation of similar items. As 15 items were negatively worded, scores were reversed and reworded into positive language. The authors grouped the responses into negative (sometimes and never) or positive (frequently and always). Treating the responses at this nominal level made it easier to interpret individual item responses. These terms were chosen to represent responses where activities or experiences were easy or positive compared to difficult or negative (e.g. coming last in a running race). Individual item responses were compared between males and females within each factor. With the total AMCQ score as the dependent variable, a General Linear Model (GLM) analysis was completed separately for each of the 26 items controlling for response category (positive or negative) and gender. Finally a chi square analysis compared the percentage of positive and negative responses by males and females for each item. Given the same dataset was used for multiple statistical analyses, to reduce the chance of Type 1 error statistical significance was set at $p<.001$.

Results

The mean score for the AMCQ was 86.55 (SD = 11.41). Males had a higher AMCQ score (M = 89.29, SD = 10.86) than the females (M = 81.60, SD = 10.78; t (158) = 4.30, p <.001). There was no significant difference between hardcopy (M = 86.98, SD = 10.61) and online AMCQ scores (M = 83.37, SD = 16.20; t (158) = 1.30, p = .09).

Factors contributing to self-reported motor competence

The PCA using varimax rotation extracted four factors with an Eiqenvalue of 1.21 or above explaining 52.31% of variance, and supported by the scree plot. The Kaiser-Meyer-Olkin value was .871 (p <.001) which indicated the sample was suitable for analysis (Pallant, 2013) as it exceeded the recommended value of .6. Items loading onto Factor 1 represented *Participation in Physical Activity and Sports* (Table 3.4). This factor comprised ten items asking about participating in the sports game, ball skills, outdoor games, individual versus team sports, bicycle riding and balancing on one foot. The second factor, *Activities of Daily Living* was represented by eight items related to flossing teeth, getting ready to go out, handwriting, using scissors, changing clothes, and walking in a straight line. The third factor comprised five items addressing *Public Performance* such as stumbling upstairs, being called clumsy, breaking objects, confusion between left and right and difficulty using a fork or a knife. The fourth factor included items related to *Peer Comparisons* such as being able to complete tasks (asking for help), coordinated like their friends, not thinking they are clumsy and not coming last in a running race. Factor loadings for all items ranged between .876 and .348. Some items such as balance, walking along a straight line and coordinated like friends loaded to a similar extent onto several factors. To investigate the construct validity of the AMCQ a second order analysis was undertaken using the first four first order factors. This yielded a one factor solution explaining 59.54% of the variance with factor loadings ranging between .735 and .796.

Table 3.4. *Factor analysis (principal components with varimax rotation) and loading factors of the AMCQ*

Factor	Items	component			
		1	2	3	4
Participation in physical activity and sports	Participate in sports game	,876			
	Hit a ball with bat	,803			
	Kick a ball	,802			
	Participate in sports at school	,792			
	Throw a ball	,728			
	Catch a ball consistently	,717	,315		
	Learn new outdoor games	,653	,304		
	Participate in team sports	,544			
	Ride a bicycle	,427		,303	
	Balance	,348	,345		,330
Activities of Daily Living	Easy to floss teeth		,657		
	Easy to get ready to go out		,664		
	Easy to read handwriting		,637		
	Easy to use scissors		,635		
	Fast handwriting		,578		
	Change clothes easily		,510		
	Walk along a straight line		,485	,381	,314
Public Performance	Do not stumble upstairs			,756	
	People do not say I am clumsy	,338		,636	,400
	Do not break objects		,327	,632	
	Right and left sides identified			,618	
	Use a fork and knife			,592	
Peer comparison	Complete tasks				,688
	Co-ordinated like friends	,472		,317	,548
	Do not think I am clumsy			,401	,484
	Do not come last in a running race				,366
% of variance		20.55	12.36	11.46	7.9

Note: Loadings <.3 have been removed
All items have been changed in to positive worded items

Group differences for individual items

Not surprisingly, there were significant differences (p<.001) in the participants' mean AMCQ scores between response categories (positive or negative) for all items (Table 3.5). Those who responded negatively to items had lower Total AMCQ scores than those who responded positively. Significant differences (p<.001) in mean AMCQ scores were also evident between males and females for 12 items (Table 3.5), in all cases favouring the males. Seven of these items

loaded onto the Activities of Daily Living factor. Males scored lower in some items, but these were not significant.

Table 3.5. *Mean total AMCQ scores [M(SD)] for positive and negative responses to each item for the total sample (N = 160),and for males (n = 103) and females (n = 57).*

Factor	Item	Response category				Gender	
		Positive	**n**	**Negative**	**n**	**Male**	**Female**
Participation in physical activity and sport	Participate in sports game	89.43 (8.63)	132	72.96 (13.17)	28	80.72 (1.53)	79.70 (1.31)
	Hit a ball with bat	89.93 (8.37)	125	74.49 (12.71)	35	84.17 (1.13)	79.75 (1.25)
	Kick a ball	91.20 (7.22)	112	75.71 (12.09)	48	84.01 (1.08)	82.77 (1.20)
	Participate in sports at school	89.32 (8.91)	131	74.03 (13.15)	29	82.29 (1.45)	79.60 (1.36)
	Throw a ball	89.45 (8.02)	135	70.88 (14.16)	25	82.09 (1.25)	78.15 (1.27)
	Catch a ball consistently	88.90 (8.30)	145	63.87 (12.73)	15	74.82 (1.91)	75.62 (1.45)
	Learn new outdoor games	88.21 (9.21)	149	64.09 (14.85)	11	75.20 (2.06)	75.53 (1.94)
	Participate in team sports	89.22 (9.90)	124	77.36 (11.64)	36	**85.71 (1.19)**	**80.05 (1.35)**
	Ride a bicycle	87.96 (9.91)	149	67.45 (13.64)	11	75.72 (2.44)	77.10 (1.93)
	Balance	87.72 (10.11)	149	70.73 (16.16	11	75.89 (2.94)	78.47 (1.91)
Activities of Daily Living	Easy to floss teeth	88.79 (8.96)	126	78.24 (15.27)	34	**86.30 (1.09)**	**77.96 (1.44)**
	Easy to get ready to go out	88.03 (9.72)	144	73.25 (16.47)	16	**83.24 (1.38)**	**74.82 (1.70)**
	Easy to read handwriting	88.50 (9.30)	111	82.12 (14.29)	49	**88.19 (1.04)**	**79.34 (1.45)**
	Easy to use scissors	89.11 (9.07)	128	76.31 (14.00)	32	**85.43 (1.11)**	**77.94 (1.39)**
	Fast handwriting	88.64 (9.52)	121	80.08 (14.21)	39	**87.10 (1.12)**	**79.43 (1.44)**
	Change clothes easily	88.18 (9.31)	141	74.42 (17.31)	19	**84.09 (1.37)**	**76.84 (1.59)**
	Walk along a straight line	87.90 (10.04)	145	73.53 (15.53)	15	**83.71 (1.60)**	**77.28 (1.66)**
Public Performance	Do not stumble upstairs	88.35 (8.99)	148	64.33 (14.88)	12	**79.12 (1.53)**	**73.10 (1.59)**
	People do not say I am clumsy	88.75 (8.86)	141	70.21 (14.83)	18	81.78 (1.45)	77.40 (1.41)
	Do not break objects	87.97 (9.67)	146	71.79 (17.13)	14	**82.70 (1.53)**	**75.44 (1.71)**
	Right and left sides identified	87.54 (10.01)	149	73.18 (19.44)	11	73.15 (2.88)	80.77 (1.87)
	Use a fork and knife	87.65 (9.93)	150	70.10 (18.62)	10	77.20 (2.25)	79.25 (2.29)
Peer Com-parison	Complete tasks	88.07 (10.18)	136	77.96 (14.18)	24	**85.77 (1.29)**	**78.20 (1.57)**
	Co-ordinated like friends	88.71 (8.80)	144	67.13 (13.98)	16	80.03 (1.52)	76.25 (1.42)
	Do not think I am clumsy	90.46 (8.50)	104	79.29 (12.59)	56	86.79 (1.07)	82.02 (1.31)
	Do not come last in a running race	89.15 (9.35)	103	81.86 (13.26)	57	**88.00 (1.10)**	**81.54 (1.39)**

Bold: Gender difference p<.001
Note: All items have been positively worded

A number of interactions between response category (positive or negative) and gender (p<.05) emerged for eight items from the Participation in Physical Activities and Sports factor (participate in sports game p = .007, participate in sports at school p = .037, catch a ball consistently p = .005, learn new outdoor games p = .006, ride a bicycle p = .006, balance p = .005) and

Public Performance factor (right and left sides identified $p = <.001$, use a fork and knife $p = .001$). In these instances, the mean AMCQ scores for the males who responded negatively were lower than the mean scores for the females who also responded negatively. Figure 3.4 shows the interaction between male and female responses for the item 'use a fork and knife' as an example.

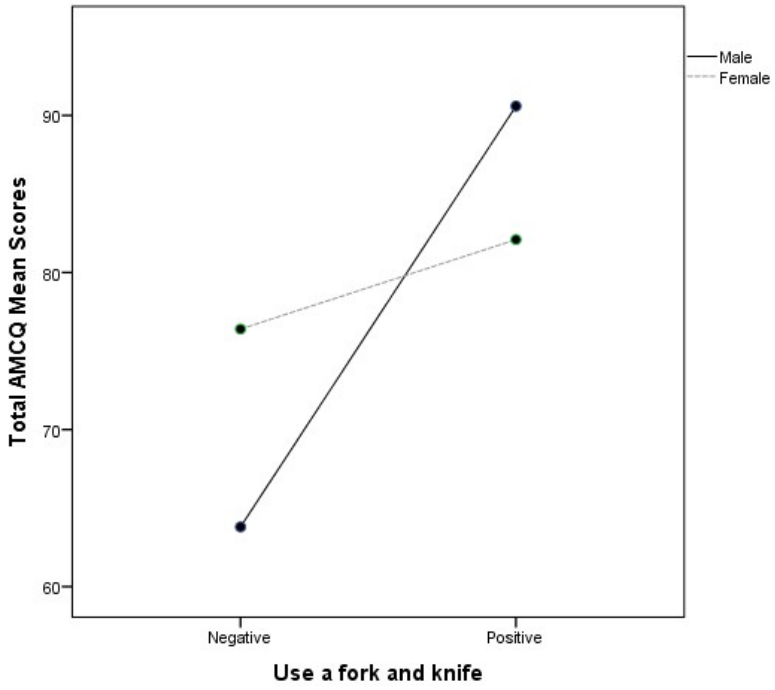

Figure 3.4. Example of the interactions of male and female responses to the item 'use a fork and knife'

The chi square analyses were significant for a number of items (Table 3.6). A higher percentage of the females compared to males responded negatively to seven items, primarily relating to Participation in Physical Activities and Sports (in particular, ball skills such as hit, kick, and throw) and Peer Comparison. For example, 37% of females compared to 14% males

responded negatively to being able to hit a ball with a bat. Most males responded positively to the test items.

Table 3.6. *The number and proportion of positive and negative responses for males (n = 103) and females (n = 57) for each item*

Factor	Item	Gender				
		Male Positive n (%)	Negative n (%)	Female Positive n (%)	Negative n (%)	x^2
Participation in physical activity and sport	Participate in sports game	**93 (91)**	**10 (10)**	**39 (68)**	**18 (32)**	**.001**
	Hit a ball with bat	**89 (86)**	**14 (14)**	**36 (63)**	**21 (37)**	**.001**
	Kick a ball	**88 (85)**	**15 (15)**	**33 (58)**	**24 (42)**	**<.001**
	Participate in sports at school	91 (88)	12 (12)	40 (70)	17 (30)	.005
	Throw a ball	**95 (92)**	**8 (8)**	**40 (70)**	**17 (30)**	**<.001**
	Catch a ball consistently	98 (95)	5 (5)	47 (82)	10 (18)	.009
	Learn new outdoor games	98 (95)	5 (5)	51 (89)	6 (11)	.179
	Participate in team sports	87 (84)	16 (16)	37 (65)	20 (35)	.005
	Ride a bicycle	99 (96)	4 (4)	50 (88)	7 (12)	.046
	Balance	100 (97)	3 (3)	49 (86)	8 (14)	.008
Activities of Daily Living	Easy to floss teeth	79 (77)	24 (23)	47 (82)	10 (18)	.382
	Easy to get ready to go out	91 (88)	12 (12)	53 (92)	4 (7)	.342
	Easy to read handwriting	66 (64)	37 (36)	45 (79)	12 (21)	.048
	Easy to use scissors	83 (81)	20 (19)	45 (79)	12 (21)	.823
	Fast handwriting	78 (76)	25 (24)	43 (75)	14 (25)	.989
	Change clothes easily	92 (89)	11 (11)	49 (86)	8 (14)	.542
	Walk along a straight line	97 (94)	6 (6)	48 (84)	9 (16)	.019
Public Performance	Do not stumble upstairs	98 (95)	5 (5)	50 (88)	7 (12)	.091
	People do not say I am clumsy	**98 (95)**	**5 (5)**	**43 (75)**	**14 (25)**	**<.001**
	Do not break objects	95 (92)	8 (8)	51 (89)	6 (11)	.565
	Right and left sides identified	100 (97)	3 (3)	49 (86)	8 (14)	.008
	Use a fork and knife	98 (95)	5 (5)	52 (91)	5 (8.8)	.334
Peer Com-parison	Complete tasks	88 (85)	15 (15)	48 (84)	9 (16)	.634
	Co-ordinated like friends	**100 (97)**	**3 (3)**	**44 (77)**	**13 (23)**	**<.001**
	Do not think I am clumsy	**78 (75)**	**25 (24)**	**26 (46)**	**31 (54)**	**<.001**
	Do not come last in a running race	74 (72)	29 (28)	29 (51)	28 (49)	.007

Bold: p<.001
Note: All items have been positively worded

Discussion

The PCA of the AMCQ scores identified four factors that contributed to Australian adolescent self-report of their motor skill competence. These were related to Participation in Physical Activities and Sports, Activities of Daily Living, Public Performance and Peer Comparison. The males in the sample had higher mean AMCQ scores than the females and were more likely to respond

positively to many of the questionnaire items compared to the females. In particular items relating to Participation in Physical Activities and Sports and Public Performance.

The four factors from the AMCQ were named according to the best representation of items and based on evidence of factors developed for other questionnaires such as Fine Motor/Handwriting, Gross Motor/Planning and General Coordination (Wilson et al., 2009), Fine and Gross Motor Function and Writing, ADLs, and Organization Skills (Tal-Saban et al., 2012). However, a couple of items on the AMCQ loaded onto a number of factors. For example, 'use of fork and knife' loaded onto the Public Performance factor even though it is an activity of daily living. Clearly, to use these utensils efficiently a degree of coordination is required. 'Balance' loaded onto Participation in Physical Activities and Sport, however it is also needed during ADLs such as dressing and tying shoelaces and can be observed through peer comparisons. 'Walking along a straight line' loaded onto ADLs. This activity also requires coordination and can be easily observed by peers. 'Co-ordinated like friends' loaded onto Peer Comparisons, however an adolescent's participation in physical activities and sport and their level of co-ordination are also important for this item. Although some items loaded onto a couple of factors, all four factors converged into one higher order factor of motor competence. This is an important finding to acknowledge as it demonstrates the AMCQ has construct validity.

These results highlight the greater perceived importance placed by males on participation and sport based activities and physical activity than

females (Harter, 2012a; Ullrich-French & Smith, 2009). It has been suggested that cultural norms often dictate what each gender "should" focus on regarding certain activities, which in turn affects self-perceptions. These different expectations and social norms for men and women are then reinforced through environmental influences, including the media and parents (Harter, 1993). This is supported given the strong sporting culture in Australia and the level of adoration afforded to our sporting heroes, particularly male athletes (Vandello, Bosson, Cohen, Burnaford, & Weaver, 2008). Unfortunately, female athletes are often not given the same level of recognition (Angelini, 2008). Parents of boys have also been reported to hold higher perceptions of their competence in physical tasks and consider sport as more important, in comparison to girls (Fredricks & Eccles, 2005). Even from a young age, Australian males see participation in physical activities as an opportunity to win, compete and hang out with their friends (Hands et al., 2015; Rose et al., 2011). In this study, even the males with self-reported low levels of motor competence responded positively to most items relating to sport participation. Cairney et al. (2013) also found that Canadian males, regardless of motor skill competence, were more likely to participate in physical activities. It is possible that males benefit from sports participation to a greater extent than females as studies have found that males prefer competitive orientated activities (Mehta & Strough, 2010), experience positive social involvement in organized physical activities which improves resiliency skills (Zimmerman et al., 2013), and develop larger social support networks with team mates and adult figures (Guan & Fuligni, 2016; Ullrich-French & Smith, 2009). This contributes to a positive sense of self and a healthy identity (Doumen et al., 2012). In our study, more females, regardless

of level of perceived motor competence, responded negatively towards participation in physical activities such as ball skills, and participating in sports. This finding is not surprising as adolescent females tend to participate in less physical activity (Cairney et al., 2005; Cairney et al., 2013). They tend to place greater importance on close friendships, emotional support, activities relating to their appearance (Byrd-Craven & Geary, 2007; Harter, 2012a; Rose et al., 2011) and participate in co-operative rather than competitive activities (Hands et al., 2015; Labbrozzi, Robazza, Bertollo, Bucci, & Bortoli, 2013; Mehta & Strough, 2010; Rose et al., 2011). Consequently factors that contribute to their perceived motor competence are not strongly related to sports participation. Studies have shown that only females with high levels of actual and perceived motor competence continue to participate in sports during their adolescence (Barnett et al., 2013). This may be dependent on the changes in a female's motor proficiency from childhood through to adolescence (Barnett, van Beurden, Morgan, Brooks, & Beard, 2010). For example, many begin to place greater focus on developing close friendships rather than physical activities (Tatlow-Golden & Guerin, 2017).

It is unclear from the results whether females have a more realistic view of their own ability, assess themselves more negatively compared to their male counterparts or males overrate their motor competence. The gender interactions for six items involving participating in sports, catching a ball, learning new outdoor games, riding a bicycle and balancing revealed that those males who responded negatively had a lower overall AMCQ score compared to the females who responded negatively. This suggests that those males with lower self-

reported motor competence were more aware of their inability to complete these physical performance tasks than other factors.

There is some evidence that females receive health benefits from lighter physical activity and do not require the same intensity and amount of physical activity compared to males (Hands et al., 2016), and are often less motivated to participate (Labbrozzi et al., 2013). Other studies have also suggested that perceived competence plays a role in engagement of physical activity (Ferrer-Caja & Weiss, 2000; Sollerhed et al., 2008), therefore girls may choose to participate less due to feelings of poor competency in physical activity tasks and place less value on sports participation (Fredricks & Eccles, 2005; Slater & Tiggemann, 2011). Furthermore, males and females may experience contrasting views towards sporting stereotypes (Schmalz & Davison, 2006) and gender identity roles (Spoor & Hoye, 2014) as well as use different coping strategies to deal with their perceived inadequacies in their motor competence (Harter, 2012a; Miyahara & Cratty, 2004). These include placing themselves out of sight during team sport selections, using humour to diffuse the situation (Fitzpatrick & Watkinson, 2003; Missiuna et al., 2008), devalue the area/domain of disadvantage, select a reference group that suits their perceptions and discount any negative attitudes directed towards them (Crocker & Major, 1989). It is possible that females base their judgement of their own motor competence on factors associated with ADLs rather than participation in sport and deal with the impact in different ways to males.

The ability to efficiently complete some ADLs emerged as a factor influencing adolescent self-report motor competence. The males had higher

AMCQ mean scores, when controlling for response category, for all items relating to ADLs than the females. The males may be discounting the importance of performing these activities well compared to females who tend to place more importance on their personal appearance and body image (Harter, 2012a; Kilpatrick, Herbert, & Bartholomew, 2005; Weiss & Smith, 2002), fine motor skills such as neat and fast handwriting and creative activities such as arts and crafts (Barnett, Henderson, Scheib, & Schulz, 2011). Furthermore, social norms place greater pressure on females to perform well in daily activities (Vandello et al., 2008).

Not surprisingly, Public Performance emerged as a factor evidenced by stumbling upstairs, being called clumsy, frequently breaking objects, confusing left and right sides, and having difficulty using a fork or a knife. This result suggests that an adolescent's perceived and actual motor competence may be closely related. These movement difficulties are very public and reinforce to the adolescent their own inadequacies (Cairney et al., 2005; Fitzpatrick, & Watkinson, 2003; Stodden et al., 2008). Interestingly, only males with very low perceived competence reported having difficulty distinguishing between right and left side and using eating utensils. This may be a result of many males discounting the importance of these skills, whereas the females may be more accepting of their difficulties.

Finally, issues associated with Peer Comparisons emerged as an important factor. Those with lower motor competence were aware they were more uncoordinated than their friends, they knew they would come last in a running race, thought they were clumsy and often had to ask for help. Peer

acceptance and spending time with friends becomes very important during adolescence (Guan & Fuligni, 2016). Several qualitative studies have found that level of motor competence affects social acceptance during this time (Barnett et al., 2013; Payne et al., 2013). Rose and colleagues (2015) also found that self-perceptions around close friendships, social acceptance, romantic appeal and physical appearance were dependent upon level of motor competence among Australian adolescents.

Strengths and limitations

This is the first time that a study has been undertaken to identify factors that contribute to Australian adolescents' self-report of their motor competence. Interestingly, clear gender differences in response patterns emerged. While the sample size was adequate, generalization of the results to the broader Australian population is not possible due to recruitment difficulties. Participants were drawn from a range of sources. In order to ensure an adequate representation of adolescents with low motor competence, it was important not to over recruit participants through sporting associations, which was the easiest way to access adolescents outside school. Significant differences in the Total AMCQ scores were found between those recruited through sporting clubs (M = 91.75, SD = 6.95) compared to those recruited elsewhere (M = 82.18, SD = 12.57; t (138.15) = 6.08, p <.001). The latter group comprised adolescents attending a movement clinic as well as many community contacts. This recruitment process ensured participants had motor competence levels ranging from high to low, which was important for the purpose of the study. The exact response rate was not calculated from the schools or clubs that were contacted due to the complexity of trying to recruit a sample with a range of motor competence levels. It also

may have contributed to fewer females than males being recruited into the study. The sample comprised a broad age range, so some developmental differences may be present but the sample size did not allow for smaller age groupings. The variation in the data collection between online and hardcopy surveys may have affected the results, however this method had to be adopted in order to reach a desired sample size and no significant differences were found.

Conclusions

In this study four factors that contributed to Australian adolescents' self-reporting of their motor competence were identified. These related to participation in physical activities and sport, ADLs, Public Performance and peer comparison. Overall, males had higher self-reported motor competence scores compared to females. Males self-reported responses showed that they were particularly influenced by their ability to participate in sports and physical activities. On the other hand, activities related to daily living and the impact of Public Performance were more influential for the females. These gender differences in responses to aspects of motor performance should be considered when designing interventions or building support networks for adolescents with motor difficulties. For example, males place greater importance on sporting prowess and should be provided with competitive and non-competitive options to be physically active, whereas females place more importance on completing ADLs. Programs should facilitate the promotion of an active lifestyle rather than a focus on participation and competition in team based sports and physical activities.

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CHAPTER FOUR: The assessment of adolescence identity in Australia: An investigation of the suitability of the Assessment of Identity Development in Adolescence (AIDA) Australia

Social support

'Yeah, like there are certain things like teenage stuff you can talk to your friends about but you cannot talk to your parents about because it is just weird. They say, we were teenagers once but they just do not get it. So definitely there is friends' support there.'

(14 year-old LMC female)

Abstract

Background and Objective. The Assessment of Identity Development in Adolescence (AIDA) questionnaire was developed in Europe to assess identity on a continuum of healthy to less healthy. Cultural validation studies of this measure are necessary as the health of person's identity accommodates social and environmental differences. This paper reports the adapted translation of AIDA for an Australian population. **Methods.** An expert panel and a reference group culturally adapted the 58-items, with equivalency checked by the original author. Basic psychometric properties were established with a convenience sample of 34 adolescents (14-16 years). The main test version was completed by 126 adolescents (67.5% boys, M = 14.6 years, SD = 0.9) which allowed the selection of 58-items equivalent to the original version. **Results and Conclusions.** The reliability was excellent for the total scale $\alpha = .95$, the two primary scales .90 (Discontinuity) and .94 (Incoherence), and 6 subscales (between .74 and .82). An Exploratory Factor Analysis extracted a one-component solution providing evidence of construct validity. No significant differences for age range, age groups (12-14 and 15-18 years) or gender were found. The AIDA Australia appears to be a valid and reliable measure of identity, suitable for use in Australian adolescents.

Introduction

The health and consolidation of identity is a core process during adolescence and is significantly affected by an individual's social environment and personal life experiences (Crocetti et al., 2014; Duriez et al., 2012). The health of an adolescents identity develops by searching and programing self-relevant information which guides their decision making and problem solving skills (Berzonsky, 1989, 1999). Identity is considered to be a central feature of personality functioning (Gøtzsche-Astrup & Moskowitz, 2016). The Diagnostic and Statistical Manual, fifth edition (DSM-5; APA, 2013) defines personality functioning through two domains which include self-functioning (identity, self-direction) and interpersonal functioning (empathy, and intimacy). Identity is described as a unidimensional continuum ranging from integrated to diffused (Schmeck et al., 2013; Skodol et al., 2011). An integrated or cohesive identity is regarded as healthy (Kassin et al., 2013; Kernberg, 1981), while a disintegrated or fragmented identity (identity diffusion) is less healthy and may contribute to mental ill health (Kassin et al., 2013) or even social, physical or cognitive deficits (Goth et al., 2012; Schmeck et al., 2013). Identity diffusion is defined by the inability to identify with personal attributes, interests or life goals that are reliable and stable over time within social situations as well as forming relationships with significant others (Schmeck et al., 2015).

A questionnaire designed to measure the identity continuum in adolescence was developed by a Swiss-German-American research group in 2010 after recognizing a lack of congruency between social-cognitive psychology (Erikson, 1968; James, 1950) and psychanalytic strains of identity

(Kernberg, 1981, 2004; Marica, 1966). The Assessment of Identity Development in Adolescents (AIDA) uses a hybrid theoretical framework to differentiate between identity integration, identity crisis and identity diffusion (Goth et al., 2012). The AIDA consists of 58 items and has a 5-step response format: 0=no, 1=more no, 2 = part/part, 3=more yes, and 4=yes. A total scale score is calculated from the 58 items, with a higher score relating to Identity Diffusion (less healthy identity). Two primary subscales measuring continuity and coherence were purposely chosen to consider both psychological and psychanalytic identity (Goth et al., 2012). The Discontinuity subscale (27 items) measures the unconscious, subjective interior (I-self) to identity as it is stable and exhibits self-sameness over time (Goth et al., 2012; James 1950; Sollberger, 2013). On the other hand, the Incoherence subscale (31 items) addresses how an individual continually integrates themselves into different social situations and incorporates their self-concept and openness towards social attention (Me-self; Goth et al., 2012; James 1950; Sollberger, 2013). Coherence is considered the 'sense of identity' as humans are social beings that rely on social interactions to develop a sense of belonging (Sollberger, 2013). In order to give greater understanding to identity, three psychosocial subdomains comprising of self-images (personal interests and self-concept), social interactions (belonging to group ideals) and mental representations (emotional and cognitive self-expressions) underpin the primary scales (continuity and coherence) and the factor structure of the AIDA. In addition, six semi-open questions are available as a secondary clinical assessment.

Psychometric properties for AIDA were originally established in Germany. Goth et al. (2012) completed AIDA with a German school sample

(*N* = 305) and Swiss patient sample (*N* = 52) aged 12- to 18-years. Evidence of construct, criterion, convergent validity, item selection and scale reliabilities have been reported (Goth et al., 2012). The results showed acceptable scale reliabilities for Identity Diffusion α = .86, Discontinuity α = 86 and Incoherence α = 92, with subscales ranging between α = .73 and .86. An Exploratory Factor Analysis (EFA; Principal Component Analaysis [PCA]) was performed at the item (15 extracted factors explained 66.2% of the total variance) and subscale level (1 factor explained 24.27% of total variance) which supported a one-factor solution of 'Identity Diffusion'. Overall the results showed the individual items and subscales were highly correlated with their assigned primary scale. Evidence indicates acceptable reliability and validity of AIDA has been established (Goth et al., 2012; Jung et al., 2013; Kassin et al., 2013).

The health of identity involves adopting cultural roles and responsibilities that become a part of an individual's future orientation which distinguishes them from other individuals and different cultures around the world (Jackman & MacPhee, 2015). Individuals, even from a very young age, begin to internalize good and bad behaviours modelled by their parents, peers and the wider society (Becker et al., 2014). During adolescence, personality functioning and self-definition are affected by cultural aspects such as motivation, socialization and cognition (Becker et al., 2014; Markus & Kitayama, 1991; Yuki, 2003). Differences exist between cultures due to the range of philosophical perspectives such as East-West or Collectivism-Individualism (Becker et al., 2014). For example, western countries such as America incorporate an independent view of the self, compared to other countries like Japan or China that create an interdependent view of self that

look towards the goals of the community and place less importance on the individual group members (Markus & Kitayama, 1991; Tam et al., 2012; Yuki, 2003).

Individuals from countries that value individualism display less group loyalty, value self-direction and personal uniqueness and prioritize personal goals, whereas collectivists tend to conform and do not distinguish between personal or collective goals as they focus on in-group harmony (Harter, 2012a; Triandis, Marin, Lisansky, & Betancourt, 1984; Yuki, 2003). Additionally, an individual's emotional functioning between interdependent and independent countries may differ. Those residing in interdependent countries view social interactions in a cooperative manner, whereas those from independent countries can be more ego-focused and likely to express personal emotions frequently (Markus & Kitayama, 1991). Clearly, the context in which one lives influences the health of their identity and sense of self. To understand the unidimensional characteristics of identity, measures must be validated for each culture (Smith, 2016). Cultural adaptations, therefore, are important as the formulation of each item needs to reflect cultural factors such as living conditions, language, and mentality (Calude & Pagel, 2011; Kassin et al., 2013) and account for current circumstances and environmental differences (Anderson, 1994; Hambleton, Merenda, & Spielberger, 2004).

Currently, cultural adaptations of AIDA are being undertaken in a number of countries around the world following the requirements of the International Test Commission (International Test Commission, 2005) to provide a true equivalence and to measure changes in phenotypes across

different cultures (Hambleton et al., 2004). These are all at different stages of completion, seven countries are in a pilot phase, and 13 countries are completing their main test versions. In Mexico, a culture-adapted Spanish AIDA version has been developed (Kassin et al., 2013). This Spanish AIDA study recruited a school sample (N = 265) and a juvenile justice system sample (N = 41) aged between 12- and 19-years. Evidence of item analysis and scale reliability, as well as construct and criterion validity has been reported (Kassin et al., 2013). High scale reliabilities were found for the total scale α = .94 (Identity Diffusion), the primary scales .85 (Discontinuity) and .92 (Incoherence) with ranges between α = .70 and .83 for the subscales (Kassin et al., 2013). The EFA for the Spanish AIDA was similar to the original AIDA as 15 extracted factors explained 66.2% of the total variance with the first component alone explaining 25.4%. Some language differences in the items between the two versions emerged. For example, in Germany it is best to say '*I feel like belonging to my community*', whereas in Mexico it is more culturally appropriate to say '*I am proud of my roots*.' The purpose of this paper is to report the cultural adaptation of AIDA for an Australia population.

Methods and Results

Procedure

A series of empirical beta, pilot and main tests using adolescents were completed to ensure content equivalence and adequate psychometric properties were established following a standardized procedure based on the guidelines from the International Test Commission (Hambleton et al., 2004; International Test Commission, 2005). This project was approved by the Human Research

Ethics Committee of the University of Notre Dame in Perth, Western Australia. Data collection for the main test took place over a two year period. The questionnaire and written consent forms were distributed to sporting clubs and collected two weeks later. Depending on the school, the questionnaire and consent forms were completed as a hard copy or online. Schools that opted for hard copies obtained written consent before the adolescents completed the AIDA during an allocated class. Online completion enabled teachers and year group coordinators to email parents about the study. Adolescents were able to complete the questionnaire and online consent form at a time convenient to them.

Stage 1: Beta test: Method.

Instrumentation

The English version of the AIDA (58 items) was examined by the research team in Perth, Western Australia in cooperation with the original author. Some language adjustments were made to ensure that the items were culturally appropriate. An additional seven items with similar formulations were included for comparison and would be clarified by a convenience reference group who were recruited through a staff member (65 items in total). This group comprised eight typically developing adolescents (4 girls and 4 boys) between the ages of 14 to 16 years (M_{age} = 15.20 years) who sat with the primary author to review each of the 65 items. They considered each item for comprehension, life circumstances and cultural-specific aspects. The language of each test item was discussed in-depth and response patterns were monitored to account for

common responses between boys and girls. Consideration was given to life circumstances and experiences from the reference group for each item.

Beta test: Results

The terminology of 16 items, were adjusted to better reflect the responses of the Australian adolescents. For example, an Australian girl and boy would probably not say: *I often have a block when I ask myself why I did things*, an Australian boy and girl would more likely say: *I often have a mental blank when I ask myself why I did things.* After consulting with the reference group, items were adjusted for language, with seven items eliminated so that the questionnaire comprised 58 Items. These adjustments were reviewed by the original author for equivalency and additional feedback and comparisons were made to some formulations that had been validated in other countries. For example, an Australian adolescent suggested: *I feel that I have many different faces and they don't go together very well.* The original author suggested to use a stronger Italian formulation of: *I feel I have many different sides to me, that do not agree with each other*.

Stage 2: Pilot test

Participants.

A convenience sample of 34 adolescents (M_{age} = 14.26 years, *SD*= 1.44; 71% male, 29% females) were recruited through friends (*n* = 12), staff members (*n* = 9), and a local basketball sporting club (*n* = 13). The inclusion criteria were adolescents aged between 12- and 18-years, from an English speaking background with sufficient linguistic skills to comprehend the items.

Results and Preliminary analyses

Scale reliabilities and item-total correlation (abbreviated as: r-it) and as part of the subscale (abbreviated to: r-it1) for each item was examined. The criteria for the item-total correlation is satisfied if r-it>.30 and scale reliabilities >.70 (Pallant, 2013). The preliminary analysis showed acceptable scale reliability for the two primary scales α = .86 (Discontinuity) and .87 (Incoherence). Subscale reliabilities ranged between .59 and .77. Most items matched the criteria for the item-total correlation (>.30). Consequently, a total of thirteen items received an r-it1<.30. Language was re-adjusted for these items (r-it1 ranged from .191 to -.227). For example, item 28 *My parents think that I'm no good* (r-it1 = .191) changed to *My parents think that I am good for nothing*.

Four items (8: = .094, 26: = .109, 40: = .108, and 48: = -.122) received the lowest r-it. In order to improve the r-it for these items, four additional items (59, 60, 61 and 62) were included in the main test version (*N* = 62 items). For example, item 26 *I have a clear idea of what my future might be* (*e.g. getting married and having children, a particular kind of job, hobbies, etc)* was compared against a new item 59 *I have a clear idea what kind of future I want for myself*.

Stage 3: Main test

Participants.

The sample consisted of 126 adolescents aged 12 to 18 years (M_{age} = 14.60 years, *SD*= 0.9; 67.5% males). They were recruited through personal contacts (*n* = 22) community sporting clubs [Australian rules football league (AFL; *n* =

52), netball (n = 3) and basketball clubs (n = 3)] and local schools [Independent (n = 42) and Government (n = 4)]. Inclusion criteria were aged between 12 and 18 years, from an English speaking background with sufficient linguistic skills to master the written task and comprehend the questions.

Results: Item Analysis and scale reliability

The main test scale reliabilities showed excellent psychometric properties for the AIDA Australia. The total scale (Identity Diffusion) reliability was high α = .96. The two primary scales were .90 (Discontinuity) and .94 (Incoherence), with ranges on the subscale level from .74 to .82. The main test version results showed the formulation adjustments made to the 13 items in the pilot test improved the scale reliabilities [the pilot primary scales: .86 (Discontinuity) and .87 (Incoherence) and subscale ranged between .59 and .77]. The procedures used showed that the item improvements were successful and led to an equivalent version with 58 items matching the criteria stated above. Therefore it was possible to finalise 58 items with sound psychometric properties for AIDA Australia (Table 4.1).

Table 4.1. *Scale reliability a for AIDA Australia pilot version (N = 34), main test version (N = 126) and marker items per subscale, factor loadings f of the subscale on the joint factor 'Identity Diffusion' and two marker items per subscales (-) = reverse scoring*

Scales	**α German**	**No. items**	**α pilot**	**α main**	***f***	**Marker items**
Diffusion total score	**.94**	**58**		.96		**Sum of scales**
1. Discontinuity	**.86**	**27**	.86	.90		**Sum of subscales**
1.1 attributes	.73	9	.67	.74	.76	26: I have a clear idea what kind of future I want for myself; 41: I have had very good experiences with listening to my gut (feelings).
1.2 relationships	.76	11	.72	.83	.85	18: I feel I don't really belong anywhere; 43: When I see myself in a mirror, I recognize myself immediately.
1.3 emotional self-experience	.76	7	.59	.79	.88	29: Sometimes I have very strong emotions for no obvious reason; 11: I'm not sure if my friends really like me.
2. Incoherence	**.92**	**31**	.87	.94		**Sum of subscales**
2.1 consistency	.86	11	.69	.82	.93	4: I feel that I have different sides of my personality, which do not fit together well; 13: I often feel lost, as if I had no clear inner self.
2.2 autonomy	.84	12	.67	.82	.88	42: When I'm alone I feel helpless; 38: If I am criticized or others see me failing, I feel really worthless and devastated.
2.3 cognitive self-experience	.76	8	.77	.79	.90	37: Often I am surprised about my own behaviour and feelings; 35: I am confused about what kind of person I really am.

Distribution of the sample in relation to gender and age

Data from the community and school samples demonstrated a normal distribution of the total score with acceptable skewness (.669) and kurtosis (.078) values. Significant differences in the AIDA Australia scales and subscales scores were found between boys and girls but with small effect sizes ($\eta 2p$ = 0.029 to 0.056, criteria <0.060). In addition, no systematic differences were seen for the full age range or for age groups (12-14 and 15-18-years; Table 4.2). We concluded that gender and age specific norms were not necessary.

Table 4.2. *Mean scale and subscale scores [M(SD)] with effect sizes 'n2p' for gender (boys n = 85, girls n = 41) and age groups (12-14yrs; n = 65, 15-18yrs; n = 61)*

	Gender				Age			
	Boys	Girls			11-14 yrs	15-18 yrs		
	M (SD)	M (SD)	p	η2p	M (SD)	M (SD)	p	η2p
Diffusion	62.0 (31.6)	79.0 (35.5)	.007	.056	64.1(28.8)	71.2 (38.2)	.242	.011
1. Discontinuity	25.3 (13.5)	32.6 (16.3)	.009	.053	25.7 (12.3)	29.8 (16.9)	.121	.019
1.1 attributes	11.1 (4.9)	13.0 (6.4)	.059	.029	11.4 (5.3)	12.1 (5.7)	.438	.005
1.2 Relationships	6.4 (5.7)	9.4 (7.0)	.010	.052	6.1 (4.3)	8.7 (7.7)	.021	.042
1.3 Emotional	7.9 (5.0)	10.1 (5.7)	.026	.039	8.2 (4.9)	9.0 (5.7)	.429	.005
2. Incoherence	36.7 (19.2)	46.4 (20.6)	.010	.052	38.4 (17.9)	41.4 (22.3)	.411	.005
2.1 consistency	12.0 (7.6)	15.4 (9.1)	.030	.038	12.3 (7.1)	14.0 (9.2)	.235	.011
2.2 autonomy	14.8 (7.8)	18.7 (7.3)	.009	.054	16.2 (7.0)	15.9 (8.6)	.867	.000
2.3 cognitive	9.8 (5.4)	12.4 (5.6)	.016	.046	10.0 (5.2)	11.4 (5.9)	.143	.017

Construct validity

An EFA (PCA) was performed at the subscale level to examine the dimensionality of AIDA Australia. The AIDA was designed to measure the higher construct of Identity Diffusion and has been separated into two subscales for descriptive reasons. One component was extracted for AIDA Australia with an Eigenvalue of 4.5 that explained 75.4% of the variance (factor loadings *f* are presented in Table 4.1). Discontinuity subscale factor loadings ranged from .76

to .88 with Incoherence subscale factor loadings ranging from .88 to .93. The Discontinuity and Incoherence subscales reveal a strong positive correlation (r= .861, p = <.001). This analysis supports a one-factor solution of 'Identity Diffusion' as shown in the scree plot (Figure 4.1).

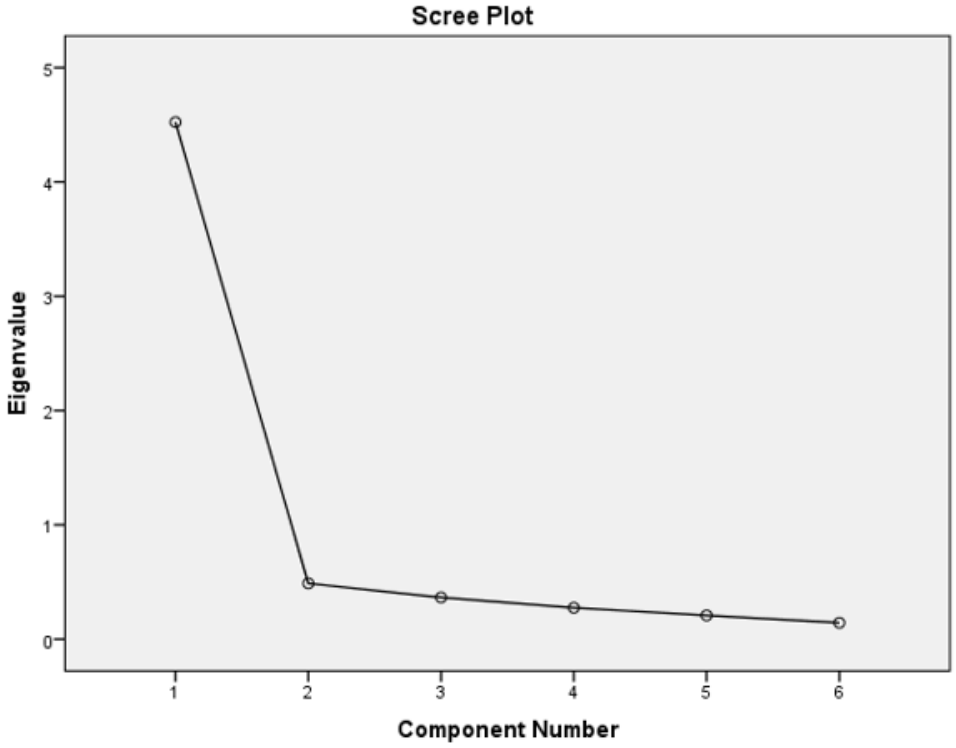

Figure 4.1. Screenplot for EFA (PCA, Promax) on subscale level, one component extracted explaining 75.4% variance

Discussion

A valid measurement tool to assess identity during adolescence is important to establish whether an adolescent has developed a healthy identity and a positive sense of self (Goth et al., 2012; Gøtzsche-Astrup & Moskowitz, 2016). Based on the evidence reported above, we concluded that AIDA Australia is a valid and reliable measure for assessing the complex construct of identity integration versus identity diffusion in a non-clinical Australian sample. Some differences between the original AIDA, the Spanish AIDA and the AIDA Australia were

found and language adjustments to a number of items in the AIDA Australia were undertaken to ensure the cultural context of the items were appropriate (Calude & Pagel, 2011).

The developmental protocol used by the original author and followed by the Australian research team enabled a successful culture-adapted transition to AIDA Australia. Similarities in the reliability of the total score were evident between the original AIDA (α =.86; Goth et al., 2012), the Spanish AIDA (α = .94; Kassin et al., 2013) and AIDA Australia (α =.96). The main test results for AIDA Australia showed improved item-total correlations as a result of the language adjustments. In all instances, the content of the items regarding identity-pathology remained the same, however the sentence structure or concrete formulation changed to incorporate more appropriate cultural phrases and colloquialisms. Some changes included removing the item example, while others simply needed language adjustments. For example, the phrase '*unstable relationships*' was preferred over '*on again, off again relationships*.' This may be because Australian adolescents do not refer to relationships as on-again and off-again but rather identify with in-group relationships such as their sports club (Tanti et al., 2011). Language changes such as '*appreciate me*' over '*praises me*' improved item-total correlation as this was better understood by Australian adolescents. This process was similar to those reported in the development of the Spanish AIDA where four items with coefficients below the criterion resulted in language changes (Kassin et al., 2013).

The significant gender difference in the total scores for AIDA Australia was similar to the other adaptations (Goth et al., 2012; Kassin et al., 2013). The

Australian girls had systematically higher AIDA scores than the boys. The lower scores for the Australian boys suggest a healthier and better identity integration than Australian girls. Similarly, German girls had systematically higher AIDA scores than boys (Goth et al., 2012), whereas the Spanish AIDA revealed that Mexican girls had systematically lower AIDA scores than boys. Schwartz, Mason, Pantin, and Szapocznik (2009) found that identity confusion scores decreased over time for Hispanic girls compared to boys. The gender difference in AIDA scores needs further exploration. Potential explanations include differences in pubertal maturation (Bond et al., 2006), emotional processing (Goddings, Burnett Heyes, Bird, Viner, & Blakemore, 2012) or self-perceptions (Rose et al., 2011). For example, Rose et al. (2011) found girls had higher self-perceptions for behavioural conduct and close friendships than boys who had significantly higher perceptions in athletic competence, physical appearance, romantic appeal and, most importantly global self-worth. A positive sense of self and maintaining self-sameness over time are important constructs to developing an integrated identity (Becker et al., 2012; Goth et al., 2012; Harter, 2012a).

The similar scores across the age range for AIDA Australia were similar to the German sample (Goth et al., 2012). This could be due to similar lifestyles, social norms, cultural values and beliefs (Markus & Kitayama, 1991; Tam et al., 2012; Yuki, 2003). In contrast, the scores for the Mexican sample were different between the two age groups with small to medium effect sizes (Kassin et al., 2013). This suggests that the health of identity in Mexican youth is age-related, as the younger adolescents displayed higher levels of 'identity diffusion' without reaching pathological levels (Kassin et al., 2013). Kasin et

al. (2013) explained that typically, the younger age group experienced an identity crisis. The socioeconomic differences between the three countries could also contribute to this difference as Hispanics place greater importance on '*simpatico*' like-minded relationships (Marus & Kitayama, 1991; Triandis et al., 1984), whereas Australians and Germans use a more individualistic view towards the self, their motivation, goals, values and beliefs (Markus & Kitayama, 1991; Tam et al., 2012). Similar wording for the item '*at home in my community*' was used for the German and Australian versions, whereas '*proud of my roots*' was more appropriate for the Mexican version.

Limitations

This study is the first to report on a culture-adapted translation of AIDA for an Australian sample. Although a strict protocol was followed, this study has some limitations. The AIDA was initially developed for use with patient samples to identify impairments and to help understand personality disorders. This was not the focus, or within the scope of the current study. Rather the participants were a convenience sample of Australian adolescents drawn from a range of backgrounds. Although a self-report method is suitable in this population, as with all such studies, truthfulness by the adolescents when completing the questionnaire is assumed but not guaranteed.

Future Directions

Once other translations of AIDA have been completed, comparisons between findings could lead to a better understanding of cross cultural differences in the health of identity. Even in this small study which compared the translations between three countries, important differences were found. Future research

using AIDA Australia with a clinical sample may lead to a better understanding of personality disorders and inform clinical practice. In addition, longitudinal studies examining changes in the health of identity through the transitional ages of 12- to 18-years-olds could significantly advance the field.

Conclusion

The step-by-step method of the culture-adapted-translation test construction of AIDA Australia enabled the development of a questionnaire with sound psychometric properties. It can be used to assess the construct of identity Integration versus identity Diffusion in Australian adolescents. This study supports the cross-cultural generalizability of identity yet confirms the need for culture-specific test adaptations

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CHAPTER FIVE: The influence of motor competence and gender on identity health in Adolescents: A mixed method study

Importance of friendships

'I think for me friends are becoming more important. Like, when I was in primary school you kind a hanged out with whoever, but now you have your best friend and then you kind of hung out with all different people and then over the year, like in year seven you hang out with people that you really did not have really never had anything to do with, but now as we have gotten older our class is now starting to get to know and interact with each other as a whole class.'

(16 year-old HMC female)

'My best friend does some music but not as much as me. He plays trumpet in a couple of bands. He debates and public speaks regularly like me. He also does amnesty like me. He also does a lot of sport. Rowing and tennis. He also read a lot like me. He has also participated in some drama before, like me. He also aspires me to be a leader

(15 year-old HMC males)

Abstract

A person's identity evolves throughout the lifespan and shapes their ones sense of belonging and self, which is particularly fragile during adolescence. A person's identity may range from integrated (healthy) to diffused (less-healthy). A number of factors influence this, and one yet to be fully explored is level of motor competence. The purpose of this explanatory sequential mixed methods study was to examine whether motor competence level influences an adolescent's identity health and if this differs between males and females. Adolescents (N = 160, male n = 103, M_{age} = 14.45 SD = .75) completed questionnaires to measure motor competence (AMCQ) and identity (AIDA). The AMCQ scores were used to group the participants into high (HMC) and low (LMC) motor competence. Females reported higher (less-healthy) identity scores than males. The LMC group had less healthy identities compared to HMC group. A subsample of 17 interviews of HMC and LMC youth helped to interpret these results. The most at risk group were the LMC females who identified many challenges involving negative peer comparison, poor social support and stress. Well-designed and manageable support services within the home, schools and wider community that consider motor competence levels are important, especially for these females.

Identity is defined as an overall broad expression of who one is (Erikson, 1986) which includes components of the self, such as personal beliefs and positive and negative evaluations (Harter, 2012a). Whilst definitions of the self and identity are sometimes used interchangeably, it is important to clarify that identity is not synonymous with the self. Identity incorporates one's knowledge outside of the self such as social roles (family, sexual and cultural; Goth et al., 2012). Identity can range from healthy to less healthy and is dependent upon whether an individual experiences a positive or negative sense of self, is able to recognise their personal strengths and limitations and is able to integrate these into different social settings. Therefore the health of identity is influenced by a number social-emotional, cognitive, physical and behavioral changes, and an adolescent's ability to identify with personal interests (Harter, 2012a). Adolescence, is the most important phase for the development of a healthy identity as many begin to actively seek out the adult they aspire to be by reflecting on their childhood experiences and incorporating these into adult roles and responsibilities such as academic or occupational decisions which ultimately contribute to the health of their identity (Erikson, 1968; Harter, 2012a). Previous research has investigated identity in relation to personal problem solving and decision making skills which are referred to as identity styles (three styles have been developed: information-oriented, normative-oriented and diffuse-avoidant; Berzonsky, 2011), the mental ill health of identity development such as personality impairments or disorders (Kernberg, 2004) and identity considered as a social construct (Erikson, 1968). A new unidimensional framework proposed by Goth et al. (2012) examines identity on

a continuum from an integrated, healthy identity to a diffused, less-healthy identity.

Health of Identity

Identity formation during adolescence is described as the decision making phase when overwhelming plethora of future choices such as scholastic and career opportunities, social engagement, and participation (sports or leisure activities) become a priority (Erikson, 1986). According to Goth et al. (2012) an integrated, healthy identity is connected by two constructs: continuity and coherence. Continuity is considered one's 'sense of self' as it includes feelings of security, comfort and stable thoughts (Goth et al., 2012; Sollberger, 2013). Coherence is one's 'sense of belonging' as the self is integrated into a social context which allows for attention and public connectedness (Sollberger, 2013). Consequently, adolescents who engage in fewer social interactions (greater incoherence) and receive less social support may develop a more fragmented sense of self (greater discontinuity; Goth et al., 2012). Goth et al. (2012) suggest this may result in maladaptive and dysfunctional behaviours, leading to a less-healthy, diffused identity. These individuals are unable to identify with personal attributes, interests or life goals, and experience difficulties forming lasting relationships with significant others, which may contribute to mental ill health (Kassin et al., 2013) or social, physical or cognitive deficits (Goth et al., 2012).

Numerous studies have identified a variety of psychosocial factors that contribute to identity health. These include level of parental and peer support (McLean, & Jennings, 2012), social-emotional factors such as social acceptance

(Berzonsky 2011; Klimstra, Hale, Raaijmakers, Branje & Meeus, 2010), physical attributes such as sports participation (Lingam, Novak, Emond, & Coad, 2013), and pursuing personal interests which guide future decisions and shape their future (Goth et al., 2012; Harter, 2012a). Whilst many of the factors described above have been widely explored, there is a paucity of knowledge on the influence of level of motor competence on one's identity.

Motor competence

Motor competence plays an important role in social (Payne, Ward, Turner, Taylor, & Bark, 2013), emotional (Hill, Brown, & Sorgardt, 2011) and behavioural (Green, Baird, & Sugden, 2006) development. An individual's level of motor competence and self-efficacy towards physical activity and active play influences their willingness to participate in a range of social opportunities including team sports or school dances (Cairney, Hay, Faught, Mandigo, & Flouris, 2005; Payne et al., 2013). Adolescents with high motor competence (HMC) usually participate in a wider range of activities which can lead to greater social acceptance (Ullrich-French & Smith, 2009), a positive sense of self (Rose, Larkin, Parker, & Hands, 2015) and potentially a healthier identity. On the other hand, adolescents with low motor competence (LMC; who may receive a diagnosis of Developmental Coordination Disorder [DCD]; American Psychiatry Association [APA], 2013) may shy away from participating in these social activities (Fitzpatrick & Watkinson, 2003; O'Dea & Connell, 2016) as they experience difficulties efficiently completing activities of daily living (Kirby, Williams, Thomas, & Hill, 2013) which may

subsequently impact on how they perceive themselves and consequently their identity.

LMC also influences self-perceptions across a range of domains (Rose et al., 2015; Skinner & Piek, 2001) and contributes to social-emotional challenges such as social isolation, fewer peer interactions, and even social immaturity (Hill et al., 2011; Payne et al., 2013). Adolescents with LMC may develop coping strategies to avoid exposing their physical awkwardness (Fitzpatrick & Watkinson, 2003), such as devaluing their athletic performance (Harter, 2012a). These additional personal and interpersonal stresses may lead to greater internalizing symptoms (Cairney, Rigoli, & Piek, 2013), poorer mental health (Lingam et al., 2012) and a higher possibility of experiencing identity diffusion (Jung, Pick, Schluter-Muller, Schmeck, & Goth, 2013). A pilot study examining psychopathology among children diagnosed with DCD found the majority experienced behavioural and emotional issues such as social difficulties and conduct problems (Green et al., 2006). In a longitudinal study, psychiatric conditions (affective/mood disorders in particular) were most common among those diagnosed with Deficits in Attention, Motor Control and Perception (DAMP), a synonym used by some for DCD (Hellgren, Gillberg, Bagenholm, & Gillberg, 1994) at the age 16-years. Such results lead Rigoli and Piek (2016) to suggest that research examining motor competence should include screening for psychological difficulties due to the co-occurrence of additional conditions. Together, these findings suggest that psychosocial problems are associated with LMC, however only one qualitative study (Lingam et al., 2013) has examined how it impacts one's identity.

Gender

Gender differences in motor competence may also have a powerful influence on the health of identity (Sinclair & Carlsson, 2013). Males in Western cultures experience greater pressure to participate in team sports as their social relationships are often driven by competition (Cairney, Kwan, Hay, & Faught, 2012), while females prefer to participate in more cooperative activities (Perry & Pauletti, 2011). For example, 14-year-old males rated physcial acitvity as important for a chance to compete, to win and spend time with friends (Hands et al., 2015). During adolescence, males and females primarily socialise in gender segregated peer-groups. Females mostly interact in a cooperative manner, whereas males socialise in larger groups that often involve peer comparisions (Sinclair & Carlsson, 2013). The male's preference to participate in competitive and physically demanding activities may influence their level of social support (Cairney et al., 2012; Hands et al., 2015) and thereby drive the development of their sporting-identity. Therefore, considering differences in gender and motor competence towards the health of identity is important.

Many researchers have examined the social-emotional and self-perception challenges of LMC (Hill et al., 2011; Payne et al., 2013; Skinner & Piek, 2001; Wilson, Piek & Kane, 2013), however only one study has examined the importance of identity and empowerment among adolescents with LMC (Lingam et al., 2013). Lingam et al. (2013) interviewed 11 adolescents with LMC aged 11-to 16-years and found social networks provided them with a sense of belonging and a positive identity. From their findings, Lingam et al. (2013) suggested that further research investigating motor competence and

identity is needed. The purpose of this study, therefore, was to examine whether differences exist in the health of identity between adolescents with high and low levels of motor competence and whether these differed between males and females.

Method

The study used an explanatory sequential mixed method design (Andrew & Halcomb, 2009). During phase one, the participants completed two questionnaires. The second phase involved semi-structured interviews with a subsample of participants in order to explore and elucidate the initial quantitative findings. This project was approved by the Human Research Ethics Committee of the University of Notre Dame in Perth, Western Australia.

Phase one: Quantitative questionnaires

Participants

In phase one, 160 adolescents (64.4% males, M_{age} = 14.44 years, SD = 0.750) participated in the study. The inclusion criteria were adolescents aged between 12- and 17-years, English as a first language and no other diagnosed movement-related disability such as muscular dystrophy.

Measures

Adolescent Motor Competence Questionnaire (AMCQ; Timler et al., 2016) is a self-report, motor competence questionnaire developed for adolescents aged between 12- and 18-years. It consists of 26 items covering the ecological (skills in physical surroundings) presence of motor tasks and functional ALDs

and was informed by the Diagnostic and Statistical Manual of Mental Disorders (fifth edition; DSM-5) criteria for DCD (APA, 2013). Participants respond on a 4-point Likert scale of Never (1), Sometimes (2), Frequently (3), and Always (4). To account for response bias, fifteen items are reverse scored. A maximum AMCQ score is 104, with a higher score relating to a higher level of motor competence. A score of 83 or below indicates motor difficulties may be present (Timler et al., 2016). The questionnaire has evidence of concurrent validity against the MAND (McCarron, 1997), test re-test reliability (intra-class correlation coefficients = 0.96), internal consistency (α = 0.90; Timler et al., 2016) and can be completed in less than 10 minutes.

Assessment Identity Development in Adolescence (AIDA; Goth et al., 2012) is a measure of identity designed for 12 to 18 years-olds. The questionnaire consists of 58 items and has a 5-step response format: 0=no, 1=more no, 2 = part/part, 3=more yes, and 4=yes. An identity score is derived along a continuum between an integrated to a diffused identity. The total scale score is calculated, with a higher score relating to less-healthy, diffused identity, while a lower score relates to a healthier, cohesive identity. All items on the AIDA are formulated negatively with the overall scale Identity Diffusion including two primary subscales: Incoherence (31 items) which refers to a sense of belonging in a social context and Discontinuity (27 items), an individual's sense of self. The questionnaire has evidence of construct (r = 0.61~0.80) and criterion validity (d = 2.27~2.56) and internal consistency (α = 0.73~0.94; Goth et al., 2012). To accommodate for cultural differences, the AIDA Australia was used in the current study (Timler, McIntyre, Hands, & Goth; under review).

Procedures

Overall data collection took place over a two year period. The data collection for phase one was completed using hardcopy or online questionnaires. Participants were recruited through personal contacts (n = 6), a movement clinic (n = 4), and sporting clubs [(AFL; 69 returned/140 distributed), basketball, (7/50) and netball (6/20)]. These participants received hardcopies of the questionnaires and the consent form, which were collected two weeks later [Response Rate (RR) 92/210 = 44%]. Thirty-four government (137 total = 25%), 54 Independent (62 total = 87%) and 9 Catholic (25 total = 36%) schools with students in years 9, 10 and 11 within the metropolitan area were contacted. Only seven independent and 5 government schools agreed to help recruit who distributed a mixture of hardcopy and online surveys. It took approximately 35 minutes to complete both questionnaires. The overall quantitative RR was 39% (160/415).

Data Analysis

Statistical Package for Social Sciences for Windows (version 23; SPSS) was used to analyse the quantitative results. Descriptive statistics were derived for total sample, motor competence and sex. The questionnaires (AMCQ and AIDA) demonstrated a normal distribution, with acceptable skewness (+/-1) and kurtosis (+/-1) values allowing for parametric tests to be used for analysis (Pallant, 2013). The t-distributions [M = 50 (SD = 10)] were derived for the overall Identity Diffusion scale, Discontinuity (sense of self) and Incoherence (sense of belonging) subscales. Participants were grouped into high (n = 108, males = 80, females = 28) and low (n = 52, males = 23, females = 29) motor

competence based on their Total AMCQ (≤83 = LMC). Two-way ANOVAs (motor competence x sex) were used to examine differences between groups for the overall Identity Diffusion scale and both subscales. One–way ANOVAs were used to further examine group differences for gender (males and females) and motor competence (high and low). To reduce the chance of Type 1 error, significance was set at $p<.05$.

Results

Descriptive statistics [M(*SD*)] for the total sample, motor competence, males and females are presented for age, AMCQ total scores, AIDA total and *t*-distribution scores (Table 5.1). Overall males had higher AMCQ scores (higher motor competence) and lower AIDA scores (healthier identities) on all scales compared to females.

Table 5.1. *Descriptive statistics [M(SD)] for all measures for total sample, motor competence, males and females*

Measures	Items	Total (N = 160)	HMC (*n* = 108, males = 80)	LMC (*n* = 52, males = 23)	Males (*n* = 103)	Females (*n* = 57)
Age		14.44 (0.75)	14.47 (.77)	14.38 (.72)	14.39 (.76)	14.54 (.73)
AMCQ (cut score ≤83)	26	86.55 (11.41)	**92.87 (4.87)**	**73.42 (9.80)**	**89.29 (10.86)**	**81.60 (10.78)**
AIDA Identity Diffusion	58	71.34 (24.86)	**64.98 (32.87)**	**84.56 (35.45)**	**62.79 (31.09)**	**86.81 (36.21)**
Identity Diffusion (*t*-distribution)		51.14 (10.32)	**49.25 (9.74)**	**55.06 (10.46)**	**48.60 (9.24)**	**55.71 (10.65)**
Discontinuity	27	29.36 (15.50)	**26.21 (14.32)**	**35.88 (15.95)**	**25.46 (24.00)**	**36.40 (16.57)**
Discontinuity (*t*-distribution)		51.08 (10.43)	**48.93 (9.73)**	**55.56 (10.79)**	**48.45(9.13)**	**55.86 (11.24)**
Incoherence	31	41.99 (21.28)	38.77 (20.81)	48.67 (20.87)	**37.33 (19.69)**	**50.40 (21.62)**
Incoherence (*t*-distribution)		51.18 (10.43)	49.59 (10.28)	54.46 (10.07)	**48.86 (9.69)**	**55.35 (10.50)**

*AMCQ total score out of 104, AIDA total score out of 232

* Normal t distribution [M = 50(SD = 10)]

* Note. Bold indicates group differences p < .05

Two-way (motor competence x gender) ANOVAs revealed main effects between males and females for all Identity scales. In all cases, the females had higher Identity Diffusion, Discontinuity and Incoherence scores than males (Table 5.2). Adolescents with LMC scored higher on Identity Diffusion and Discontinuity (self) subscale compared to those with HMC, but not for the Incoherence (belonging) subscale. There were no significant interactions between motor competence and gender. Although Identity scores were high for the females and LMC group, scores were within a normal range of a healthy identity, except for two female participants who were in the HMC group. The total AIDA scores ranged from 4 to 153. There were no significant differences between AMCQ scores (p = .09) or AIDA scores (p = .94).for those completed by hardcopy compared to online.

One-way ANOVAs were used for further comparisons between 4 groups; LMC Males, HMC males, LMC females and HMC females. The Bonferroni post hoc tests revealed significant differences between the LMC and HMC females on Identity Diffusion and Discontinuity (self) subscale compared to the HMC males. Differences were also found for the Incoherence (belonging) subscale scores between the LMC females compared to the HMC males. No differences were evident between the LMC males and the HMC males had the lowest Identity Diffusion scores compared to the other groups. These results were analysed first by the primary author to inform phase two. The inclusion of the qualitative interviews was to further explore why gender differences emerged from the questionnaire responses, and to understand an adolescent's identity health, personal views and social context, especially for the LMC females.

Table 5.2. *Identity Development Scale and subscales t-distribution [M(SD)] scores for gender and motor competence groups*

		Low motor competence			High motor competence			Group F (*p*)	
Scale	Items	Total N = 52	Males (*n* = 23)	Females (*n* =29)	Total N= 108	Males (*n* =80)	Females (*n* = 28)	Gender	Motor
Diffusion	58	55.05 (10.46)	52.04 (8.77)	57.45 (11.21)[a]	49.25 (9.74)	47.61 (9.19)[a, b]	53.93 (9.93)[b]	**11.68 (.001)**	**5.35 (.022)**
Discontinuity	27	55.56 (10.79)	52.82 (8.89)	57.72 (11.78)[a]	48.94 (9.73)	47.19 (8.86)[a, b]	53.93 (10.51)[b]	**11.48 (.001)**	**7.22 (.008)**
Incoherence	31	54.46 (10.07)	51.52 (8.71)	56.79 (10.59)[a]	49.59 (10.28)	48.10 (9.88)[a]	53.86 (10.38)	**9.56 (.002)**	3.29 (.072)

a = significant effects between the LMC females and the HMC males
b = significant effects between the HMC females and the HMC males
* Note. Bold indicates group differences $p < .05$
* Normal t-distribution [$M = 50$, ($SD = 10$)]

Phase two: Qualitative interviews

Participants

In the second study phase a purposive subsample from a pool of 79 who nominated to participate were contacted a second time. A purposive sampling approach was utilised to ensure the cases that are deemed information-rich for the purposes of the study were included (Sandelowski, 2000). Interviews were completed at the start of 2016, 4 months after the quantitative data was collected. However due to the participants busy schedules, a final sample of 17 homogeneous (separated by gender) one-on-one (n = 6) or small group semi-structured interviews (n = 5) were conducted (RR = 4.7%). The completion of one-on-one interviews were included in addition to the small groups to enable participants who could not reach a group interview an opportunity to participate as they were still interested to be involved. Participants who took part in the small group interviews were allocated to a group according to their motor competence level (AMCQ cut score $\leq$ 83) and gender (n = 7 HMC, males = 4; n = 10 LMC, males = 6).

Adolescent interviews

The interviews consisted of 13 semi-structured questions derived from the participant's questionnaire responses. These included mechanisms such as social support (family, and peers), environmental stressors (sporting, school, and home), identity formation and future planning (Appendix A).

Procedures

The interviews were held after school and were located on participants' postcodes for convenience. Parental and adolescent written consent was obtained. Interviews lasted between 45 – 90 minutes. Interviews were audio recorded, transcribed verbatim and analysed thematically until saturation was reached and no new themes emerged.

Data Analysis

Data was managed using QSR NVivo 10. The adolescent interviews were analyzed using a deductive theoretical approach as the qualitative themes were integrated with the identity scale. The Clarke and Braun (2017) procedure for thematic analysis was used to analysis and develop a coding scheme. This approach incorporated four parts: naïve reading, comprehensive understanding and interpretation, structured thematic analysis and matrix coding (Creswell & Plano Clark, 2007). Firstly, transcripts were read repeatedly to ensure familiarity with the text and open coding was used to derive themes by comparing all transcriptions. In addition, the transcriptions were coded line by line to examine if any subthemes emerged. Transcripts were read and coded consecutively among two members of the research team in order to establish evidence of intra-rater reliability. Debriefing with the research team to resolve any disagreements between interviews allowed for credibility of the results. Evidence of dependability was established as transcripts were read until no new themes emerged and saturation was reached. Further comparisons between groups (a) gender and (b) motor competence were analyzed using matrix

coding, word frequency and clusters to look for evidence of transferability of the results.

Results

The responses from the interviews were analysed in two stages to further explain the quantitative findings. In the first stage, thematic analysis was used which lead to five key themes emerging: Communication, Peer Support, Personal Changes, School Experience and Future Planning. These themes were named by the research team as they were the most appropriate to capture identity health. In the second stage, each theme was considered in relation to the identity scales. Responses to the Identity Diffusion scale were best explained by the Peer Support (activities) and School Experience themes. Personal Changes and Future Planning themes were closely aligned with the Discontinuity subscale. Peer Support (mainly around peer comparisons) and Communication themes related to the Incoherence subscale.

Identity diffusion

Adolescents who are actively seeking to find their identity are more likely to form a healthy, cohesive identity (lower Identity Diffusion; Goth et al., 2012). The questionnaire results revealed that an adolescent's level of motor competence and gender influenced Identity Diffusion scores. These were best explained by their level of peer support and school experiences.

Peer support and activities. Interview findings indicated that many received some peer support, however the HMC group reported greater social networks than the LMC group. Those in the HMC group perceived friendships

were becoming more important as they shared common interests, were highly motivated by sports participation and reported large social networks that ranged from 10 to 30, especially the HMC males. For example, a 17-year-old HMC male wanting to become a professional athlete said his spare time was spent online listening to a physiotherapist's advice about knee injuries or watching a soccer match to focus on players in 'his' playing position. Playing video games was a preferred leisure activity among all males, regardless of motor competence. The HMC females felt having a close friend to talk to was most important for their social acceptance as many enjoyed being physically active with them. A 16-year-old HMC female said:

> Our church has a soccer league I play in … I have, me and my friend who just hang out, but we do physical things, we will sit around and stuff but we like to go out to places and do things that are active.

The LMC adolescents enjoyed more sedentary activities such as reading or watching television over sport participation. Specifically, males preferred playing video games on their own, online, or with friends and females preferred 'hanging out and chatting' with close friends Most reported smaller social networks, experienced lower levels of social acceptance, felt less comfortable talking to their friends, or preferred to work independently to avoid distractions. A 14-year-old LMC male told us:

> Well these days I do not have really close friends… that I talk with… last year the friend that I told you about was more so, we were able to talk about some things but I do not think I would ever be fully comfortable talking [with close friends].

In some instances, the LMC group were motivated to participate in physical activities but often volunteered for other sport related tasks such as refereeing. A 15-year-old LMC female explained the difference between sports and leisure activities:

I do like somethings outdoors but not all, I do not like sports at school but I do like some sporty things like snorkeling and rock climbing and some …other [things] than soccer and basketball, so I am more outdoorsy than sporty.

While a 14-year-old LMC male basketball player said:

You are sort of inspired by your parents to do that sport [basketball]… and then when you are older you want to do something else for yourself.

School experience. The LMC adolescent's school experience included aiming to achieve high grades, participating in extension programs, and placing a lot consideration towards post-secondary education. The pressure some placed on themselves to perform well at school sometimes lead to them doubting their own academic abilities. A 14-year-old LMC male felt upset when he was limited to only selecting six subjects. While a 15-year-old female voiced her concerns about the difference in homework expectations from middle to high school and was seeking peer support to complete tasks. She told us:

They are not my friends, but there are two girls who are really clever; they are really smart and they just understand everything, so I am always saying "can you please help me with this one?"

Some of the older LMC females were starting to enjoy their school experiences as they were allowed to choose their school subjects and avoid other subjects that they felt uncomfortable participating in. her A 15-year-old LMC female said:

Last year was a bit of a struggle for me, but I said over the holidays that this was going to be my year and it has been. I [am] really enjoying school… [Picking classes], has made me want to be at school…because [school] makes you do a lot of things that you do not really have interest in, so it is a lot better when you do get to do what you want to do.

The HMC group valued their education as many were considering post-secondary education but also placed less academic pressure on themselves and were more relaxed about completing assignments, test and exams. They often

related academic subjects to future career choices. Only the 17-year-old HMC male athlete felt high school was interfering with his future plans. Another 17-year-old HMC male enjoyed attending mentoring session's afterschool and was not worried about the amount of time he spent on homework, he said:

> I am a mentor. I really like helping out other people. So I guess it has given me a lot more confidence in my leadership skills... [it] has shaped who I am… people would tell me I should do a bit more [homework] seeing as it is my final year.... I normally do around two to three hours a night. People say "you might want to push it up to about four". So I do a bit more, but if it was up to me I would probably just stay with the two to three.

Teachers. An adolescent's school experience was also influenced by the support of their teachers. The LMC adolescents respected their teachers but felt uncomfortable talking to them about personal matters. Some LMC females felt their classroom content was difficult to understand and developed alternative study methods. A 15-year-old LMC female said:

> I have a lot of problem with my teachers, some of them are just no good at teaching. I just do not understand the way they do it. With my math and my chemistry teachers… I am struggling to understand what they are teaching me. I just go through the text books at home.

However, teachers who were aware of their student's co-ordination difficulties provided additional assistance towards achieving personal goals which made their school experience positive from a young age. A 14-year-old LMC female reflecting on her year four teacher said:

> I talk to teachers in a general sense… I do not like discussing things as much as I like to with my parents... I just found that she was really fair because she would always find how we could improve… because I have Dyspraxia and she knew that I wanted to get my pen license. My hand writing was messy but I really wanted a pen license so I worked really hard and when she saw the improvement that is when she gave me the pen license.

Adolescents with HMC admired their teachers for other reasons, and would seek advice from them about their future and approach them for extra

support particularly if they taught in the adolescent's favourite subject. A 17-year-old HMC male said:

> Last year with my physical education teacher. When I had my knee operation, he gave me a lot of advice and he told me if I wanted to do something in sports, then maybe go into coaching… he gave me a lot of advice to try to get me to do coaching, and coaching is an option that I am looking at right now.

Discontinuity subscale

The Discontinuity subscale measures an adolescent's ability to feel comfortable within themselves and invest time into personal interests (Goth et al., 2012). The LMC group and females regardless of motor competence scored higher on this subscale as they experienced greater levels of stress and anxiety. The interview responses around the themes of Personal Changes and Future Planning helped to explain these group differences:

Personal changes and sense of self. Most of the adolescents interviewed were reflecting on their new sense of self as they were noticing changes in their behaviour. Both males and females felt the health of their identity was improved by observing traits, personalities and different characteristics of people that they admired. A group interview with LMC females identified the value they placed on personal attributes and characteristics in order to develop themselves. A 14-year-old LMC female shared:

> My reading, you read about all these different characters and their personalities and stuff and you kind of reflect on your own and they inspire you.

Similarly, a 14-year-old HMC male said:

> I feel even though I have all of these friends, I absorb a bit of their personality, of everyone I meet, more so with people that I am impressed with, like I feel I incorporate other people's personality to create my own.

An adolescent's sense of self, however, fluctuated based on their level of motor competence and preference to participate in new experiences. For example a 14-year-old LMC male sense of pride came from his academic skills:

A lot of my self-worth comes from my intellect, I pride myself on the fact that other people see me as smart and intelligent, as someone that you could come and see if you need some help. I am currently at the top of my year for economics, politics and law so I quite enjoy that prestige.

Many of the LMC adolescents were less outgoing as they did not like change. They wanted to know particular details such as who their teacher would be for their chosen subjects, preferred structured activities and avoided unfamiliar situations. A 14-year-old LMC male shared:

I am not comfortable going outside of my comfort zone. I prefer to stay with things that are familiar to me... I would try something new if I understood what it was and how to do it… I did make a big mistake on camp a couple of years ago. There was a massive great big 20 meter pole that you had to climb up, which was all rickety and you had to jump up off to the side. You had a harness, but you felt like you did not have one. I decided to go first to get it over with and it was absolutely terrifying. I am never EVER doing something like that again... I definitely have limited comfort zones and I know what they are.

***Maturity and responsibility*.** The HMC adolescents felt their behaviour had improved through their new found sense of maturity. A 14-year-old HMC male said:

I feel like I am getting more mature and being less silly, because I do look back on my past self like 11 years or younger with extreme embarrassment of who I was then, I use to [be] like I did not like school and I just wanted to go off and sort of do my own thing.

While the LMC group felt great pressures of responsibility. A 14-year-old LMC male said:

Yeah responsibility for sure, I am trying to look for a suitable job… but there are so many jobs out there and so many options and choices.

Stress and pressure. Fluctuations in stress levels varied depending on the adolescents' future goals and level of motor competence. For example the 17-year-old male athlete put pressure on himself to be 'on top of his game.' Those with HMC relaxed after a stressful day by hanging out, playing sports with friends or completing homework whereas LMC adolescents felt greater stress from school and would cope by completing their homework straightaway or undertaking sedentary activities such as reading to help them escape. For example, a 14-year-old LMC female shared that reading, even though time consuming, as a 'stress relief': A 15-year-old LMC female shared:

> More with school, the workload is a lot. There is just a bit more stress and pressure especially because now I started doing [university] subjects. Yeah, I am in year 10 and I have exams coming up, so the stress of the work is high, and because I want to get into [university], there is a lot of pressure to make sure I get good grades… I am scared of not graduating at all.

Future Planning. The importance of planning for the future was only thinking about their immediate plans which extended to thinking three years ahead (but did not include more long term planning such as thinking 5 or 10 years) down the track. Regardless of motor competence, females' valued organizational skills to develop a clear future plan. A 15-year-old HMC female told us she had to balance her time efficiently due to her busy school and dancing schedule. However some LMC females procrastinated about their future plans as they were fearful of not achieving them. A 14-year-old LMC female shared how both of her future goals made her feel:

> I definitely think about my future a lot, I try to place where I am in the future and see how I can get there… if it does not scare you then it does not make you stronger, but with acting, in three years' time I am scared about what is going to happen and that strives me when I compare it to math [teaching]… I would not be as scared.

Males, regardless of motor competence, were not so stressed about their future planning as many had occupational goals or knew their next step (attending university). Those who had clear goals put some consideration into their future, as a 14-year-old HMC male said:

> In the future you are going to be looking back at what you are doing today and think was that getting me nearer to where I am now, or has it gotten me there faster? Yeah so, that is a motivating factor about where you got to be. I do not tend to think about [responsibility], I tend to think about what experiences am I going to have in the future, am I going to be a CEO…

Only the 17-year-old athlete felt uncomfortable sharing his future plans of becoming a professional athlete because his parents wanted him to go to university. Generally, males valued their parents' advice for their future to a greater extent than the females although for some males their parents had encouraged greater focus on schooling rather than part time employment options. A 14-year-old HMC male reflected his parents influence towards his future:

> I have talked to my parents about [Engineering] quite a bit because my dad is an engineer as well so he knows quite a bit about process, flow… and he is quiet supportive of my ideas.

Whilst another 14-year-old LMC male felt his father encouraged his future plans. He said:

> [My father] really wants me to do engineering because I am alright at maths, I am in the top class in year 10, and that is something you need for engineering so he thought that is something that I can pursue.

Incoherence subscale

The Incoherence subscale refers to an adolescents interaction with their peers and significant others (Goth et al., 2012). Overall, females in this study had

higher scores compared to males. Issues relating to Peer Support and Communication helped elucidate these results.

Peer support and comparison. The HMC males reported that peer support through large social networks was important. On the other hand, females (LMC and HMC), valued close friendships. However, LMC females often experienced fragmented friendships and lacked trustworthiness among their peers, did not enjoy judgements made about their poor physical ability and were negatively influenced by peer comparisons. Some said their friends would describe them as cautious. A 14-year-old LMC female reflecting on her own dancing ability said:

> I know that I am not very talented in dancing, I just really go to there for the acting... I am not as good as the other people [at dance class], I can definitely tell that but I do enjoy it and I try my best and sometimes it will take me a while to get it, but I find it easy to do it with them and I know I will not get a lead in a dance bit but that is okay because I am quiet self-conscious about dancing in front of a big group of people because I am afraid that I will forget stuff.

The LMC females sometimes acted differently around their friendship groups to avoid conflict or upsetting others. Some felt they had lost contact or drifted apart from friends which caused them to find new friendship groups. A 15-year-old LMC female shared:

> Well I moved here at the end of year 4 and I became best friends with this girl. Last year we drifted and now she has moved schools and we do not even talk anymore, but there was an incident that happened and that kind of made us grow apart as well, and we have just become different people, learning who we are, what we want in life and so that forced us to drift.

Adolescent Communication and Support.

Parents and family. The LMC females preferred to go to their parents, especially their mothers for advice. In comparison, some of the HMC group felt anxious about disappointing their parents so they often sought advice from

other adult figures such as other family members or friends before consulting with their parents. A 17-year-old HMC male said:

> It is my friend's mum who I am most comfortable talking with, because the first time I met her she gave me and her son lectures about what to do as teenagers. I know that when she talked to me and him about it, I knew I would be able to talk to her about similar stuff… If I have got a problem that I am not comfortable talking to my parents about, then I talk to her and she will give me some advice on how to cope with it.

Siblings. The adolescents who had older siblings close in age developed their sense of self through their siblings'. Differences between how the LMC females and the HMC males reacted to their older sibling's experiences were apparent. The HMC males seemed inspired by their siblings, as a 17-year-old HMC male said:

> My older brother, he would have liked to have gone to university, but did not get the right score, but he got into [college], and now he is doing web design. So [my parents] are really happy that he did not sit around after [school], he actually did something. [My parents] would not mind if I did not make it [to university] either, as long as I try to do what I want to do.

In contrast, some LMC females felt like they had to work persistently hard to achieve similar results to their younger siblings. A 14-year-old LMC female felt nervous about her future after seeing how her brother was negotiating his. She told us:

> It is not so long and my older brother is finishing [secondary school] this year and he is really calm about it, but you have to do a lot of stuff once you finish school because that is when you apply for universities. I know you can try again but… he is really relaxed about it. That freaks me out, because this year it came out what he wanted to do and I find it really difficult to understand…

In conclusion, the HMC males were most relaxed about their future, while the HMC females and LMC males shared similar challenges towards developing themselves. The LMC females felt the greatest barriers towards developing a healthy identity, as they experienced greater pressure to reach

their future goals and more fragmented friendships which may explain this groups high Identity Diffusion scores.

Discussion

The results of this study showed that adolescents with LMC had less healthy identities compared to the HMC group, and that overall, females had a less-healthy identity compared to males. The interviews with a subsample of adolescents identified a number of reasons for these findings.

Influence of motor competence

The HMC adolescents in this study had healthier identities which were related to their positive school, social environments, and sense of self. Participation in weekend and after school sports is a primary form of socialisation for this age which often leads to strong social relationships (coherence) and confidence within themselves (continuity; Goth et al., 2012). The importance of participation in physical activities has been noted in many studies. For example, Ullrich-French and Smith (2009) found that adolescents with higher perceived motor competence, were more likely to continue to participate in the same soccer team as they formed positive relationships with parents and their peers.

The LMC group participated in more sedentary activities such as video games and academic accomplishments and were less motivated by sport participation unless they experienced environmental support. Other studies identified lower participation levels in physical activity may result in poor peer support (Hill et al., 2011), lower self-efficacy towards physical play (Cairney et al., 2005; Wilson et al., 2013), preference to participate in leisure activities

(Rivilis et al., 2012), and less motivation towards sports (Bardid et al., 2016). Barnett et al. (2013) found supportive environments including access to facilities, transport, home activity and exercise programs and encouragement from significant others motivated teenagers with LMC to engage in physical activities. Supportive environments that provide social support help to lower environmental stressors associated with identity diffusion (Jung et al., 2013) while, specifically those with LMC develop a sense of belonging if they found social acceptance at school (Lingam et al., 2013).

The quantitative results revealed that the LMC group experienced greater fluctuations in their sense of self (Discontinuity scores), which were supported by the interviews as many with LMC felt their motor ability contributed to a lower sense of self and feeling disheartened towards trying new activities. Adolescents with LMC often experience difficulties completing household responsibilities, maintaining close relationships, joining community sports and completing executive functioning activities such as concentration and learning new tasks (O'Dea & Connell, 2016) which may lead to lower levels of self-regard (Goth et al., 2012; Jung et al., 2013). Those with a diffused identity are more likely to develop unsuitable coping strategies such as distancing and avoidance resulting in poorly organized self-structures (Berzonsky, 2011; Bosh & Card, 2012), contributing to lower self-esteem.

Gender differences

The males in the study had lower Identity Diffusion scores than the females which indicated a healthier identity. The male interviewees reported lower levels of stress about their future and school achievements and also recognized

their own maturity. Similarly, Klimstra et al. (2010) reported that maturity influenced a stable identity in male adolescents as they were more confident to reconsider and explore alternative responsibilities. More males maintain a high level of sports participation regardless of their level of motor competence (Cairney et al., 2012) as they mature which could be why they place great importance on their physical activity (Hands et al., 2015). They also value communication with family members and significant others. During adolescence, parent and peer communication is important for building resiliency skills (Zimmerman et al., 2013) and decreasing depressive symptoms (Klostermann et al., 2016).

Overall the female interviews revealed they placed greater emphasis on school performance and organizational skills to achieve their goals which may contribute to their less healthy identity scores. Harter (2012a) considered identity exploration to be more complex for females than males, as they establish their identities across a greater number of settings. Females in this study participated in a wide range of activities and experienced fluctuations in their sense of self depending on their level of social acceptance and close friendships. Other study has also identified participating in cooperative and more sedentary activities, employment opportunities and societal gender roles as major influences on the health of females' identity (Sinclair & Carlsson, 2013).

The lower identity health of the females compared to the males was unusual. In other studies, adolescent males have been identified as a higher risk group for mental health issues (Vandello et al., 2008). For example, Berzonsky

(2011) found a higher proportion of males with greater identity diffusion. However, depression, eating disorders and non-suicidal self-injuries (e.g. cutting) have been found to be more common among females possibly as they are considered more vulnerable to depressive thoughts, self-blaming, poor body image and negative social comparisons (Perry & Pauletti, 2011). Further research on the changes in social norms, technology and access to social pressures such as internet on an adolescent's identity health is needed, in particular how this might differ between males and females.

Gender and Motor competence

The group who experienced the least healthy identity scores in this study was the LMC females, in particular with respect to their sense of belonging (Incoherence subscale). The LMC females placed greater stress on themselves to perform well at school, experienced negative judgements about their physical ability and constantly compared themselves against their siblings or peers. Casement et al. (2014) found that earlier social stressors in females when 11- to 12 year-old were associated with a higher risk of developing depressive symptoms at 16-years. Similarly, Viholainen and colleagues (2014) discovered level of motor competence in adolescent females mediated their mental health and psychosocial well-being particularly toward school-related activities such as math, language studies and physical education classes. The females with LMC in this study developed some successful coping strategies such as completing their homework straight away and reading for escape.

The finding that males with LMC had healthier identities than the females was interesting. Most males still participated in many physical

activities, an important avenue for social support during this age group. Cairney et al. (2012) also found LMC males aged 9-to 13-years participated in more active play than LMC females. It is possible LMC males were able to develop a more integrated identity as they continue to find ways to participate which develops resiliency skills and a positive involvement in organised activites (Cairney et al., 2005; Zimmerman et al., 2013). Others may devalue the importance of their LMC and focus on other areas such as academic competence (Harter, 2012a). The LMC males openly communicated their future plans with their parents which may help them to form stronger interpersonal relationships (Goth et al., 2012). An integrated identity forms around a positive sense of self and belonging to a social network (Goth et al., 2012; Harter, 2012a). Motor competence seems to be a protective factor for male's identity health but not for females. The LMC females experience a double disadvantage by having a low level of motor competence and developing support networks which impacted their identity health.

Limitations and future research

There are a number of limitations of the current study. Firstly, participants were recruited from a number of locations to collect a range of motor competence levels ranging from high to low. Significant differences in the Total AMCQ scores were found between those recruited through sporting clubs (M = 91.75, SD = 6.95) compared to those recruited elsewhere (M = 82.18, SD = 12.57; t (138.15) = 6.08, p <.001). The latter group comprised adolescents attending a movement clinic as well as many community contacts. Females were underrepresented in the sample due to difficulty recruiting them into the

study. Questionnaires were completed via hardcopy and online in order to reach a desired sample. No significant differences were found between these results. The RR for the interviews was low, which may have been due to a loss of interest in the study, or due to inability to reach the interview location. Small group, phone and Skype options were provided as alternative options.

The strength of this study was the mixed method approach which sought further explanations of responses through qualitative interviews. This allowed for a deeper understanding of the AIDA and provided the participants, in particular the LMC females, with an opportunity to discuss the factors impacting the health of their identity. Such information cannot be gathered using just a quantitative measure, such as a questionnaire. This research design allowed the more vulnerable participants to have a voice and express their difficulties for the first time in a safe environment.

Conclusion

In summary, the results confirmed that level of motor competence influences the health of identity in different ways for adolescent females compared to males. The group most at risk was the LMC females as they experience additional stresses which are primarily self imposed. This group is in need of well-designed and managed support services in schools, social environments and the wider community. Intervention programs should focus on building social capital such as developing a number of friendship groups through a range of activities, not only based on sport or physical activity. This will help adolescents develop positive peer networks that provide social inclusion.

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CHAPTER SIX: Adolescent self-report motor assessments may be more realistic than those of their parents'

Importance of parent support

'I struggled to play football a bit as a kid because of my dad, because he played it all his life and that, now he has helped me out, because I go to the oval or the gym with him and then now football has just become a passion of mine as well'

(15 year-old LMC male).

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Research Paper

Adolescents' self-reported motor assessments may be more realistic than those of their parents

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Abstract

Introduction: Adolescents' motor competence influences their physical, social and emotional development. Parent-reported assessments may not be truly representative of their adolescent's motor difficulties. This study examined the congruency between parent- and self-reported motor competence in 133 parent-adolescent dyads.

Method: The adolescent-reported Adolescent Motor Competence Questionnaire (AMCQ; ≤83) and the parent-reported Developmental Coordination Disorder Questionnaire 2007 (DCDQ-07; ≤57) cut scores classified 133 (M_{age} = 14.5 years) adolescents into high and low motor competence. Parents also completed the Swanson, Nolan and Pelham IV (SNAP-IV) for descriptive purposes.

Findings: A moderate correlation ($r = 0.56$, $P < 0.001$) was found between the AMCQ and the DCDQ-07 scores. Overall, 42 low motor competence cases were identified by both measures (AMCQ and DCDQ-07). Parents identified more boys (11) than girls (9) with low motor competence, whereas more female adolescents (22) self-reported low motor competence than boys (18). A high proportion agreement (0.82) was seen, which was principally due to the 91 (68.4% of sample) high motor competence case agreements.

Conclusion: Parents identified fewer motor difficulties in their adolescent, especially for girls. Self-report motor assessments may be more realistic for adolescents as they are aware of their own capabilities. Such measures are also more likely to identify previously undiagnosed adolescents with low motor competence.

Keywords
Parents, adolescence, low motor competence

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People with low motor competence (LMC) are unable to perform many motor tasks with the same level of proficiency as their peers. They experience difficulties in performing many activities of daily living (ADL) such as dressing and using eating utensils (Dunford et al., 2005). This condition may be formally diagnosed as developmental coordination disorder (DCD; American Psychiatric Association, 2013; Kirby et al., 2011) when all criteria in the Diagnostic and Statistical Manual (fifth edition; DSM-5) are met. Some will outgrow the condition (American Psychiatric Association, 2013; Kirby et al., 2011); however, between 50% and 70% of those identified during childhood still experience motor difficulties into adolescence and adulthood (Purcell et al., 2015).

The adolescent phase is thought to span from 12 to 22 years of age (Harter, 2012) and is considered to be when an individual develops an independent identity separate from their parents (Kroger, 2007). Therefore, adolescence is an important time for those with LMC to receive support as they face many social-emotional and physical challenges during this phase (Hill et al., 2011; O'Dea and Connell, 2016) and may conceal their motor difficulties from their parents. Unfortunately, many remain undiagnosed or unsupported for a number of reasons. Parents may be unaware of the existence of the disorder or visit many health professionals before receiving a diagnosis (Missiuna et al., 2006a). Other parents may place their concerns on the 'back burner' as motor difficulties are able to be managed at home (Missiuna et al., 2006b), or their child is given a different diagnosis due to symptoms being similar to other developmental disorders such as autism spectrum disorder, learning difficulties or attention deficit hyperactivity disorder (ADHD; Kirby et al., 2007). Finally, adolescents with LMC may adopt coping mechanisms that mask or hide their difficulties (Fitzpatrick and Watkinson, 2003), particularly from their parents or peers in order to fit in (Hill et al., 2011). For example, many conceal bullying or peer-victimisation from their parents, which may lead to fewer social opportunities and lower levels of social support (Missiuna et al., 2008). The lack of peer support experienced by some (O'Dea and

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Abstract

Introduction. Adolescents' motor competence influences their physical, social and emotional development. Parent-reported assessments may not be truly representative of their adolescent's motor difficulties. This study examined the congruency between 133 parent and adolescent dyad reported motor competence. **Method.** The adolescent-reported Adolescent Motor Competence Questionnaire (AMCQ; $\leq$ 83) and the parent-reported Developmental Coordination Disorder Questionnaire-2007 (DCDQ-07; $\leq$ 57) cut scores classified 133 (M_{age} = 14.5 years) adolescents into high (HMC) and low (LMC) motor competence. Parents also completed the Swanson, Nolan and Pelham-IV (SNAP-IV) for descriptive purposes. **Findings.** A moderate correlation (r = .56, $p <$ .001) was found between the AMCQ and the DCDQ'07 scores. Overall, 42 LMC cases were identified by both measures (AMCQ and DCDQ-07). Parents identified more males (11) than females (9) with LMC, whereas more female adolescents (22) self-reported LMC than males (18). A high proportion agreement (0.82) was seen, which was principally due to the 91 (68.4% of sample) HMC case-agreements. **Conclusion.** Parents identified fewer motor difficulties in their adolescent, especially for females. Self-report motor assessments may be more realistic for adolescents as they are aware of their own capabilities. Such measures are also more likely to identify previously undiagnosed adolescents with LMC.

People with low motor competence (LMC) are unable to perform many motor tasks with the same level of proficiency as their peers. They experience difficulties in performing many activities of daily living (ADLs) such as dressing and using eating utensils (Dunford, Missiuna, Street, & Sibert, 2005). This condition may be formally diagnosed as Developmental Coordination Disorder (DCD; APA, 2013; Kirby et al., 2011b) when all criteria in the Diagnostic and Statistical Manual (fifth edition; DSM-5) are met. Some will outgrow the condition (APA, 2013; Kirby et al., 2011a), however between 50-70% of those identified during childhood still experience motor difficulties into adolescence and adulthood (Purcell, Scott-Roberts, & Kirby, 2015).

The adolescent phase is thought to span from 12- to 22-years of age (Harter, 2012a) and is considered to be when an individual develops an independent identity separate to their parents (Kroger, 2007). Therefore adolescence is an important time for those with LMC to receive support as they face many social-emotional and physical challenges during this phase (Hill et al., 2011; O'Dea and Connell, 2016) and may conceal their motor difficulties from their parents. Unfortunately, many remain undiagnosed or unsupported for a number of reasons. Parents may be unaware of the existence of the disorder or visit many health professionals before receiving a diagnosis (Missiuna et al., 2006). Other parents may place their concerns on the 'back burner' as motor difficulties are able to be managed at home (Missiuna et al., 2006) or their child is given a different diagnosis due to symptoms being similar to other developmental disorders such as Autism Spectrum Disorder (ASD), learning difficulties or Attention Deficit Hyperactivity Disorder (ADHD; Kirby, Salmon, & Edwards, 2007). Finally, adolescents with LMC may adopt

coping mechanisms that mask or hide their difficulties (Fitzpatrick & Watkinson, 2003), particularly from their parents or peers in order to fit in (Hill et al., 2011). For example, many conceal bullying or peer-victimization from their parents which may lead to less social opportunities and lower levels of social support (Missiuna et al., 2008). The lack of peer support experienced by some (O'Dea and Connell, 2016; Payne et al., 2013) may contribute to lower levels of self-worth (Skinner and Piek, 2001) and associated internalizing behaviors (Cairney et al., 2013). The recognition of motor difficulties by parents during adolescence would attract support in the development of strategies to negotiate social-emotional challenges; (Skinner and Piek, 2001; Rose et al., 2015; Payne et al., 2013) and improve life satisfaction and employment opportunities as they enter adulthood (Kirby et al., 2013).

A parent's awareness of their child's level of motor skill competence may differ between male and female children (Liong et al., 2015). This could be related to differences in social expectations, physical activity preferences (Cairney et al., 2012) or skill proficiency. A longitudinal study found age-related gender differences in motor skill proficiency (Barnett et al., 2010). Proficiency of kicking, catching and throwing improved for males from childhood to adolescence to a greater extent than females (Barnett et al., 2010). This could be related to different social experiences as males tend to socialize more through vigorous ball-related physical activities and competitive sports, whereas females are more likely to socialize during sedentary activities such as talking with friends or shopping (Cairney et al., 2005; Lingam et al., 2013; Hill et al., 2011; Payne et al., 2013). Consequently, movement difficulties

experienced by adolescent females may not be recognised by their peers or parents.

Some parents may realize their child has motor difficulties due to their poorer performance and lower levels of participation in physical tasks or limited social interactions (Cairney et al., 2005; Cairney et al., 2012). Many, however, have difficulties understanding their child's motor delay which may cause feelings of uncertainty about their parenting and lower levels of confidence in providing support (Barnett, Hinkley, Okley, & Salmon, 2013). Others may over assist by completing daily tasks for their child (Missiuna et al., 2006) or experience feelings of helplessness when their young person refuses assistance (Kirby et al., 2011a). Brown and Lane (2014) found parents accurately reported their child's fine motor control and manual coordination when compared to a performance based measure but were not able to accurately identify issues in other domains such as upper-limb coordination. During adolescence, peer comparisons become more important regardless of level of motor competence however among those with LMC this may have a negative impact (Payne et al., 2013). Therefore, it is important to consider the type of motor assessment tools designed for adolescents as parents may not fully understand nor be aware of the personal challenges or school-based issues faced by their young person (Hill et al., 2011; Pannekoek, Rigoli, Piek, Barrett, & Schoemaker, 2012). Parents may be unaware that their adolescent has LMC as many avoid sharing or revealing difficulties they experience regarding school-based issues or interpersonal relationships with their parents (Gagnon-Roy, Jasmin, & Camden, 2016). Alternatively, some parents may simply think their son or daughter is non-sporty and not realise the level of angst being experienced by them and the

impact LMC can have on a range of health outcomes (Missiuna et al., 2008). A parent who is aware of their child's motor competency may be able to assist them in negotiating these personal and social difficulties (Kirby et al., 2011b). The purpose of this study, therefore, is to compare a parent reported assessment of adolescent motor competence and associated difficulties to self-reported assessment by the adolescent.

Method

Study sample

The sample comprised 133 adolescent and parent dyads. The participants were recruited through personal contacts (n = 6), an adolescents movement clinic (n = 4) community sporting clubs [Australian Rules Football League (AFL, n = 62), netball (n = 5) and basketball clubs (n = 4)] and local schools [independent (n = 47) and government (n = 5)] over a two year period. The inclusion criteria for adolescents were; aged between 12 and 16 years, English as a first language, good linguistic and cognitive ability sufficient to comprehend questions, and no other diagnosed disability such as cerebral palsy, learning difficulties or muscular dystrophy. No inclusion criteria were specified for parents or guardians. Parents were asked if their adolescent had sufficient language and cognitive capabilities to comprehend the questions and if they had any other diagnosed disabilities. This project was approved by the Human Research Ethics Committee of the University of Notre Dame in Perth, Western Australia.

Measures

Motor competence.

Adolescents. The Adolescent Motor Competence Questionnaire (AMCQ; Timler et al., 2016) is a self-report measure of motor competence. The 26-item questionnaire was developed for adolescents between the ages of 12- to 18-years to examine the ecological (skill level in physical surroundings) presence of motor tasks and functional activities of daily living and was informed by the DSM-5 criteria for DCD (APA, 2013). Responses are based on a 4-point Likert scale of Never (1), Sometimes (2), Frequently (3), and Always (4) resulting in a maximum score of 104; a higher score represents a higher motor competence. Concurrent validity of the questionnaire was established against the McCarron Assessment of Neuromuscular Development (MAND; r = .49, p <.002, proportion of agreement =74%, sensitivity = 80%, specificity = 70%). A score of 83 or below on the AMCQ indicates that motor difficulties may be present. This was matched to the cut score for LMC on the MAND (Timler et al., 2016). The AMCQ has test re-test reliability (intra-class correlation coefficients = 0.96), and internal consistency (α = 0.90; Timler et al., 2016) and can be completed in less than 10 minutes.

Parents. Parent reported adolescent motor competence was measured by the Developmental Coordination Disorder Questionnaire-2007 (DCDQ'07; Wilson et al., 2009). The DCDQ'07 is designed for parents of children 5- to 15-years-old. Parents are asked to compare their child's motor performance to that of their child's peers. It consists of 15 items which represent three subscales (Control During Movement, Fine Motor/Handwriting, and General

Coordination) and uses a 5 point Likert scale of Not at all like your child (1), A bit like your child (2), Moderately like your child (3), Quite a bit like your child (4), and Extremely like your child (5). A maximum score is 75. For children aged between 10- to 15-years-old, scores below 57 indicate motor difficulties or suspected motor difficulties (Wilson et al., 2009). Evidence of internal consistency ($\alpha = 0.95$) and concurrent validity ($r = 0.34$, $p = .001$) has been established with an Australian adolescent sample (Pannekoek et al., 2012).

Adolescent Impulsivity and Hyperactivity.

As ADHD often co-occurs with DCD (Kirby et al., 2007), the Swanson, Nolan and Pelham-IV (SNAP-IV Teacher and Parents Rating Scale; Gau et al., 2008) was used to screen for this condition. The SNAP-IV is an 18-item norm-referenced checklist and uses a 4 point Likert scale of: Not at all (0), Just a Little (1), Quite a bit (2), and Very Much (3). It consists of three subscales (ADHD-Inattention, ADHD-Hyperactivity-Impulsivity and ADHD-Combined). The score for each subscale is calculated, and the Average Rating per Item is compared to the 5% cutoff scores. The scale has evidence of test-retest reliability (intra-class correlation coefficients = 0.59~0.72), internal consistency ($\alpha = 0.88$~0.90) and concurrent validity (Gau et al., 2008).

Procedures

This study employed a quantitative design. The AMCQ was used for the adolescent sample as it is the only self-report motor competence measure available for this age range. The DCDQ'07 is the most widely used and recognised parent-report measure for assessing motor competence. The

development of both questionnaires were informed by the DCD criteria outlined in the DSM (fourth version, text Revision; DCDQ'07; fifth version; AMCQ) and contain similar items that capture every day and sports based motor performance activities. Recruitment took place over a two year period. Questionnaires and written consent forms were distributed to sporting clubs and collected two weeks later (response rate 71/162 = 44%) . Depending on the school, the questionnaires and consent forms were completed as hard copies or online. Schools that opted for hard copies obtained written consent before the adolescents completed the AMCQ during an allocated class (response rate 52/162 = 32%). The parent questionnaires (DCDQ'07 and SNAP-IV) were sent home to be completed and returned to school the following day. Twenty-nine parent questionnaires were not returned, however a high overall response rate was achieved (adolescents response rate 133/162 = 82%, parents response rate 133/141 = 94%). Six schools used the online version which enabled teachers and year group coordinators to email parents about the study. Adolescents and parents (n = 14) were able to complete questionnaires and online consent forms at a convenient time to them. It took adolescents 10 minutes, and parents approximately 15 minutes to complete questionnaires. The overall response rate for returned adolescent questionnaires was 39% (162/415). Of the 162 adolescent questionnaires returned, only 133 parents also responded, thereby reducing the total sample included in the analysis to 133.

Data Analysis

SPSS version 23 (SPSS Inc., Chicago, IL, USA) was used to analyze the data. Descriptive statistics were derived for the total sample, males and females. The data (AMCQ, DCDQ'07 and SNAP-IV) were tested for normality and based on acceptable skewness and kurtosis values the appropriate parametric tests were used. For the analysis only the Total DCDQ'07 score was used and the SNAP-IV subscales were combined to group the sample into those with and without ADHD for descriptive purposes. The sample was also grouped into high and low motor competence based on the Total AMCQ (cut score $\leq$ 83) and DCDQ'07 (cut score $\leq$ 57) scores. Case agreement calculations for the two groupings were derived. Pearson's correlation was used to examine the relationship between the Total DCDQ'07 and AMCQ scores. Independent t-tests were completed to examine differences between scores for male and female adolescents, mother and father responses, hardcopy and online completion and those whose parents reported their child did or did not have ADHD.

Results

Descriptive data for 133 pairs of adolescent (66.2 % males, M_{age} = 14.49 years, *SD* = 0.794, 12 to 16 years; 88 males, 45 females) and parent motor competence measures are reported in Table 1. A total of 103 mothers and 30 fathers participated in the study. Overall, males had higher AMCQ scores compared to females. There were no significant differences between scores for male (*M* = 66.24, *SD* = 10.98) and female adolescents (*M* = 64.07, *SD* = 12.36; *t* (129) = .96, *p*=.303) or questionnaire scores completed by fathers (*M* = 68.67, *SD* =

7.53) and mothers (M = 64.58, SD = 12.25; t (131) = -1.73, p =.096) on the DCDQ'07.

Table 6.1. *Descriptive statistics [M(SD)] for age, AMCQ and DCDQ'07 measures for total sample, males and females.*

Measures	Total (N = 133) M(SD)	Males (n = 88) M(SD)	Females (n = 45) M(SD)	Gender p
Age	14.49 (.79)	14.44 (.80)	14.58 (.78)	.357
AMCQ	87.15(11.33)	89.68 (11.08)	82.20 (10.24)	.001
DCDQ'07	65.50 (11.46)	66.24 (10.98)	64.07 (12.36)	.303

AMCQ, Adolescent Motor Competence Questionnaire; DCDQ'07, Developmental Coordination Disorder Questionnaire, 2007;

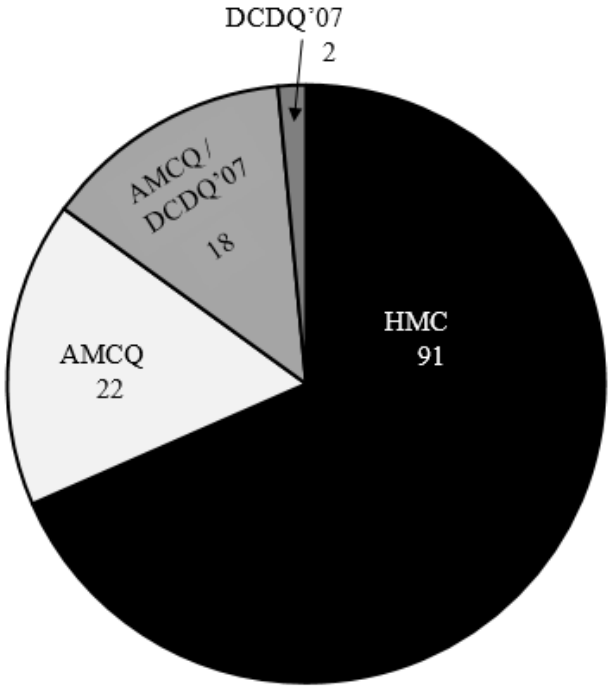
SNAP-IV scores were derived for 131 of the 133 adolescents. Of these, 14 parents (10.7%; 10 males and 4 females) reported their child had some form of ADHD (Table 2). The data for these cases were retained in the study, as DCD is often diagnosed alongside ADHD (Kirby et al., 2007). There were no significant differences between hardcopy and online versions for the AMCQ scores (p = .06) or the DCDQ'07 (p = .21). Overall 114 hardcopy (85.7%) questionnaires and 19 online questionnaires (14.3%) were completed.

Table 6.2. *Descriptive statistics [M(SD)] for SNAP-IV (N = 131) results between ACMQ and DCDQ07*

SNAP-IV measure	**Non-ADHD 117 (89) M (SD)**	**ADHD 14 (11) M (SD)**	**Group *P***
AMCQ	88.33 (10.43)	76.50 (13.84)	.007
DCDQ'07	67.33 (8.7)	49.29 (18.10)	.003

SNAPIV, Swanson, Nolan and Pelham-IV

There was a moderate positive correlation (r = .56, p < .001) between the Total AMCQ and the Total DCDQ'07 scores. The overall proportion of agreement between the DCDQ'07 and the AMCQ was 0.82 (Figure 1). This was primarily due to the high proportion of case agreements for those with HMC (n = 91; 68.4% of sample). On the other hand, 42 cases were identified with LMC by either the DCDQ'07 or the AMCQ. Of these, only 18 parent (DCDQ'07) and adolescent (8 females and 10 males; AMCQ) dyads agreed. The AMCQ scores identified more cases with LMC. Twenty two cases were identified by the AMCQ only and 2 cases by the DCDQ'07 only.



N = 133, Proportion of agreement = 0.82

Figure 6.1. The proportion of Agreement between those identified with LMC by the Adolescents Motor Competence Questionnaire (AMCQ) and the Developmental Coordination Disorder Questionnaire 2007 (DCDQ'07)

Overall a total of 20 (18 case agreements and 2 DCDQ'07 only) LMC cases were identified by parents, 11 were male and 9 female. Whereas a total of 40 (18 case agreements, and 22 AMCQ only) adolescents self-reported LMC, 18 were male and 22 were female. Most of the 22 adolescents who were not identified by parents were female (*n*= 14).

An examination of questionnaire responses for the 18 case agreements, revealed similar responses to items relating to lower levels of participation in sports and physical activities, general coordination, a tendency to bump into things, break objects or be called clumsy. Parents also identified their child's poor running skills, while the adolescents were more likely to be aware of their poor ball and fine motor skills.

The 2 adolescents (1 male, 1 female) identified with LMC by their parents, but not themselves had self-reported AMCQ scores very close to the cut point (84, 89). Their parents observed their poor handwriting and clumsiness (especially for the male). The parent of the female adolescent noted her poor jumping and running skills. When examining these two adolescents' responses to the AMCQ, only the male adolescent reported lower handwriting scores, similar to his parents DCDQ'07 responses.

Discussion

Compared to the adolescent self-reports, parents recognized fewer children with LMC. They were more likely to acknowledge motor difficulties among their sons than daughters, whereas more females than males self-reported with LMC. These results are surprising and could be explained in several ways.

First, some parents may not be aware that LMC is an issue and therefore not relate to their child's poor motor ability (Missiuna et al., 2006). Environmental influences including family socio-cultural factors (such as parents' physical activity levels; Barnett et al., 2013), social stresses (internalising behaviours; Cairney et al., 2013) and peer support (Payne et al., 2013) may also contribute to the parents' ability to recognise motor competence. Parents may over assist their young person when completing a task, such as laying out and organizing clothing before school. In addition, parent's own physical activity level and the importance they place on participation may affect their confidence when providing support to their child (Barnett et al., 2013). Some adolescents may not want to share or acknowledge their LMC to their parents due to personal frustrations which cause them to bottle up their emotions (Hill et al., 2011) or lead to poor social support as a result of shying away from social or physical activity participation (Fitzpatrick & Watkinson, 2003; O'Dea and Connell, 2016). Green and Wilson (2008) found a low level of agreement between parent report (Developmental Coordination Disorder Questionnaire, DCDQ) and self-report (Co-ordination Skills Questionnaire, CSQ) motor skill assessments across a block of interventions. However, parents were only given the opportunity to respond to specific motor skills whereas children were able to rank themselves across a wider range of skills including ADLs (Green & Wilson, 2008).

In this study, more females than males self-reported with LMC. This is different from the male:female ratio reported in the DCD diagnostic criteria (2:1; APA, 2013) and other studies that have examined these gender differences (Cairney et al., 2013). This outcome could be due to a number of factors.

Females are less motivated to participate in team sports (Fredricks & Eccles, 2005; Labbrozzi et al., 2013), prefer co-operative activities (Hands et al., 2015; Rose et al., 2011) or place greater importance on ADLs. Consequently, their poor motor skills may be less apparent or concerning to their parents. On the other hand, males place importance on sports participation and physical activities as they value a chance to compete, to win and hang out with their friends, compared to females who felt physical activities prevented them from doing the things that they liked (Vedul-Kjelsås, Regalia, Manzi, Golledge, & Scabini, 2012). For example, Vedul-Khelsas and colleagues (2012) found physical fitness and self-perceptions among 11- to 12-year-olds differed, male perceptions correlated with athletic competence whereas female perceptions were more closely related to social acceptance. Females' also tend to place greater importance on close friendships and emotional support as their self-esteem is affected by their degree of body satisfaction, self-image, and appearance to a greater extent than males (Rose et al., 2011).

Another reason for the greater identification of males than females by parents may relate to lower expectations of daughters' motor competence and placing less importance on their physical activity participation (Cairney et al., 2012). Parents often have higher expectations of boys' competence in physical tasks and consider sport as more important, compared to girls (Fredricks & Eccles, 2005). We found that parents were more likely to place higher scores ("extremely like your child") for their son's ball skill competence, running and jumping skills. Similarly, Liong, Ridgers, and Barnett (2015) also found parents were more able to accurately perceive their son's (5 to 8 year-olds) level of object control skills. The higher participation in physical tasks involving

speed, strength and endurance by boys compared to girls (Cairney et al., 2005) makes it easier for parents to observe and recognise level of motor competence in their sons as they tend to participate regardless of their motor competence level. Parents' perceptions about their adolescents motor skill competence may be influenced by gender-specific characteristics as males are often viewed as strong, robust, autonomous and self-reliant compared to females who are described as loving, loyal, and family orientated.

Assessing motor competence reliably can be challenging given developmental fluctuations (improvements during adolescence and poorer coordination during adulthood; (Hands et al., 2015), the range of skills (locomotion, object control and balance) considered to accurately assess motor competence and the tendency to include gender biased items in tests of motor skill (Hands & Larkin, 1997). This could be due the type of items typically included in motor assessments which focus on tasks preferred by males such as ball skills or females being less skilled in these activities (Hands & Larkin, 1997). The higher proportion of males diagnosed in most studies with motor difficulties compared to females (APA, 2013; Cairney et al., 2012) therefore, could also explain this gender bias.

Another factor that could account for the lack of congruency in identifying those with LMC between the parent-report and self-report results is the questionnaire design. For example, the DCDQ'07 asks parents to compare their child's motor ability against similar aged peers, whereas the AMCQ asks adolescents to reflect on how their own coordination impacts performance on motor-related activities (Timler et al., 2016; Wilson et al., 2009). The

DCDQ'07 was designed for a wider age range (5- to 15-year-olds) and therefore is more limited with the type of ADLs that could be included (handwriting and scissor use; Wilson et al., 2009). The AMCQ was designed for 12- to 18-year-olds and therefore includes more age-relevant items relating to peer comparison, social interactions, participation (individual versus team sports; Timler et al., 2016). The AMCQ also has a greater number of ADL items that are developmentally appropriate such as flossing between teeth, putting on make-up, changing clothes for physical education classes and getting ready to go out (Timler et al., 2016). Consequently, the adolescents can respond to activities that are relevant for them as greater value is placed on peer opinions and acceptance and looking presentable during this phase (Rose et al., 2011). The items on the AMCQ enable females to have a greater voice and an opportunity to report on their motor difficulties. The gender differences identified in this study suggest the content of the assessments used by parents and adolescents need further exploration. Therefore the findings from this study indicate that assessing adolescent motor competence is best undertaken using a self-report rather than a parent report measure.

Strengths and limitations

There are a number of limitations and strengths of the current study. While the sample size was adequate, generalization of the results to the broader Australian population is not possible due to recruitment difficulties. Participants were drawn from a range of sources. In order to ensure an adequate representation of adolescents with LMC, it was important not to over recruit participants through sporting associations, which was the easiest way to access adolescents

outside school. As expected, significant differences in the Total AMCQ scores were found between those recruited through sporting clubs (M = 92.63, SD = 5.86) compared to those recruited elsewhere (M = 82.64, SD = 12.71; t (105.40) = 5.98, p <.001). This latter group comprised adolescents attending a movement clinic as well as many community contacts. Fewer females participated in the study which may be due to the recruitment process and the level of interest in participating, however some interesting differences still emerged. The demographics of the family and parents were not collected, which limited an exploration of environmental and family dynamics. Further analysis could not be completed with the SNAP-IV data given the small proportion of those identified with ADHD. The data were collected in two ways; online and hardcopy surveys however this did not affect the results as no significant differences were found for both the Total AMCQ and DCDQ'07 scores.

This study adds to previous literature published on the measurement of DCD and the relevance of self-report compared to parent-report questionnaires. Adolescents are capable of describing their own motor competence. The findings of this study highlight the importance of age appropriate motor competence measures and the need for further research using adolescent specific measures. The higher number of females identified with LMC in this study suggest that future research should consider the girl:boy ratio of a DCD diagnosis (APA, 2013). It is possible that gender biased items and measures being used to gather information about motor competence are affecting results. It is important to provide adolescents with a voice at this critical phase of development. During this phase they are trying to define their

own personal identity and become more independent from their parents. Providing them with an opportunity to identify their own motor difficulties may be essential to helping find support or intervention program before they enter adulthood.

Conclusions

Adolescents are aware of, and able to identify their level of motor competence in comparison to their peers, whereas parents may not appreciate all aspects of their adolescent's experiences. Self-report questionnaires, such as the AMCQ, may be more sensitive measures of motor competence for this age group, especially among females. Further research involving interviews with parents and their adolescent would gather more in-depth information of parent and child differences in perceptions of motor ability. Education about the impact of LMC during adolescence may build awareness and support among parents as well as teachers, practitioners and health care professionals.

Key findings:

- Parents identified more males then females with LMC
- Females self-reported more LMC than males

What this study adds:

It may be more realistic for self-report motor assessments to be used for adolescents as they are aware of their own capabilities.

Acknowledgements

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Research ethics

Ethical approval was obtained from the Human Research Ethics Committee of the University of All participants provided written informed consent.

Declaration of conflicting interests

The authors confirm that there is no conflict of interest.

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CHAPTER SEVEN: Exploring the influence of self-perceptions on the relationship between motor competence and identity in adolescents.

Enjoyable activities

'Well I work out every second day of the week, mainly on legs for my rehab after my knee operation. I live for sports, I have an incredible passion for football (soccer), hopefully what I do in the near future.'

(17 year-old HMC male)

'I dance for two and half hours, once a week. I play netball twice a week during the seasons (training and the game) and once a week during the spring netball season.'

(14 year-old, HMC female)

'Music is core to me and I have ambitions to make my own, and anything adventurous has a place with me too.'

(15 years-old HMC male).

Abstract

Background: Adolescent perceptions of themselves may be influenced by a number of domains which may affect their identity health. This study examined if adolescents' self-perceptions for eight separate domains mediated the relationship between their actual level of motor competence and identity health. **Methods:** Adolescents (N =160) completed the Adolescent Motor Competence Questionnaire (AMCQ), Assessment of Identity Development in Adolescence (AIDA) and the Self Perception Profile for Adolescence (SPPA). Each of the eight SPPA domains were examined to assess the mediated association between motor competence and identity health, separated for sex (male/female) and motor competence (low/high). Motor competence scores were dichotomized based on the ACMQ with a score of 83 or below indicating low motor competence (LMC). A p value (p = .006) correction for multiple comparisons was used for the mediation analysis. **Results:** For the total sample (N =160, 64.4% males, M_{age} = 14.45 SD = .75, 12 to 16 years), perceptions of social competence, physical appearance, close friendships and global self-worth were significant mediators. No mediators were significant for female or males although notable associations were observed for close friendships and global self-worth among the males. When the sample was grouped into high and low motor competence, physical appearance and global self-worth were mediators for the HMC group. No significant meditating relationships occurred for the LMC group, although close friendships showed a notable association. **Conclusions:** The health of identity during adolescence should be considered according to gender and motor competence for individual self-perceptions. For example, adolescents with HMC perceive physical appearance and global self-worth is associated to their identity health.

Background

During adolescence, one's sense of identity may be impacted by a number of overwhelming decisions about their future arising from personal interests, hobbies, peer and parental support and social media (Perry & Pauletti, 2011). Consequently, adolescence is a fragile phase to negotiate. The development of one's identity is a lifelong process defined as an overall broad spectrum of 'who one is', which includes some elements of the self such as personal beliefs, self-awareness and evaluations (Harter, 2012a) but also comprises of social roles (for example family, sexual and cultural; Goth et al., 2012; Schwartz et al., 2011) outside of the self. Within the literature the terms identity and self have been used interchangeably. Identity differs to the self as it develops through a number of psychosocial factors according to one's social environment (Schwartz et al., 2011), whereas the self is a more stable construct and defined through personal descriptions such as talkative or friendly (Harter, 2012a). An adolescent's identity (healthy or less healthy) depends on how adolescents resolve or avoid identity crises such as class sections or occupational choices (Erikson, 1968). Those who develop a healthy identity have strong personal attributes and future goals (Goth et al., 2012) and explore a variety of avenues such as intimacy (Kelly, Zimmer-Gembeck, & Boislard-P, 2012), and receive parent and peer support that provide a sense of belonging (Kornienko, Santos, Martin, & Granger, 2016). The self assists in the formation of a healthy identity as personal beliefs of an individual's strengths and weaknesses help to inform the context of one's social environment (Goth et al., 2012; Harter, 2012a). A relatively unexplored factor that appears to affect a healthy identity is one's level of motor competence.

Adolescent's with high motor competence (HMC) are more motivated to participate in age appropriate activities such as playing sports and recreational games (Labbrozzi et al., 2013) and often receive greater peer acceptance (Guan & Fuligni, 2016). While, adolescents with low motor competence (LMC), who may also receive a diagnosis of Developmental Coordination Disorder (DCD; (APA, 2013) experience more social-emotional challenges (Hill et al., 2011) such as social isolation, social immaturity and lower social acceptance (Cairney et al., 2005; Harter, 2012a; Hill et al., 2011; Payne et al., 2013). This may lead to lower feelings of self-worth and higher levels of anxiety (Skinner & Piek, 2001; Wilson et al., 2013). These experiences may also affect the health of identity as these youth do not have the same opportunities to explore their personal interests in social settings that help reinforce a healthy identity (Goth et al., 2012; Sollberger, 2013). However, Lingam and colleagues (2013) found that adolescents with LMC who had friendship groups that valued their skills improved their sense of identity. However, there are few studies investigating in depth, the extent to which level of motor competence influences identity health.

An adolescent's level of motor competence may be influenced by their sports participation as well as other areas such as academic achievements (Ryska, 2003) as those with LMC may employ coping strategies (Fitzpatrick & Watkinson, 2003), or devalue the importance of particular domains such as athletic competence to avoid exposing their physical awkwardness (Harter, 2012b; Ryska, 2003). Motor competence differs to athletic competence as it encompasses a broad range of motor skills such as fine and gross motor as well as ability to complete activities of daily living such as self-care (Timler et al.,

2016). Athletic competence is an individual's perception towards participation in activities such as new games and team sports (Harter, 2012a). Rose and colleagues (2015) found that motor competence level among 14-year-olds was influential towards domains such as global self-worth, athletic competence, physical appearance, close friendships, social acceptance and romantic appeal, with HMC being a protective factor towards experiencing a positive self-perception. Compared to males, a females' level of motor competence affected their perceptions of close friendships (Rose et al., 2015). Children (8-to 10-years-old) and adolescents (12-to 14-years-old) with LMC had lower perceived social acceptance, athletic competence, and physical appearance compared to the HMC group, with adolescents with LMC reporting lower global self-worth compared to children with LMC (Skinner & Piek, 2001). It is possible, therefore, that the impact of an adolescent's level of motor competence on their sense of identity may be mediated by their self-perceptions in a range of domains. This could also differ for males and females.

Males and females may develop their identity differently depending on the importance placed on individual self-perceptions and motor competence. Rose and colleagues (2011) found that males valued athletic competence, physical appearance and romantic appeal more than females who perceived behavioural conduct and close friendships as more important. The value male and female adolescents place on their own motor competence may also influence their sense of identity differently. Males tend to participate in more vigorous activities involving speed, strength and endurance (Byrd-Craven & Geary, 2007; Cairney et al., 2005) and rate physical activity participation as important for a chance to compete, win, and hang out with friends compared to

females (Hands et al., 2015). Females, compared to males, tend to place greater importance on physical appearance enabling them to look presentable, develop emotional support and close friendships (Byrd-Craven & Geary, 2007; Rose et al., 2011).

Whilst researchers have independently examined motor competence in relation to self-perceptions (Rose et al., 2015; Skinner & Piek, 2001) and identity (Lingam et al., 2013), there is limited research examining associations between these three factors. The aim of this study, therefore, is to examine if an adolescent's self-perceptions mediate the relationship between motor competence and their identity. Differences between males and females and motor competence groups will also be considered.

Methods

Participants

A sample of 160 (64.4% males, M_{age} = 14.44 years, SD = 0.75) adolescents participated in the study. They were recruited through personal contacts, an adolescent movement clinic, community sporting clubs and local schools. The inclusion criteria specified adolescents to be aged between 12-and 16-years; have English as their first language, good linguistic and cognitive ability sufficient to comprehend questions and no other diagnosed disability such as cerebral palsy or learning difficulties.

Measures

The Self-perception Profile for Adolescents (SPPA; Harter, 2012c) is a self-report questionnaire for 12-to 18-year olds and examines nine domains

(scholastic, social, athletic, job competence, physical appearance, romantic appeal, behavioural conduct, close friendships, and global self-worth; (Harter, 2012c). It consists of 45 items, with each domain containing 5 items and 20 items reverse scored to avoid socially desirable responses. The SPPA uses a structured alternative format. The participants are given two statements to decide which one 'is most like them'. Once they have chosen a statement they decide if it is 'Really True for me' or 'Sort of True for me' which are scored on a four point Likert scale ranging from 1 (lowest) to 4 (highest). The SPPA has evidence of internal consistency (α = 0.68~0.87) with factorial structure with an Australian sample (Rose et al., 2011).

The Adolescent Motor Competence Questionnaire (AMCQ; Timler et al., 2016) is a 26 item self-report questionnaire designed for adolescents aged between 12-and 18-years and examines motor tasks, activities of daily living, and informed by the Diagnostic and Statistical Manual (fifth edition; DSM-5) criteria for DCD (APA, 2013). Responses are based on a 4-point Likert scale of Never (1), Sometimes (2), Frequently (3), and Always (4) resulting in a total score of 104 (a score of $\leq$83 = LMC). The questionnaire has evidence of concurrent validity against the McCarron Assessment of Neuromuscular Development (MAND; McCarron, 1997), test re-test reliability (intra-class correlation coefficients = 0.96), internal consistency (α = 0.90) with an Australian sample, and can be completed in less than 10 minutes (Timler et al., 2016).

Assessment of Identity Development in Adolescence (AIDA; Goth et al., 2012) is a self-report identity measure for adolescents aged between 12-and 18-

years. The questionnaire consists of 58 items and has a 5-step response format: 0=no, 1=more no, 2 = part/part, 3=more yes, and 4=yes. The AIDA is designed to assess identity on a continuum from an integrated (healthy) to a diffused (less healthy) identity (Goth et al., 2012). A total maximum scale score (232) is calculated from the 58 items, with a higher score indicating towards identity diffusion. The items on the questionnaire were developed around the two constructs that influence identity these are: continuity (sense of self) and coherence (sense of belonging in a social context). The questionnaire has evidence of construct validity (r = 0.61~0.80), criterion validity (d = 2.27~2.56) and internal consistency (α = 0.73~0.94; (Goth et al., 2012). To accommodate for cultural differences, the AIDA Australia was used in the current study with the Australian clinical cut off score greater than 148.

Procedures

Data collection took place over a two year period from 2014 to 2016. The questionnaire and written parental consent forms were distributed to personal contacts (n = 6), adolescents movement program (n = 4), sporting clubs [AFL club (140), basketball clubs (50) and a netball club (20)] and collected two weeks later (response rate 82/210 = 39%). Students in years 9, 10 and 11 attending schools in the Perth metropolitan were contacted from a list of schools generated by the primary author. A total of 34 government (137 schools in Perth = 25%), 54 Independent (62 schools in Perth = 87%) and 9 Catholic (25 schools in Perth= 36%) schools were contacted within the metropolitan area. However, only five government and seven independent schools agreed to assist in recruiting participants. Schools that opted for hard copies obtained written

parental consent before the adolescents completed the questionnaires during an allocated class (response rate 38/65 = 58%). One independent school handed out hardcopies of the questionnaires and consent forms with a paid-reply envelope so participants could complete and place both items in the mail at a time convenient for them (response rate 30/140 = 21%). Six schools opted for the online version which enabled teachers and year group coordinators to email parents about the study (n = 19 completed). Adolescents were able to complete the questionnaire and parents were able to complete an online consent form at a time convenient to them. The overall study response rate was 39% (160/415).

Ethical issues

This project was approved by the Human Research Ethics Committee of the University of Notre Dame in Perth, Western Australia. Written informed consent was obtained from all the participants.

Data Analysis

SPSS version 23 (IBM SPSS Inc., Chicago, IL, USA) was used to analyse the data. For some analyses, the AMCQ cut score was used to dichotomize the sample into high (>84) and low (≤83) motor competence. The AMCQ, AIDA and SPPA scores were described using mean and standard deviation for the total sample (N = 160), males (n = 103), females (n = 57) and motor competence groups high (n = 108) and low (n = 52). Normality was assessed showing acceptable skewness (+/-1) and kurtosis (+/-1) allowing parametric tests to be used (Field, 2013). The AMCQ, AIDA and SPPA group differences for gender and motor competence were examined using independent t-tests. Pearson's

correlations were used to examine relationships between motor competence (Total AMCQ), identity (Total AIDA) and nine self-perception domains (Mean SPPA). Self-perception domains that did not show significant correlations with AMCQ were excluded from the mediation analyses (Field, 2013). Statistical significance was set at $p < .05$.

This study used a simple mediation equation [c = c' + ab; *a*, *b* (indirect), *c* (total effect), *c'* (direct effect = ab)], adapted using regression coefficients (Baron & Kenny, 1986) to investigate whether each self-perception variable mediate the covariance relationship between motor competence and identity health. The assumptions of variables being scale and normally distributed were met. To graphically depict simple mediation, the regression coefficients were entered into Medgraph (http://pavlov.psyc.vuw.ac.nz/paul-jose/medgraph/). Once the mediation was depicted, MacKinnon's ratio (Gonzalez & MacKinnon, 2016); indirect effect/total effect) was calculated to examine the percentage of the mediator on total effect compared to the percentage of only the direct total effect (motor competence and identity health). In addition to the above criteria, mediation was assessed on the significance of the Sobel z-value and the 95% confidence intervals (Hayes, 2009; Sobel, 1982). The sample size (N = 160) was adequate to examine mediation (a sample size of 73 achieves 80% power to detect a change in slope from 0.30 under the null hypothesis to 0.00 under the alternative hypothesis when the standard deviation of the X's is 1.00, the standard deviation of Y is 0.90, and the two-sided significance level is 0.05). Simple mediations were examined individually for each of the eight self-perception domains for the total sample, males, females, and motor competence (high or low). A Šidák (1967); $1 - (1- \alpha_1)^m$) adjusted alpha was used for

multiple comparisons (n=8 self-perception variables). Therefore the adjusted statistical significance was set at $p<.006$ for the mediation analysis.

Results

Descriptive data for the total sample, gender, high motor competence, and LMC groups are reported in Table 7.1. Overall males had a healthier identity, higher motor competence and self-perception scores except for behavioural conduct, than the females. The HMC group had a healthier identity and higher motor competence and self-perception scores except for Job competence compare to the LMC group. Identity scores were less healthy (higher scores) for females and the LMC group but within a normal range, except for 2 HMC females. Information for these 2 participants remain in the current study. Identity scores for the total sample ranged 4-153. There were no significant differences between AMCQ scores for those completed by hardcopy (M = 86.98, SD = 10.61) compared to the online version (M = 83.37, SD = 16.20; t (158) = 1.30, p = .09), and no significant difference between AIDA scores for hardcopy (M = 68.33, SD = 33.07) compared to the online version (M = 67.74, SD = 37.42; t (131) = .071, p = .94).

Table 7.1. *Descriptive statistics [M(SD)] for the total sample, gender and competence level.*

		Gender			Motor competence	
Measures	Total (N = 160)	Males (*n* = 103)	Females (*n* = 57)	Total (N = 160)	HMC (*n* = 108)	LMC (*n* = 52)
Age (mths)	14.44 (.75)	14.39 (.76)	14.54 (.73)	14.44 (.75)	14.47 (.77)	14.38 (.72)
Identity health (max = 232)	71.34 (34.86)	**62.79 (31.09)****	**86.81 (36.21)**	71.34 (34.86)	**64.98 (32.87)****	**84.56 (35.45)**
Motor competence (max = 104)	86.55 (11.41)	**89.29 (10.86)****	**81.60 (10.78)**	86.55 (11.41)	**92.87 (4.87)****	**73.42 (9.80)**
Scholastic competence	2.78 (.66)	**2.87 (.63)***	**2.62 (.70)**	2.78 (.66)	2.80 (.65)	2.73 (.70)
Social competence	3.04 (.58)	**3.18 (.52)****	**2.80 (.62)**	3.04 (.58)	**3.12 (.55)***	**2.83 (.60)**
Athletic competence	2.90 (.82)	**3.14 (.67)****	**2.45 (.88)**	2.90 (.82)	**3.23 (.61)****	**2.20 (.77)**
Physical appearance	2.69 (.75)	**2.93 (.61)****	**2.26 (.78)**	2.69 (.75)	2.77 (.69)	2.53 (.85)
Job competence	2.93 (.55)	2.94 (.54)	2.90 (.57)	2.93 (.55)	2.91 (.57)	2.96 (.52)
Romantic appeal	2.61 (.58)	**2.73 (.52)****	**2.38 (.60)**	2.61 (.58)	**2.68 (.55)***	**2.45 (.61)**
Behavioural conduct	3.02 (.61)	3.01 (.58)	3.04 (.66)	3.02 (.61)	3.03 (.56)	2.98 (.70)
Close friendships	3.19 (.63)	**3.21 (.57)****	**3.14 (.72)**	3.19 (.63)	3.25 (.59)	3.06 (.67)
Global self-worth	3.05 (.63)	3.21 (.49)	2.76 (.75)	3.05 (.63)	**3.14 (.54)***	**2.87 (.76)**

Note: HMC = High motor competence, LMC = Low motor Competence **Bold = p<.001** P.01*** (independent samples t-test)

Significant correlations between motor competence and eight self-perception domains ranged from strong (r = .610, p <.01; Athletic competence) to weak (r = .166, p = .05; behavioural conduct). Notably, the job competence (r = -.003, p .967) domain was not significant and excluded from further analyses (Table 7.2).

Table 7.2. *Pearson correlations between self-perception, motor competence and identity variables for the total sample*

	Motor competence	Scholastic competence	Social competence	Athletic competence	Physical appearance	Job competence	Romantic appeal	Behavioural conduct	Close friendship	Global self-worth	Identity health
Mean	86.55	2.78	3.04	2.90	2.69	2.93	2.61	3.02	3.189	3.05	71.34
SD	11.41	.664	.581	.820	.748	.549	.575	.606	.625	.633	34.86
Motor competence	-	.168*	.304**	**.610****	.223**	-.003	.213**	.166*	.302**	.304**	-.429**
Scholastic competence		-	.192*	.101	.409**	.242**	.134	.380**	.285**	.502**	-.391**
Social competence			-	.569*	.457**	.088	.370**	.197*	.560**	.484**	-.429**
Athletic competence				-	.404**	.046	.385**	.093	.324**	.417**	-.331**
Physical appearance					-	.012	.446**	.296**	.379**	**.766****	**-.613****
Job competence						-	.195*	.087	.159*	.140	-.154
Romantic appeal							-	.074	.338**	.393**	-.330**
Behavioural conduct								-	.216**	.406**	-.400**
Close friendship									-	.522**	-.512**
Global self-worth										-	**-.652****
Identity health											-

*$p < .05$
**$p < .001$
Bold = strong correlation (.60 to .79)

Total effect (c) between Motor Competence and Identity

The total effect of motor competence on identity was significant with HMC associated with healthier identity (c = -.43, Standard Error [SE] = .02, p <.001). When assessed separately for males and females, the total effect of motor competence on identity health was significant for males (c = -.41, Standard Error [SE] = .03, p <.001) and females (c= -.29, Standard Error [SE] = .04, p = .03). Similarly, when motor competence was separately assessed for high or LMC they both had the same association with identity in that a higher motor competence was associated with a healthier identity, HMC total effect (c = -.40, Standard Error [SE] = .01, p = <.001) LMC (c = -.40, Standard Error [SE] = .04, p = .004).

Mediation Analysis

Figure 7.1 depicts the mediation pathways which were examined separately for each of the eight domains which initially reported a significant relationship with motor competence.

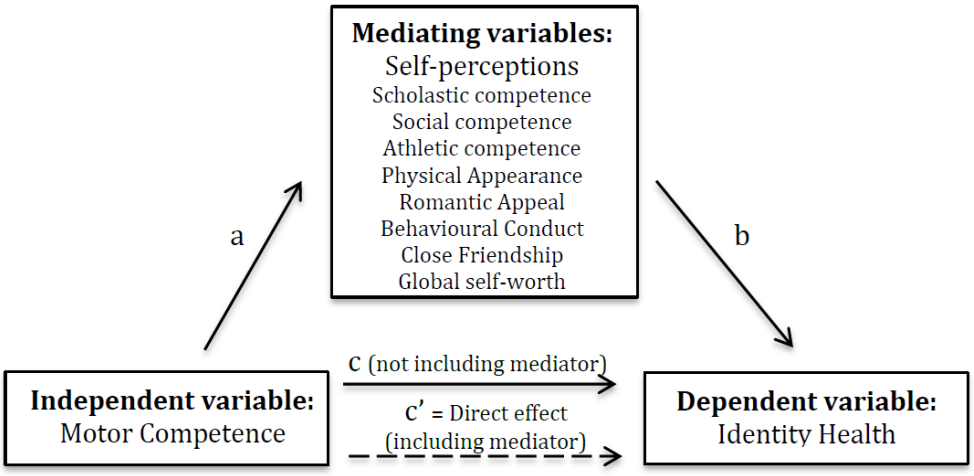

Figure 7.1. Simple mediation design showing standardised regression coefficients indicating total (c), direct (c'), and indirect effects (ab) between Motor Competence, Identity Development and eight self-perceptions with a sample of 160 adolescents.

Table 7.3 depicts the results from the mediation analysis. It is important to note that the regression coefficients for identity are negative as a healthier identity is represented by a lower score. Not all self-perception domains had a statistically significant mediating effect on motor competence and identity health. For the entire sample, Social competence, mediated 23% of the total effect of motor competence on identity health, with the remaining 77% occurring only through the direct effect (relationship of motor competence and identity health). Similarly, the mediation effect were also significant for physical appearance (20%), close friendships (23%) and global self-worth (26%). Although romantic appeal (15%; p = .030) and behavioural conduct (13%; p = .040) did not remain significant with the Šidák adjusted p, parameter estimates were high (Table 7.3, below).

Gender differences in mediating self-perceptions

No self-perception domains significantly mediated the relationship between motor competence and identity health for males. Although close friendships (30%; p = .009) and global self-worth (19%; p = .023) did not remain significant with the Šidák adjusted p, parameter estimates were high (Table 7.4). No self-perception domains significantly mediated the relationship for the females even though the direct effect was significant.

Table 7.3. *Mediation analysis for the overall sample (N = 160)*

Hypothesized mediators	Motor competence on mediator		Mediator on Identity health		Motor competence on Identity health		Mediated effect		
	a (SE)	*p*	b (SE)	*p*	c' (SE)	*p*	ab	95% CI	Sobel *p*
Scholastic competence	.17 (.01)	.034	**-.33 (3.59)**	**<.001**	**-.37 (.21)**	**<.001**	-.39	-.355 to .011	.065
Social competence	**.30 (.00)**	**<.001**	**-.33 (4.26)**	**<.001**	**-.33 (.22)**	**<.001**	**-.43**	**-.520 to -.110**	**.003**
Athletic competence	**.61 (.01)**	**<.001**	-.11 (3.85)	.226	**-.36 (.28)**	**<.001**	-.33	0 to 0	.284
Physical appearance	**.22 (.01)**	**.005**	**-.54 (2.79)**	**<.001**	**-.31 (.18)**	**<.001**	**-.61**	**-.643 to -.119**	**.004**
Romantic appeal	.21 (.00)	.007	**-.25 (4.31)**	**.001**	**-.38 (.22)**	<.001	-.33	-.317 to -.016	.030
Behavioural conduct	.17 (.00)	.035	**-.34 (3.91)**	**<.001**	**-.37 (.21)**	<.001	-.40	-.342 to -.008	.040
Close friendships	**.30 (.00)**	**<.001**	**-.42 (3.78)**	**<.001**	**-.30 (.21)**	**<.001**	**-.51**	**-.622 to -.176**	**<.001**
GSW	**.30 (.00)**	**<.001**	**-.57 (3.31)**	**<.001**	**-.26 (.18)**	**<.001**	**-.65**	**-.809 to -.266**	**<.001**

Bold indicates Šidák (1967) multiple comparisons corrected statistical significance of p<.006

a = standardised regression coefficient of Motor competence on mediator; ab = product-of-coefficients; b = standardised regression coefficient of the changes in hypothesized mediator and changes in Identity health; c' = standardised regression coefficient of Motor competence predicting Identity health with adjustment for mediator

Table 7.4. *Mediation analysis for males (n = 103), and females (n = 57).*

Hypothesized mediators	Motor competence on mediator		Mediator on Identity health		Motor competence on Identity health		Mediated effect		
	a (SE)	*p*	b (SE)	*p*	c' (SE)	*p*	ab	95% CI	Sobel *p*
Males									
Scholastic competence	.09 (.01)	.367	**-.27 (4.33)**	**.003**	**-.39 (.25)**	**<.001**	-.30	-.226 to .095	.422
Social competence	.24 (.01)	.016	-.24 (5.48)	.010	**-.35 (.26)**	**<.001**	-.32	-.342 to .026	.092
Athletic competence	**.55 (.01)**	**<.001**	-.13 (5.01)	.243	**-.34 (.31)**	**.002**	-.32	-.539 to .138	.247
Physical appearance	.12 (.01)	.238	**-.48 (3.99)**	**<.001**	**-.35 (.23)**	**<.001**	-.52	-.457 to .120	.252
Romantic appeal	.22 (.01)	.028	**-.37 (5.13)**	**<.001**	**-.33 (.25)**	**<.001**	-.44	-.457 to .080	.070
Behavioural conduct	.18 (.00)	.071	**-.38 (4.55)**	**<.001**	**-.34 (.24)**	**<.001**	-.44	-.424 to .015	.067
Close friendships	**.33 (.01)**	**.001**	**-.36 (4.90)**	**<.001**	**-.29 (.26)**	**.002**	-.46	-.593 to -.084	.009
GSW	.23 (.00)	.021	**-.45 (5.17)**	**<.001**	**-.31 (.24)**	**<.001**	-.53	-.532 to -.039	.023
Females									
Scholastic competence	.16 (.01)	.222	**-.40 (6.23)**	**.002**	-.22 (.41)	.072	-.44	-.624 to .163	.251
Social competence	.21 (.01)	.111	**-.38 (7.21)**	**.004**	-.21 (.41)	.099	-.42	-.646 to .120	.179
Athletic competence	**.57 (.01)**	**<.001**	.06 (6.54)	.728	-.32 (.53)	.049	-.13	-.486 to .696	.728
Physical appearance	.07 (.01)	.536	**-.58 (4.84)**	**<.001**	-.25 (.35)	<022	-.60	-.664 to .295	.618
Romantic appeal	-.00 (.00)	.986	-.02 (7.82)	.902	-.29 (.44)	<.032	-.02	-.015 to .015	1.000
Behavioural conduct	.19 (.01)	.151	**-.38 (6.73)**	**.003**	-.21 (.41)	.086	-.42	-.611 to .113	.177
Close friendships	.27 (.01)	.043	**-.57 (5.57)**	**<.001**	-.13 (.37)	.233	-.61	0 to .027	.062
GSW	.22 (.01)	.099	**-.68 (4.66)**	**<.001**	-.14 (.33)	.161	-.71	-.956 to .098	.111

Bold indicates Šidák (1967) multiple comparisons corrected statistical significance of p<.006

a = standardised regression coefficient of Motor competence on mediator; ab = product-of-coefficients; b = standardised regression coefficient of the changes in hypothesized mediator and changes in Identity health; c' = standardised regression coefficient of Motor competence predicting Identity health with adjustment for mediator

High and LMC differences in mediating self-perceptions

Differences in mediating factors existed between the HMC and LMC groups (Table 7.5). In the HMC group, physical appearance mediated 26% of the total effect of motor competence on identity health, with the remaining 74% occurring only through the direct effect. A similar mediation effect was significant for global self-worth (30%) but no other domains. Although social competence (18%; p=.042) and behavioural conduct (23%; p=.016) did not remain significant with the Šidák adjusted p, parameter estimates were high (Table 5). For the LMC group no self-perception domains were significant. Although close friendships (40%; p = .033) did not remain significant with the Šidák adjusted p, high parameter estimates were observed (Table 7.5).

Table 7.5. *Mediation analysis for the HMC (n = 108) and LMC (n = 52) groups.*

Hypothesized mediators	Motor competence on mediator		Mediator on Identity health		Motor competence on Identity health		Mediated effect		
	a (SE)	*p*	b (SE)	*p*	c' (SE)	*p*	ab	95% CI	Sobel *p*
HMC									
Scholastic competence	**.31 (.01)**	**.001**	-.19 (4.66)	.041	**-.34 (.62)**	**<.001**	-.29	-.834 to .042	.077
Social competence	.21 (.01)	.029	**-.45 (4.82)**	**<.001**	**-.30 (.54)**	**<.001**	-.51	0 to -.023	.042
Athletic competence	**.30 (.01)**	**.002**	-.22 (4.97)	.018	**-.33 (.62)**	**<.001**	-.32	-.901 to .014	.057
Physical appearance	**.30 (.01)**	**.002**	**-.54 (3.70)**	**<.001**	**-.23 (.52)**	**.003**	**-.61**	**0 to -.36**	**.003**
Romantic appeal	.21 (.01)	.207	**-.38 (4.97)**	**<.001**	**-.35 (.56)**	**<.001**	-.42	-.825 to .190	.220
Behavioural conduct	**.33 (.01)**	**.001**	**-.29 (5.36)**	**.002**	**-.30 (.61)**	**.001**	-.39	0 to -.117	.016
Close friendships	.16 (.01)	.109	**-.46 (4.38)**	**<.001**	**-.32 (.53)**	**<.001**	-.51	0 to .137	.127
GSW	**.32 (.01)**	**.001**	**-.46 (5.02)**	**<.001**	**-.25 (.56)**	**.003**	**-.54**	**0 to -.330**	**.003**
LMC									
Scholastic competence	.16 (.01)	.266	**-.52 (5.60)**	**<.001**	**-.32 (.40)**	**.006**	-.57	-.834 to .244	.284
Social competence	.16 (.01)	.251	**-.45 (4.82)**	**<.001**	**-.30 (.54)**	**<.001**	-.17	-.246 to .120	.501
Athletic competence	.28 (.01)	.041	-.03 (6.38)	.821	**-.41 (.50)**	**.005**	-.08	-.241 to .304	.821
Physical appearance	.09 (.01)	.525	**-.56 (4.41)**	**<.001**	**-.35 (.38)**	**.002**	-.59	-.740 to .2679	.508
Romantic appeal	.10 (.01)	.480	**-.04 (7.71)**	**.004**	**-.39 (.48)**	**.004**	-.08	-.113 to .086	.785
Behavioural conduct	.16 (.01)	.263	**-.39 (6.09)**	.003	-.34 (.44)	.008	-.44	-.615 to .188	.299
Close friendships	.47 (.01)	.015	-.37 (7.34)	.011	-.22 (.50)	.117	-.48	0 to -.049	.033
GSW	.19 (.01)	.178	**-.73 (3.83)**	**<.001**	**-.26 (.30)**	**.003**	-.78	0 to .231	.178

Bold indicates Šidák (1967) multiple comparisons corrected statistical significance of p<.006

a = standardised regression coefficient of Motor competence on mediator; ab = product-of-coefficients; b = standardised regression coefficient of the changes in hypothesized mediator and changes in Identity health; c' = standardised regression coefficient of Motor competence predicting Identity health with adjustment for mediator

Discussion

Among adolescents, the impact of motor competence on identity is influenced by a number of self-perception domains. When the sample was separated into gender and level of motor competence clearer differences emerged. Although no self-perception domains significantly mediated the relationship for males and females, males' perceptions of close friendships and global self-worth improved the association between motor competence and identity health. Physical appearance and global self-worth were significant mediators for the HMC group with social competence and behavioural conduct showing a positive relationship between motor competence and identity health. Although, not significant, only close friendships played a role among those with low motor competence. Some of these results are surprising and could be explained in a number of ways.

Looking presentable and being satisfied with one's body (physical appearance domain) was a mediator on identity health for those with HMC as feeling attractive may be affected by level of fitness and participation in physical activity and sports as these are based on an individual's body satisfaction (Harter, 2012a). Body satisfaction is often based on an individual's ability to build muscle bulk (males) and be toned and slim (females; Harter, 2012a; Perry & Pauletti, 2011). During adolescence, achieving these ideal body types often results from motor skill competence and partaking in physical activities to achieve their desired appearance. This may lead to a more positive sense of self and identity as those who feel good inside (Goth et al., 2012) are more likely to portray their physical attractiveness towards others (Harter, 2012a). Cheng and Furnham (2002) found happiness was positively associated with physical appearance,

athletic and romantic relationships. Similarly, romantic appeal refers to being romantically interested, feeling attractive, and enjoying dating (Harter, 2012b) which was important for the overall sample in this study. Kerpelman et al. (2012) found that regardless of an adolescent's relationship status (in a romantic relationship or not having a history of dating) they valued intimacy as important for their identity health during this phase.

Social competence showed a mediating effect for the overall sample and also showed a notable association for the HMC group. This domain may be closely related to the benefits of being physically active and level of motor competence as popularity and feeling socially accepted during adolescence is often influenced by participating in age appropriate activities such as team sports (Ullrich-French & Smith, 2009; Wilson et al., 2013) or school dances. Ryska (2003) found that high school sport participation lead to the development of positive socialization habits and higher perceived competence in other domains such as scholastic competence, behavioural conduct, physical appearance and a healthy self-concept. The feeling of being socially competent may contribute to the development of a healthy identity as peer support develops a sense of belonging (Goth et al., 2012) and confidence within the self (Harter, 2012a). Similarly, Doumen and colleagues (2012) found positive friendships related to a healthier identity compared to those with a more diffused (less healthy) identity which was associated more with loneliness. The importance of forming relationships through play from childhood to adolescence assists in the development of emotional, social and cognitive skills which contributes to self-identity (Raburu, 2015).

Close friendships was an important mediator overall and showed a notable association for males and those with low motor competence. Cheng and Furnham (2002) found peer friendships affected an adolescent's self-reported happiness. Similarly, developing a secure attachment to friendship groups inhibited and reduced loneliness (Doumen et al., 2012). Males tend to socialize, and therefore develop close friendships, through their participation in many physical activities regardless of their motor skill competence (Cairney et al., 2005; Cairney et al., 2013) to a greater degree than females. Vedul-Khelsas and colleagues (2012) found physical fitness and motor competence among 11-to 12-year-olds was positively correlated towards their perception of social competence, athletic competence and physical appearance and general self-worth.

Interestingly, close friendships was important for the low but not the HMC group. This may indicate those with LMC place greater importance on developing close friends, as many face greater social-emotional difficulties (social isolation, peer victimization; (Payne et al., 2013) and internalizing symptoms (Cairney et al., 2013). Brewer and Gardner (1996) suggest adolescents who are viewed as different are often excluded from valuable group experiences. Lower social support may also be a consequence of less physical play (Cairney et al., 2013) and greater participation in leisure activities such as watching television. Skinner and Piek (2001) found those with LMC often withdraw from social situations to preserve their self-esteem. Interviews with adolescents with LMC revealed that supportive environments, including transport and supportive parents encouraged physical activity participation (Barnett et al., 2013). Social support has been shown to improve school performance as peers clarify classroom instructions (Payne et al., 2013) and valued peers provided a sense of

belonging which empowered their sense of self (Lingam et al., 2013), leading to a healthier identity.

Global self-worth was a significant mediator for those with high motor competence, with an association also occurring among males. Global self-worth is described as feeling good and happy, liking personal life goals and outcomes (Harter, 2012b). This may have occurred among these groups as participation in physical activities is valued and their high level of motor competence made them feel content (Goth et al., 2012; Harter, 2012a). Studies have shown that adolescents with LMC experienced less autonomous motivation for sports and lower levels of Global self-worth compared to those with HMC (Bardid et al., 2016; Labbrozzi et al., 2013). For males, greater involvement in physical activities may contribute to the health of their identity as they experience greater social acceptance (Ullrich-French & Smith, 2009) which guides their global self-worth (Harter, 2012a). Similarly, among 14-year-olds, Rose and colleagues (Rose et al., 2015) found that as males' motor competence level improved, so did their perceived global self-worth, athletic competence and physical appearance, compared to females.

The self–perception domain of behavioural conduct refers to the ability to avoid trouble making, feeling good about individual actions and doing the right thing (Harter, 2012b). Although this was not a significant mediator, behavioral conduct was associated with motor competence and identity health for those with high motor competence. Perceptions of ones' ability to behave well may affect identity health for this group through the ease of participating in social situations such as the ability to read social cues and respecting significant others (Goth et al., 2012), including their parents

(McLean & Jennings, 2012) which helps to develop lasting relationships. Ryska (2003) found young athletes with high levels of task motivation positively predicted other self-perception domains such as behavioural conduct. Therefore adolescents who are involved in physical activities and sports may feel they display good behaviour due to their ability to participate, which enhances their self-esteem and sense of identity (Goth et al., 2012; Harter, 2012a). Similarly, those with HMC may also learn sportsmanship, confliction resolution and how to win and lose graciously which has taught them how to behave appropriately in other settings.

No self-perception domains were significant mediators for the females. It was surprising that close friendships did not mediate a female's identity health as they often experienced higher levels of happiness from their friendships compared to males (Cheng & Furnham, 2002; Rose et al., 2011). A females' perceived peer support was mediated by their self-evaluations, depressive symptoms, social anxiety and social avoidance, compared to males perceived peer support which was mediated by social avoidance (Bédard, Bouffard, & Pansu, 2014). However, this finding could be from the lack of importance females place on their motor competence as only individual self-perceptions of athletic competence (p <.001) and close friendships (p = .043) influenced a females motor competence (Table 3). Females may place greater importance on other areas such as self-image, as they often develop a more complex identity through establishing themselves into a large number of settings (Harter, 2012b). Today, social media usage among females relates to higher appearance-related feedback, body dissatisfaction, emotional symptoms and self-preservation compared to males (de Vries, Peter, de Graaf, & Nikken, 2016) which may help to explain why no significant mediators emerged for females. During adolescence, females physical activity levels also often declines

(Bédard et al., 2014) as females receive similar health benefits from less vigorous and intense physical activity compared to males (Hands et al., 2016). This may lead to females devaluing their motor competence level when it comes to their sense of identity.

Limitations and recommendations for future research

The sample size was adequate, although generalization to the broader Australian population is not possible due to recruitment difficulties. Participants were drawn from a range of sources. As expected, significant differences in motor competence scores for those recruited through sporting clubs (M = 91.75, SD = 6.95) compared to those recruited elsewhere (M = 82.18, SD = 12.57; t (138.15) = 6.08, p <.001) occurred. This latter group comprised adolescents from the community and attending a movement clinic. One consequence was fewer females participated in the study, which may have affected the findings. Hardcopy and online questionnaires had to be used to reach an adequate sample, although no significant differences between hardcopy and online versions were found. A number of methods exist for testing mediation such as regression coefficients or Structural Equation Modelling. Simple mediation using regression coefficients was used in the current study to accommodate for multiple comparisons.

Although studies have examined motor competence, self-perceptions and identity independently, this is the first study to examine these three variables. This is a strength of this study as clear associations for different mediators were seen among males, HMC and LMC groups. This study demonstrates the importance individual self-perceptions can have on identity. Further longitudinal studies would benefit the

understanding of how self-perceptions mediate motor competence and identity across adolescence, which may allow further gender differences to be explored.

Conclusions

Motor competence and identity health are mediated by a number of self-perception domains which differ according to an adolescent's level motor competence and gender. Those with HMC had the most self-perception domains that influenced their identity. Close friendships appear important for those with LMC and males, whilst Global self-worth was important for HMC group and males. No associations were found for adolescent females in this sample which could indicate that the health of their identity may form through different experiences. These results are important to raise awareness about the how self-perceptions may impact the health of identity, particularly among those with lower motor competence. These findings suggest that movement based interventions should consider the development of positive self-perceptions using strategies focused on particular domains identified in this study. For example, those with HMC could participate in physical activity programs that focus on skill development and forming close friendships during physical activity participation.

Declarations

Abbreviations

APA; American Psychiatric Association; DCD; Developmental Coordination Disorder; AMCQ; Adolescent motor competence questionnaire; SPPA; Self Perception Profile for Adolescents; AIDA: Assessment of Identity Development in Adolescents

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Consent for publication

Not applicable.

Availability of Data and Material

The dataset analysed during the current study can be made available from the corresponding author on reasonable request and with permission of BH.

Authors' contributions

AT drafted the report, FM, ER and BH participated in the statistical analyses, interpretation and report revisions. All the authors approved the final version and agreed to be accountable for the study.

Ethical approval and consent to participate

This project was approved by the Human Research Ethics Committee of the University of Notre Dame in Perth, Western Australia. Written informed consent was obtained from all the participants.

Competing interests

The authors declare that they have no competing interests

CHAPTER EIGHT: Discussion & conclusions

Future planning and feeling supported

'Some of them do, my best friend we have quite similar goals because we are in a lot of the same classes because we are quite smart, so we both want to get into university, she is looking at getting into physiotherapy as well, but some of the other friends want to be like actors and that sort of thing so it is quite different.'

(15 year-old HMC female)

In this chapter the key findings from the primary research studies are examined in light of the conceptual model and explained by both the quantitative and qualitative results. The strengths and limitations of the studies are noted. The chapter concludes with a number of recommendations for parents, health practitioners and teachers, knowledge translation and future research.

Overall there were five key objectives to this study. The first objective involved the development and evaluation of a self-report motor assessment for adolescents aged between 12-to 18-years (Chapter 3). Before identity health could be examined, a cultural adaption of the AIDA was completed (Chapter 4). These first two stages allowed for the primary research question: *Does identity health differ between those with high and low motor competence?* to be examined in Chapter 5. Finally, additional psychosocial factors such as parent awareness of adolescent motor competence (Chapter 6) and self-perceptions (Chapter 7) were examined to see if they further explained the relationship between level of motor competence and identity health (Figure 8.1).

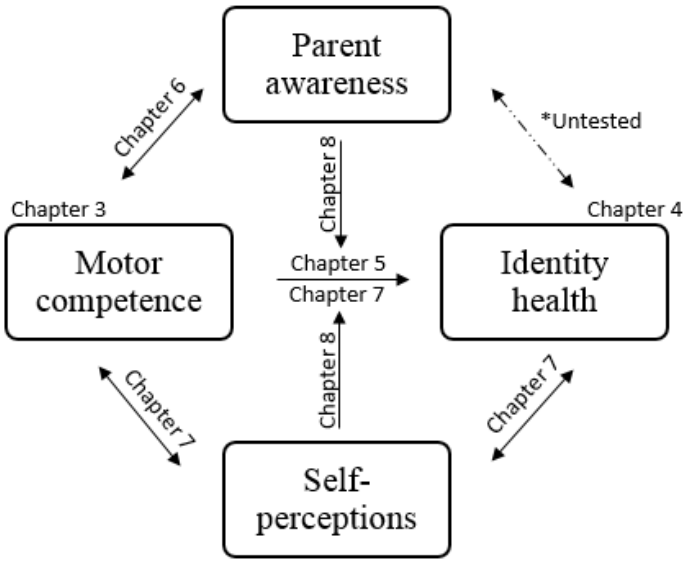


Figure 8.1. The who.i.am motor competence framework and relevant chapters

Note: The results from Chapter 5 consist of Adolescents' interviews and Adolescents' questionnaire responses (AMCQ, AIDA). The results from Chapter 6 are explained by the Adolescents' perceived motor competence (AMCQ) and Parents' awareness (DCDQ'07). The results from Chapter 7 are explained by a mediation model and the Adolescents' questionnaire responses (SPPA, AMCQ, AIDA). All components of the conceptual framework have also considered gender differences.

Key findings

1. Self-report questionnaires are important during adolescence as they provide adolescents with an opportunity to report on their own motor abilities. Self-report may be a more sensitive measure of motor competence during adolescence than parent report (Chapter 3). A parent's awareness of motor competence level in their adolescent was not always congruent with their child's perceived motor competence, in particular many parents were unaware of LMC in their daughters (Chapter 6).

2. Proportionately more females self-identified with LMC compared to the widely accepted male:female ratio of 2:1 reported in the literature. This is important as it raises questions about the accuracy of other measures but also the potential for gender bias (Chapter 3).

3. An adolescent's level of motor competence influences a number of personal factors including the health of their identity. Those with HMC formed healthier identities compared to those with LMC, several reasons were their ability to participate in a range of sporting activities and develop large social networks. Key factors influencing a poorer identity health in those with LMC were their reduced peer support and the greater focus placed on academic achievements rather than sports participation (Chapter 5).

4. Males and females view their level of motor competence differently. Males responded positively to their ability to be involved in physical activities and sports regardless of their motor competence as measured by the AMCQ compared to the females (Chapter 3). On the other hand females' perceptions of motor competence were related to aspects of ADLs.

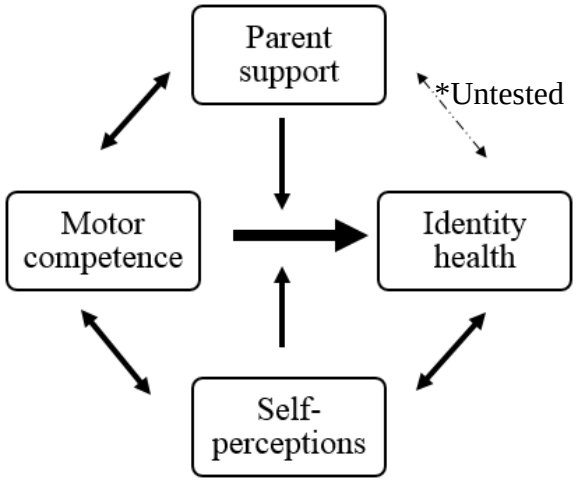
5. Identity health differed between males and females. Males, regardless of motor competence, had healthier identities, as measured by the AIDA, compared to females, particularly those with LMC. In this study, based on the AIDA scores and interviews the most at risk group was the females with LMC (Chapter 5). Again, this finding differs from previous research.

6. Self-perceptions in several domains mediated the relationship between an adolescent's motor competence and the health of their identity (Chapter 7). The self-

perceptions of the HMC group regarding their physical appearance and global self-worth mediated their identity health. Although not significant, notable relationships were seen between their perceptions of athletic competence, social competence, and behavioural conduct towards their identity health. The strength of self–perceptions across a range of domains did not affect the relationship between motor competence and identity health for the LMC group, although close friendships did appear to ameliorate the negative influence of LMC on their identity health. This was also reported during the interviews. In addition, for the males, perceptions of close friendships and global self-worth were important for their identity health. No self-perceptions mediated this relationship for the females.

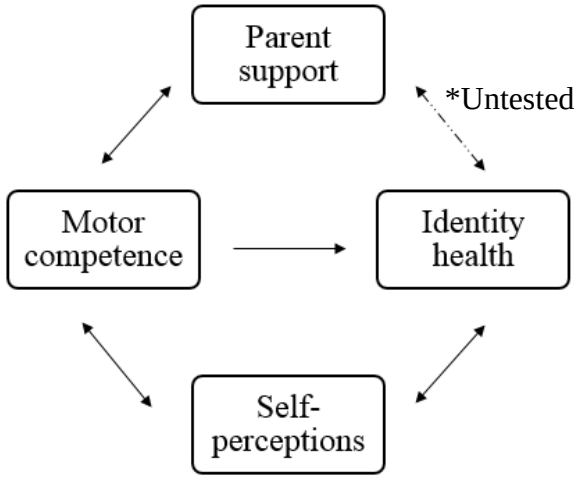
General summary and conceptual framework

To summarise the overall findings of the study, the who.i.am motor competence framework (Figures 8.2 to 8.5) was revisited to represent the influence between each of the four factors (Parent support, Motor competence, Self-perceptions and Identity health) for males (Figure 8.2), females (Figure 8.3), HMC (Figure 8.4) and LMC (Figure 8.5) groups. The lines between the four factors are bolded if the relationship between variables was strengthened. Further exploration of the conceptual framework was not undertaken for LMC males, HMC males, LMC females and HMC females due to the small sample size within these sub-groups



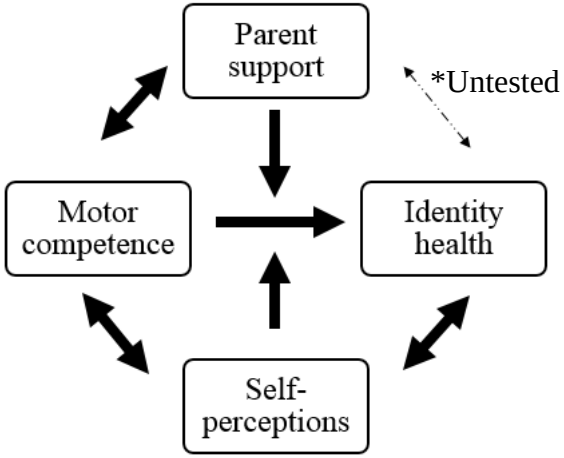
1. Motor Competence (MC) was related to Identity health (IH)
2. Parents were aware of motor competence
3. Perceptions of close friendships and global self-worth mediated relationship btw MC and IH

Figure 8.2. Males (n = 103) who.i.am motor competence framework



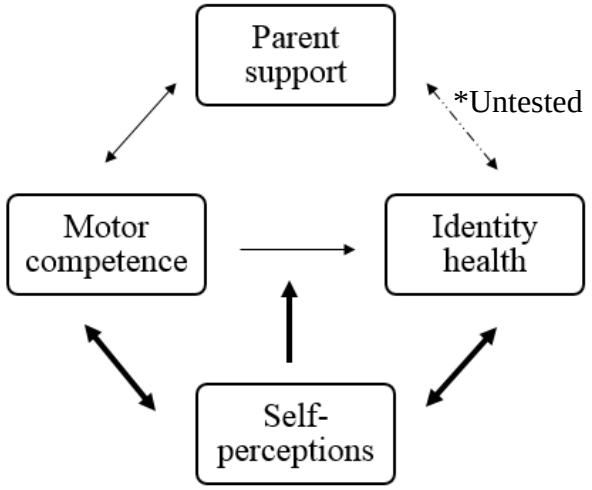
1. Level of MC was not related to IH
2. Parents were less aware of MC
3. No self-perceptions mediated the relationship btw MC and IH

Figure 8.3. Females (n = 57) who.i.am motor competence framework



1. Higher MC related to Higher IH
2. Parents were aware of MC
3. Perceptions of close friendships, physical appearance and global self-worth mediated

Figure 8.4. High motor competence group (n = 108) who.i.am motor competence framework



1. Lower MC was related to lower IH
2. Parents were less aware of LMC
3. Perceptions of close friendships mediated the relationship btw MC and IH health

Figure 8.5. Low motor competence group (n = 52) who.i.am motor competence framework

Gender

The relationship between an adolescent's level of motor competence and identity health Differed between males and females.

Males

A male's level of motor competence was strongly associated with the health of their identity (Figure 8.1), in particular they felt the quality of their public performance of physical activities and sport, and subsequent peer comparisons were influential (Chapter 3). In other studies, males reported enjoying participating in vigorous-ball related physical activities that showcased their strength, speed and endurance (Byrd-Craven & Geary, 2007) and also placed importance on competing, winning and hanging out with their friends (Hands et al., 2015). Similarities in parent and son identification of their level of motor competence were also found (Chapter 6). Parents may be more aware of motor competence levels among their sons as they may place higher expectations on boys' competency in physical tasks and sports participation compared to girls (Fredricks & Eccles, 2005). Parent may also encourage their sons to participate in more sports and physical activities compared to their daughters.

Interviews with the male participants revealed most enjoyed sports participation, formed large social networks and were relaxed within their school setting (Chapter 5). Small relationships were seen between male's self-perceptions of close friendships and global self-worth which improved their identity health (Chapter 7). Males, more than females, tend to base their self-concept on the quality of their physical activity participation (Tatlow-Golden

& Guerin, 2017) and also perceive higher global self-worth compared to females (Rose et al., 2011).

Females

No relationships between one variable to another improved among any of the four factors (Parent support, Motor competence, Self-perceptions and Identity health) for females (Figure 8.2). Female perceptions of motor competence were more related to aspects of daily living (Chapter 3) rather than physical activity. It was also apparent that parents of females were less likely to be aware of LMC in their daughters (Chapter 6). Interviews with the girls revealed that close friends with whom they could talk with were important influences on their identity (Chapter 5) and as their motor competence increased they had more positive perceptions of their close friendships which contributed to a healthier identity (Chapter 7). Previous research has also found that females value close friendships, physical appearance, self-image and emotional support more (including support from their parents) than males (Harter, 21012a; Kilpatrick et al., 2005; Rose et al., 2011; Tatlow-Golden & Guerin, 2017).

Harter (1999) describes the development of a healthy identity as more complex for females as many attempt to establish themselves in a greater number of settings, such as various social groups, activities ranging from sports and physical activity to sedentary activities such as shopping, fashion and arts and crafts compared to males (Harter 2012a). Those females interviewed revealed that school experiences and planning for the future were important, but also caused additional pressure and stress (Chapter 5). Other studies have also found that females experience greater fluctuations in their emotional thoughts

(Harter, 2012a; Oyserman et al., 2012) and report higher school based anxiety during adolescence (Brinthaupt & Lipka, 2002). Today, females report higher social media usage compared to males, which may cause them to experience poor sleeping patterns, increased daily stress, lower self-image, (Thompson & Leugneed, 2012), increased depressive symptoms (Blomfield Neira & Barber, 2014), attract negative feedback from peers and greater body dissatisfaction (de Vries et al., 2016). Overall the health of male and female identities are heavily influenced by their social activities (including sports participation), peer support (Blomfield et al., 2014; Tatlow-Golden & Guerin, 2017), parents awareness of their motor competence and their perceived and actual levels of motor competence.

Motor competence

Comparing and interpreting measures of motor competence can be difficult given the range and type of test items (gross motor, fine motor, locomotion, object control, balance, ADLs and functional skills; Wright, 1997), and measures (questionnaire, field based test, clinical test). The higher ratio of females self-reporting with LMC in this study may indicate that a gender bias that favours the males exists in the selection of test items comprising many motor assessments, (Hands & Larkin, 1997) or the tasks are not developmentally appropriate for adolescents (Hands et al., 2015). Kirby and colleagues (2010) recommend the assessment procedure for motor skill competence should follow a stepwise process (http://www.eacd.org/publications.php; Barnett, Hill, Kirby, & Sugden, 2015) such as the completion of a questionnaire and then a clinical test [BOT-2

(Bruininks & Bruininks, 2005), MABC- 2 (Henderson et al., 2007) or MAND (McCarron, 1997)]. Questionnaires are an ideal first step in the assessment process to screen for suspected motor difficulties which may then lead to further testing and a diagnosis of DCD. Questionnaires are also useful to identify level of motor competence in larger samples as they are relatively cheap to print and distribute, do not require a trained professional to administer and can include elements such as ADLs that are difficult to capture in clinical assessments (Missiuna et al., 2008; Zwicker, Missiuna, Harris, & Boyd, 2012).

The AMCQ provides adolescents with an opportunity to report their perceived motor competence (Chapter 3) as a parent's perceptions of their child's motor competence is not always accurate nor comprehensive (Chapter 6). The evaluation of the AMCQ indicates that it may be a more sensitive measure of adolescent motor competence, especially for females. The responses to the AMCQ revealed more female adolescents self-reported LMC compared to males in the sample (Chapter 3). This finding was surprising as it is different from the male:female ratio of 2:1 which is widely reported (APA, 2013, Cairney et al., 2013; Rivard, Missiuna, McCauley, & Cairney, 2014).

Motor difficulties are often easier to observe among males due to their tendency to participate in more physical activities compared to females (Brown & Lane, 2014; Fredricks & Eccles, 2005). Females' motor difficulties may be less noticeable as they tend to participate in more sedentary, less competitive activities such as socializing, chatting, going to the movies and developing close friendships (Tatlow-Golden & Guerin, 2015). Therefore providing adolescents with a self-report questionnaire such as the AMCQ may provide

them with an opportunity to voice their perceptions of their level of motor competence. The completion of parent questionnaires (DCDQ'07; Wilson et al., 2009), older adolescent and adult (FDQ-9; Clark et al., 2013; ADC; Kirby et al., 2010; AAC-Q; Tal-Saban et al., 2012) may not capture the essence of issues surrounding levels of motor competence during this developmental phase, as they may not be aware of many aspects of their adolescent's motor proficiency, nor place importance towards motor competency the same way as these adolescents would.

HMC adolescents

The relationship between the four factors comprising the who.i.am framework (Motor competence, Self-perceptions, Parent support and Identity health) were strongest for the HMC group as they had higher motor competence and healthier identities (Figure 8.3). This finding is not surprising as the HMC adolescents participated in a greater range of age appropriate activities such as team sports (Chapters 3), their parents were aware of their level of motor competence (Chapter 6), and they had high self-perception about their physical appearance and global self-worth (Chapter 7). Their self-perceptions of social competence, athletic competence, and behavioural conduct, although not statistically significant in the mediation analysis, also showed notable improvements towards their level of motor competence and identity health. Rose et al. (2015) also found HMC to be a protective factor for positive psychosocial health, as those with higher motor competence had higher self-perceptions across a number of domains such as global self-worth, athletic competence, physical appearance, close friendships, social acceptance and romantic appeal than those

with lower motor competence. Interviews with the HMC adolescents revealed they had strong social support and sense of belonging, a positive sense of self and were confident that they were on track to achieve their future goals (Chapter 5). In other studies, strong social support (Doumen et al., 2012), good emotional (Berzonsky 1992; Klimstra et al., 2010) and psychological well-being (Phillips & Pittman, 2007; Vleioras, & Bosma, 2005) and a sense of belonging to a sporting team or club (Ryska, 2003) were also found to influence the development of a healthy identity during adolescence. These factors were reported by the HMC group, but not by the LMC group.

LMC adolescents

The negative impact of LMC on identity health was ameliorated among those with close friendships (Figure 8.4; Chapter 5, Chapter 7). This was confirmed in the interviews with the LMC group, who reported that if they had support from their peers, they were happier and more likely to cope with daily stressors. This finding is similar to Lingam et al. (2013), who found a sense of belonging was improved for those with LMC if they had positive social support from their peers. Interviews with this group revealed that they experienced some personal emotional fluctuations, so preferred structured routines and often had smaller friendship circles. They were more likely to value their academic achievements (Chapter 5) as they did not experience many sporting achievements. Gagnon- and colleagues (2016) also found that the social participation of teenagers and young adults with LMC was mainly based around school. If their attempts to develop interpersonal relationships were unsuccessful, secondary emotional problems such as mental health difficulties may emerge. During adolescence

those who experience additional stressors (including academic pressure) may develop negative coping strategies such as wishful thinking, diffusion of a stressful event by using distractions to reduce tension (Berzonsky, 1992), or simply avoid social situations (Bosch & Card, 2012). Those with LMC often hesitate trying new activities due to the fear of failure (Fitzpatrick & Watkinson, 2003). Some develop coping strategies such as using humour (Fitzpatrick & Watkinson, 2003) or volunteer for less active roles such as team manager or score keeper in order to avoid publically exposing their physical awkwardness (Fitzpatrick & Watkinson, 2003). Interviews with the LMC group in this study revealed that they would avoid stressful situations by arranging to complete their homework straight after school or escape reality with a good book. Many adults diagnosed with DCD continue to experience difficulties in executive functions (Tal-Saban, Ornoy, & Parush, 2014a), ADLs, changes in daily routines and social interactions and engagements (Purcell et al., 2015).

Parents may be unaware that their adolescent has LMC (Chapter 6). Payne et al. (2013) also interviewed adolescents diagnosed with DCD who felt their parents were frustrated by their motor difficulties, and that their mother was more understanding than their father, especially for the males (Payne et al., 2013). It appears that LMC is more likely to be recognised by parents of males than females (Brown & Lane, 2014). This could be related to the higher value placed on physical prowess for males compared to females (Fredricks & Eccles, 2005) and the opportunities that are provided for them to be involved in sports and physical activity (Barnett et al., 2013). Many adolescents, particularly females with LMC, may not make their parents aware of their motor difficulties

in order to preserve their sense of self-worth (Skinner & Piek, 2001) and even prevent their parents from over assisting or interfering to an extent that may worsen their school or social situations (Missiuna et al., 2006).

Those interviewed with LMC experienced less social support. As a result, they only attended occasional social events and participated in physical activities if they were personally valued or in a supportive environment such as non-competitive sports or fitness programs (Chapter 7). The additional environmental stressors experienced by this group can contribute to a downward spiral resulting in lower peer acceptance. Many feel inhibited from engaging in physical activity which is a primary mode of peer participation during adolescence (Cairney et al., 2013), and also experience lower self-perceptions of athletic competence, social competence, global self-worth, scholastic competence and close friendships (Bardid et al., 2016; Hill et al., 2011; Rose et al., 2015; Skinner & Piek, 2001). Lower levels of social support during adolescence may impact their identity health and employment status later in life which then leads to a lower sense of wellbeing during adulthood (Kirby et al., 2013). Social support for LMC adolescents may improve if they form a friendship network which provides a sense of belonging (Lingam et al., 2013), receive encouragement from parents and teachers (Payne et al., 2013), and find a supportive exercise environment (Barnett et al., 2013)

To summarise, the HMC group and the males developed healthier identities compared to those with LMC and the females. These differences were largely driven by physical activity and sports participation and social support. In the next section, differences between males with HMC and LMC and females with HMC and LMC are examined.

Gender and motor competence

When examined independently, differences were also found between males and females within the HMC and the LMC groups.

Males and females with HMC

Males with HMC had the healthiest identities of all four groups (Females with HMC, and males and females with LMC). This appears to be related to their large social support networks and high level of participation in many team-based sports (Chapter 5). This is supported by findings from a number of studies that found during adolescence a male's social support is largely dependent on their enjoyment and participation in physical activities (Byrd-Craven & Geary, 2007; Cairney et al., 2005; Hands et al., 2012; Okely et al., 2001; Ullrich-French & Smith, 2009). Similarly, it appears that participation in team or individual sports among females with HMC (although moderately lower than males) also contributed to their identity health (Chapter 5). Physical activity participation (organised and informal) often declines during adolescence, particularly for females (Okely et al., 2001), and only those more capable continue to participate (Barnett et al., 2013). This may be due to a female's preference to participate in other less active and competitive activities revolving around their self-image such as doing their hair or make-up (Harter, 2012a; Mehta & Strough, 2010).

Overall, the parents of the HMC males and females reported a similar level of motor competence for their child (Chapter 6). These parents may have high regard for socio-environmental factors such as their behaviour towards involvement

in physical activity which is reflected on their child's participation (Barnett et al., 2013). This group participated in a wide range of activities including informal physical activities such as bike riding and many competitive sports (Chapter 5). Their stronger self-perceptions of physical appearance and global self-worth also contributed to their identity health (Chapter 7). It is possible that positive perceptions of athletic competence, behavioural conduct and social competence may also improve their identity health (Chapter 7). Others have also reported that HMC (Gallahue & Ozmun, 2006; Hands & Larkin, 2002), and feelings of self-confidence (Goth et al., 2012; Harter, 2012a) increases resiliency skills and positive socialisation (Zimmerman et al., 2013).

Males and females with LMC

In this study, males with LMC reported a similar level of identity health to females with HMC. The interviews with the LMC males revealed that those who experienced a more positive sense of self, participated in many social opportunities and had open communication with their parents (Chapter 5). In Western cultures great importance is placed on our sporting heroes and ability to participate in sports (Angelini, 2008), which probably impacts on the identity health of many males. The male interviewees with LMC stated that they still found ways to be involved in physical activities by adopting roles such as refereeing. This was also reported by Cairney et al. (2012) who found boys with LMC participated in more active play than females with LMC. This may be a result of the physical activity opportunities presented to males compared to females. Some, however, devalued the importance of motor competence, also reported by Crocker and Major (1989), and placed greater focus

on other areas such as academic achievements. This group identified that close friendships were most important for positive identity health (Chapter 7). Some LMC males were engaged in positive socialisation through non–competitive sporting activities such as skateboarding or playing outdoors with friends however others who were not able to become involved in these socially desirable activities prided themselves on their academic ability.

Females with LMC had the least healthy identities compared to the other three groups which can be explained by a number of interesting findings from this thesis. For example, the interviews with this group revealed parent support was very important (Chapter 5), however many parents did not recognise low motor skills and the impact this had on their daughters (Chapter 6). This may have contributed to some confusion and a lack of coherence between their sense of self and identity (Cantell, 1998; Goth et al., 2012) and resulted in less open and honest communication with parents or significant others (Brewer, 1991).

Although close friendships were identified as important for identity health among those with LMC (Chapter 7), the interviews with the LMC females revealed that they experienced more fragmented friendships which lead too many realising they needed to develop new social networks (Chapter 6). This added stress was also identified by Casement et al. (2014) who reported that girls who experienced challenges in developing social relationships during late childhood were at a higher risk of developing depressive symptoms at 16 years of age. Similarly, Viholainen and colleagues (2014) found that lower motor competence in adolescent females affected their mental health and psychosocial well-being particularly regarding the school-

related areas of math, language and physical education classes. The high importance placed on sports participation in Western cultures (Angelini, 2008) may also partly explain why females with LMC experienced less healthy identities, as unlike any of the males, they were unable to find ways to participate in this socially desirable activity. Overall a higher ratio of females self-reported LMC compared to males in this study than widely reported in the literature. Other studies have identified more males with LMC than females (Cairney et al., 2013; Rivard et al., 2014). This finding needs to be further explored, and could be due to a number of reasons. For example, as noted earlier, some gender bias may exist in items included in other motor competence questionnaires. Alternatively, there may be a higher referral rate of males to health professionals as more parents recognise motor difficulties in males rather than females (Fredricks & Eccles, 2005). Overall the HMC males formed the healthiest identities and the LMC females experienced some unique challenges that affected the health of their identity, especially those related to their social interactions and school experiences.

Based on the results described above, additional factors could be considered in relation to the conceptual model (Figure 8.6). These factors include age, socio-cultural factors, and stress and anxiety. These factors should be considered as identity health may fluctuate between early (12-to14-years), middle (15-to 17-years) and late (18 years and older; Goth et al., 2012), parent support and socio-cultural factors may influence physical ability and level of motor skill competence (Barnett et al., 2015), and lastly stress and anxiety may increase due to an adolescent placing importance on certain domains such as academic or physical activity achievements.

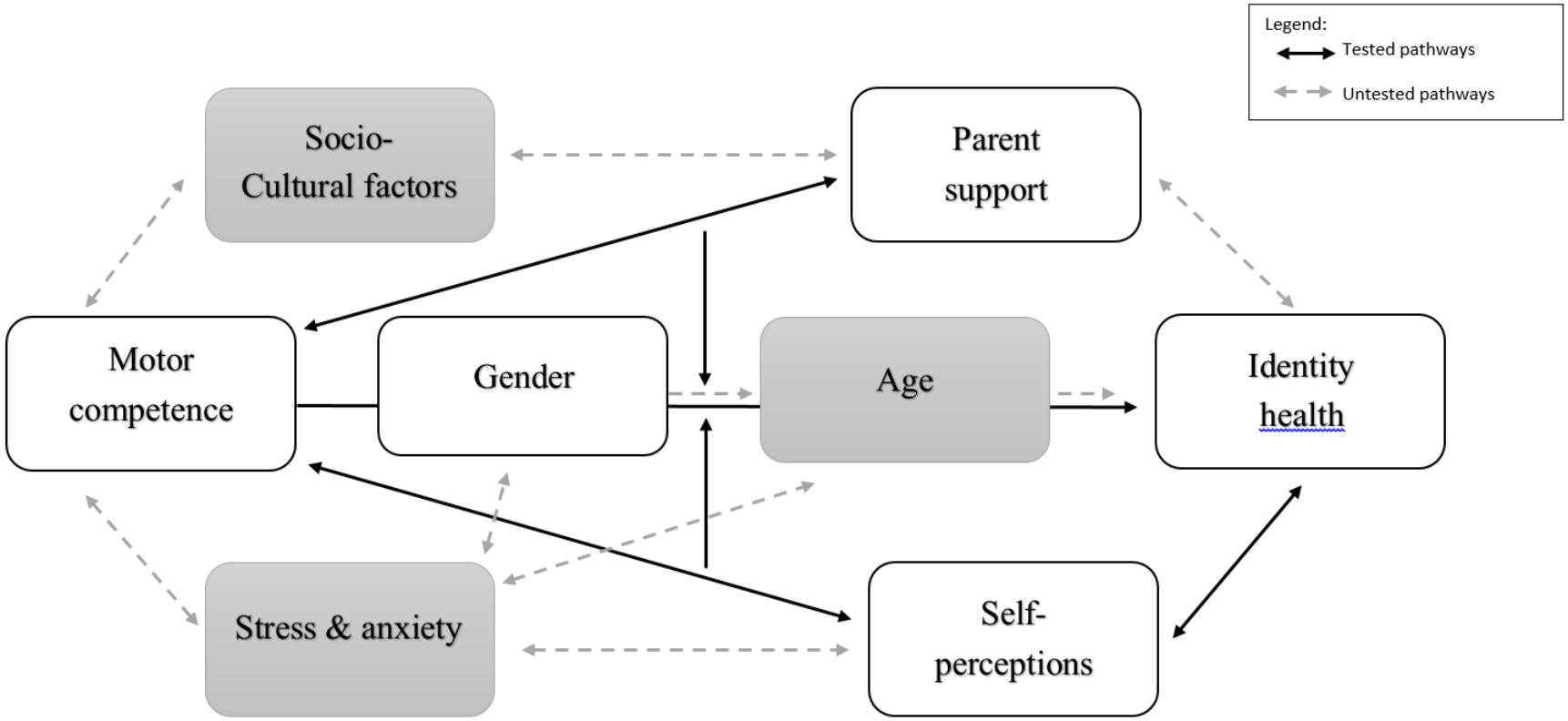


Figure 6. The Who.i.am motor competence framework summary

Conclusions

In conclusion, the findings of this study indicate that level of motor competence influences the health of an adolescents' identity. Those with HMC experienced greater parent awareness and had higher self-perceptions across a range of domains compared to those with LMC. The latter group experienced greater confusion about their identity, and placed higher importance on close friendships. They appear to be at a greater risk of psychosocial issues and a less healthy identity. Further, level of motor competence among males positively influenced the health of their identity but this was not so apparent among females. Females with LMC experienced the greatest challenges regarding the health of their identity. Their lower motor skills, were observed mainly in social and school contexts, but not in their home environments.

The support provided by parents is important, particularly regarding their level of awareness of their son or daughter's motor competence. Finally, positive self-perceptions of social competence, physical appearance, close friendships and global self-worth mediated the impact of motor competence on identity health for the entire sample. The influence of motor competence on identity health between males and females is influenced by their level of motor competence. In this thesis clear gender differences were seen for perceived social support from peers and parents, and the influence of different self-perceptions on the health of their identity.

Strengths

The research project had a number of strengths. First, a new motor competence questionnaire for adolescents (AMCQ) with evidence of content, concurrent and construct validity, and reliability (test-retest, and internal consistency) was developed. This tool is the first questionnaire designed to assess motor competence among 12-to 18-year-olds. Cultural adaptations of the AMCQ are currently being completed in a number of countries. The first has been completed in the Netherlands (Zwiers, Timler, Hands, McIntyre, Crawford, & Cantell, manuscript in preparation). Other countries (Brazil and Iran) are at different stages of the process.

The difference between parent-report and self-report motor competence assessments identified in this thesis raises issues related to assessment in this age group. It highlights the need for further examination of the value of different types of assessments as well as the developmental appropriateness of assessments currently used with this age group. The higher ratio of females compared to males who self-reported LMC requires further exploration. It is possible that a gender bias in current assessments of motor competence may be contributing to the widely reported higher ratio of males. Is the ratio of 2:1 in favour of males with DCD (APA, 2013) really a reflection of the test items?

The interviews completed with adolescents allowed further exploration of the factors influencing identity health between males and females and those with HMC and LMC. Important psychosocial factors impacting the health of an adolescent's identity were identified with differences seen between males and females and motor

competence groups. The interviews provided adolescents with a voice to share how they felt about their identity, especially for the females in this study.

Limitations

Although a sequential mixed methods design was used, a number of limitations were identified. The cross-cultural adaptation of the AIDA was not able to establish evidence of construct validity as the sample did not include a pathological 'clinical borderline personality sample'. Therefore, the use of the AIDA may be a limitation for this study as it was originally designed to measure identity in a clinical sample, which was beyond the scope of this study. The AIDA was used as few measures exist to quantify identity health in adolescents, and the advantage was this tool distinguishes between a healthy and a less healthy identity.

The pathway in the who.i.am motor competence framework between Parent support and Identity health was not examined as this was outside the scope of the study.

A major limitation was the recruitment of a smaller sample size than originally planned. Although a number of recruitment strategies were explored (leisure and sporting clubs and schools), more sporting clubs were approached due to accessibility to this age group, which resulted in more HMC male adolescents participating in the study. A number of government and independent schools and sporting clubs around the Perth metropolitan area were contacted to include a range of participants from different socio-economic backgrounds. Differences in identity health of those participants recruited through schools or sporting clubs were not

examined, as this was not the focus of the study. Unfortunately information about the participant's cultural background was not collected.

The time (35 to 45 minutes) taken to compete all three surveys may have caused response fatigue, poor motivation and affected truthfulness in the self-reported results. Hardcopy and online methods for questionnaire completion were adopted for participant convenience, which may have affected responses, although no significant differences were seen. Participation in the adolescent interviews had a low response rate (4.7%) due to a loss of interest in the study, conflicting extra-curricular schedules or not being able to get to the interview location. Telephone and Skype interviews were offered but only a few agreed to this interviewing method. Only complete parent and adolescent dyads could be used for some analyses (Chapter 7) therefore some cases were excluded from the analyses.

Only the SNAP-IV was used to screen participants with ADHD. Additional screening tools for ASD, cerebral palsy, learning difficulties or muscular dystrophy were not completed by parents. However parents were asked to disclose if their child had one of these conditions in the demographic questions. Participants were excluded if they had an additional neurodevelopmental condition.

Although a smaller sample size than originally planned was recruited, the development of the AMCQ seems to be a reliable measure of perceived motor competence during adolescence. In addition, the interviews provided greater insight into what psychosocial issues adolescence value towards their identity health.

Recommendations for Practice

Parents

- Strategies are needed to educate parents on ways to recognise LMC or associated motor difficulties, especially among their daughters. For example education sessions that focus on building awareness of LMC could help parents identify their child's motor difficulties. Once adolescents have been identified, resources such as flyers, pamphlets, and websites about LMC (and DCD) could assist parents' knowledge about support services and community interventions that are available for those with LMC. These resources could help parents find appropriate activities in which their child could develop social support and friendships.

Health practitioners / Teachers

- Interviews with the LMC adolescents revealed that when teachers were aware of their motor difficulties and willing to provide them with additional support, this helped to improve their school experience. Therefore professional development sessions surrounding recognition of LMC and provision of support within the school environment may assist these students achieve their personal goals. For example, strategies for Physical Education teachers on how to support and encourage those with LMC to participate during allocated class time may increase the likelihood of them developing social support and close friendships

- In addition, building awareness among teachers around the importance of peer-to-peer support for those with LMC could also foster stronger social networks

for these adolescents. This focus on social skills will help these adolescents become better equipped to negotiate social settings within the community such as the work place during adulthood.

Recommendations for future research and knowledge translation

Measures

- Assessment of perceived motor competence among adolescents may be most accurate if using a self-report rather than a parent-report measure. The results from this study suggest that adolescents were more likely to report motor difficulties compared to their parents. This may be because they had an opportunity to self-report their motor difficulties. Therefore the use of self-report rather than parent report motor assessments are important during adolescence.

- It would be useful to continue to gather data on both the AMCQ and the MAND in order to further establish concurrent validity of the AMCQ and, to confirm the primary cut score ($\leq$83 = LMC; Chapter 3) used to distinguish those with LMC.

- Researchers in other countries who request the use of the AMCQ may need to complete a cultural adaptation of the items before using this tool in their research. For example language adjustments or additional examples may need to be included for some items to fit within the cultural context of different countries (For example '*I can ride a bicycle*' was preferred for the Australian

AMCQ whereas '*I can ride a bicycle without using my hands*' was included on the AMCQ-NL as everyone in the Netherlands rides a bicycle). The cultural adaptations of the AMCQ could be collected and made available to other researchers in order to gather information from different countries regarding the level of LMC. This would enable the gathering of international data on self-reported motor competence in this age group.

- Additional research with the AMCQ could further explore differences in responses between males and females. This could be examined using a larger community based sample with an equal number of male and female participants which would allow for a greater depth of understanding as to how the individual AMCQ items may be capturing motor competence during adolescence.

- The AIDA Australia is a tool that can be used for future research in Australia. Additional researchers wanting to use the AIDA Australia could examine its construct validity as this was outside to scope of this study. The AIDA has already been culturally adapted in a number of countries; therefore it would be valuable to compare similarities and differences in identity health across a number of countries.

Future direction for the who.i.am motor competence framework

- As a result of the study, age, stress and anxiety, and socio-cultural factors were identified as possible contributing factors and added to the conceptual model (Figure 8.6).). These warrant further exploration as the sample size did not support a closer examination of differences between early, middle and late

adolescence. However the results suggested that throughout adolescence there were fluctuations in individual identity which often resolved with age. A person's socio-cultural context also appear important to consider as it encompasses individual perceptions and social support, parental involvement and opportunities to be physically active. It is probable that an individual's motor competence may be affected by where they live (urban versus rural), and through cultural experiences and expectations such as beliefs around physical activity levels and engagement. Finally, an adolescent's level of stress and anxiety was influenced by their motor competence, age, and sense of self. Therefore, it is recommended that future studies examining the who.i.am framework should consider these additional factors.

- Further studies examining the factors within the who.i.am framework could be completed. For example, further exploration of gender differences between the HMC males, HMC females, LMC males, and LMC females could be completed as the current sample size was too small for this analysis.

- DCD is often diagnosed alongside other developmental disorders, therefore separating the sample into those with DCD compared to those with another, or multiple diagnoses could help further explore differences in identity health among different groups.

- In addition, the relationship between Parent support and Identity health in the who.i.am framework could be examined. This information would help identify similarities and differences between parent support and strategies used with

adolescents with low or high motor competence. Further research could explore the relationship between both of these factors as they are important for an adolescent's future. Understanding parent support and how it influences the formation of a healthy identity is important to help guide and provide support for adolescents to negotiate future decisions such as employment or occupational pursuits. These factors (Parent support and Identity Health) may also help to highlight some strategies to allow adolescents to develop their own personal autonomy, independence as well as social networks separate from their parents.

- Longitudinal studies examining self-perceptions and identity health could help to track changes over time during the early, middle and late adolescence phases. It may also allow for researchers to examine different age bands as many physical, cognitive and developmental changes occur during different phases of adolescence. This data may be able to identify critical time points during the adolescent phase of development, particularly for at risk groups such as LMC females. Further longitudinal mediation analyses involving self-perceptions could be used to investigate if self-perceptions changed over time.
- Further studies recruiting adolescents could work with other research groups nationally within Australia or internationally to help obtain a larger sample and to check for consistency between findings.

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APPENDIX A: Adolescent Motor Competence Questionnaire

ADOLESCENT MOTOR COMPETENCE QUESTIONNIARE

Full Name:_____ Date: _____

Birthdate:_____ Please circle one: Male / Female

On the following pages you will find statements that could be used to describe your co-ordination. For each statement, please put an X in the box that best describes you. Please answer each statement even if you are not entirely sure of the answer. There are no right or wrong answers, just place an X in the box that describes you best.

	NEVER	SOMETIMES	FREQUENTLY	ALWAYS
1. I CAN THROW A BALL TO HIT A TARGET	☐	☐	☐	☐
2. I PREFER TO PARTICIPATE IN INDIVIDUAL SPORTS (SUCH AS SWIMMING, MARTIAL ARTS, ATHLETICS) RATHER THAN TEAM SPORTS (SUCH AS FOOTBALL AND NETBALL)	☐	☐	☐	☐
3. I PREFER NOT TO PARTICIPATE IN SPORTS AT SCHOOL	☐	☐	☐	☐
4. I CAN KICK A BALL ACCURATELY TO HIT A TARGET (E.G. FOOTBALL OR RUGBY BALL)	☐	☐	☐	☐
5. PEOPLE SAY I AM CLUMSY	☐	☐	☐	☐
6. I CAN RIDE A BICYCLE	☐	☐	☐	☐
7. I FIND IT EASY TO GET READY TO GO OUT (E.G. BRUSH AND STYLE MY HAIR, PUTTING ON MAKEUP, BUTTONING UP SHIRTS)	☐	☐	☐	☐
8. I CAN CATCH A BALL CONSISTENTLY	☐	☐	☐	☐

	NEVER	SOMETIMES	FREQUENTLY	ALWAYS
9. USING A BAT, I CAN HIT A BALL THAT IS THROWN AT ME	☐	☐	☐	☐
10. I WOULD RATHER BE A SPECTATOR THAN PARTICIPATE IN THE SPORTS GAME	☐	☐	☐	☐
11. I CAN USE SCISSORS TO NEATLY CUT OUT A PICTURE FROM A MAGAZINE	☐	☐	☐	☐
12. MY HAND WRITING IS EASY TO READ	☐	☐	☐	☐
13. I AM MORE UN-COORDINATED THAN MY FRIENDS (E.G. I BUMP INTO OBJECTS OR PEOPLE)	☐	☐	☐	☐
14. I FIND IT HARD TO USE A FORK OR A KNIFE WHEN EATING A MEAL	☐	☐	☐	☐
15. I DO NOT THINK I AM CLUMSY	☐	☐	☐	☐
16. I GET CONFUSED BETWEEN MY RIGHT AND MY LEFT SIDES	☐	☐	☐	☐
17. MY HAND WRITING IS FAST ENOUGH TO KEEP UP WITH THE REST OF THE CLASS	☐	☐	☐	☐
18. I GET NERVOUS ABOUT COMING LAST IN A RUNNING RACE	☐	☐	☐	☐
19. I ASK MY FRIENDS AND FAMILY FOR HELP TO COMPLETE ACTIVITIES THAT REQUIRE CO-ORDINATION (E.G. USING A CAN OPENER)	☐	☐	☐	☐
20. I CAN EASILY FLOSS BETWEEN MY TEETH	☐	☐	☐	☐
21. I STUMBLE WHEN GOING UP STAIRS	☐	☐	☐	☐
22. I AM SLOW TO CHANGE MY CLOTHES (E.G. CHANGING INTO SPORTS CLOTHES FOR PHYSICAL EDUCATION CLASSES)	☐	☐	☐	☐
23. I BREAK OBJECTS ACCIDENTLY MORE OFTEN THAN MY FRIENDS	☐	☐	☐	☐

	NEVER	SOMETIMES	FREQUENTLY	ALWAYS
24. I CAN BALANCE ON ONE FOOT FOR AT LEAST 15 SECONDS	☐	☐	☐	☐
25. I FIND IT HARD TO WALK ALONG A NARROW STRAIGHT LINE	☐	☐	☐	☐
26. I HAVE TROUBLE LEARNING NEW OUTDOOR GAMES	☐	☐	☐	☐

PLEASE MAKE SURE YOU HAVE PUT AN ANSWER FOR EVERY QUESTION, THANK YOU ☺

AMCQ-NL:

ADOLESCENT MOTOR COMPETENCE QUESTIONNIARE - NL

Volledige naam:_____ Datum: _____

Geboortedatum:_____ Omcirkel wat van toepassing is: Man / Vrouw

Op de volgende pagina's staan stellingen waarmee je het coördineren van je lichaamsbewegingen zou kunnen beschrijven. Zet bij elke stelling een X in het vakje dat het beste bij jou past. Beantwoord alle stellingen, ook als je niet helemaal zeker bent van het antwoord. Er zijn geen goede of foute antwoorden. Zet gewoon een X in het vakje dat het beste bij jou past.

	NOOIT	SOMS	VAAK	ALTIJD
1. IK KAN EEN BAL GERICHT TEGEN IETS AAN GOOIEN (B.V. MIKKEN OP EEN LANTAARNPAAL)	☐	☐	☐	☐
2. IK DOE LIEVER EEN INDIVIDUELE SPORT (ZOALS ZWEMMEN, VECHTSPORT, ATLETIEK) DAN EEN TEAMSPORT (ZOALS VOETBAL EN VOLLEYBAL)	☐	☐	☐	☐
3. IK DOE OP SCHOOL LIEVER NIET MEE MET SPORT	☐	☐	☐	☐
4. IK KAN EEN BAL GERICHT TEGEN IETS AAN SCHOPPEN (B.V. EEN VOETBAL)	☐	☐	☐	☐
5. ANDERE MENSEN ZEGGEN DAT IK ONHANDIG BEN	☐	☐	☐	☐
6. IK KAN KUNSTJES OP DE FIETS DOEN (B.V. MET LOSSE HANDEN FIETSEN)	☐	☐	☐	☐
7. HET KOST ME WEINIG MOEITE MEZELF TE VERZORGEN ALS IK WEGGA (MIJN HAAR BORSTELEN EN (MET GEL) IN MODEL BRENGEN, MAKE-UP AANBRENGEN, OVERHEMD DICHTKNOPEN)	☐	☐	☐	☐
8. BIJ HET OVERGOOIEN KAN IK DE BAL STEEDS VANGEN	☐	☐	☐	☐

	NOOIT	SOMS	VAAK	ALTIJD
9. IK VIND HET LASTIG OM EEN DUNSCHILLER TE GEBRUIKEN (B.V. BIJ HET SCHILLEN VAN EEN (AARD)APPEL)	☐	☐	☐	☐
10. IK KAN EEN BAL DIE NAAR ME TOE WORDT GEGOOID RAKEN MET EEN KNUPPEL (BIJ SOFTBAL, SLAGBAL)	☐	☐	☐	☐
11. IK KNOEI TIJDENS HET ETEN OP TAFEL OF OP MIJN KLEREN	☐	☐	☐	☐
12. IK KIJK LIEVER TOE DAN DAT IK MEEDOE MET EEN SPORTWEDSTRIJD	☐	☐	☐	☐
13. IK KAN MET EEN SCHAAR NETJES EEN PLAATJE UIT EEN TIJDSCHRIFT KNIPPEN	☐	☐	☐	☐
14. IK WORD SNEL MOE ALS IK LICHAMELIJK ACTIEF BEN	☐	☐	☐	☐
15. MIJN HANDSCHRIFT IS GOED LEESBAAR	☐	☐	☐	☐
16. IK BEN ONHANDIGER DAN MIJN VRIEND(INN)EN (B.V. TEGEN DINGEN OF MENSEN AAN BOTSEN)	☐	☐	☐	☐
17. IK VIND HET LASTIG OM BIJ DE MAALTIJD MET MES EN VORK TE ETEN	☐	☐	☐	☐
18. IK VIND MEZELF NIET ONHANDIG	☐	☐	☐	☐
19. IK HAAL LINKS EN RECHTS DOOR ELKAAR	☐	☐	☐	☐
20. IK KAN SNEL GENOEG SCHRIJVEN OM DE REST VAN DE KLAS BIJ TE HOUDEN	☐	☐	☐	☐
21. BIJ EEN HARDLOOPWEDSTRIJD ZIT IK EROVER IN DAT IK LAATSTE ZOU KUNNEN WORDEN	☐	☐	☐	☐
22. IK VRAAG VRIENDEN EN FAMILIE OM HULP BIJ ACTIVITEITEN WAAR HET COÖRDINEREN VAN BEWEGINGEN VOOR NODIG IS (B.V. EEN BLIKOPENER GEBRUIKEN)	☐	☐	☐	☐
23. IK KAN MAKKELIJK MIJN TANDEN FLOSSEN	☐	☐	☐	☐

	NOOIT	SOMS	VAAK	ALTIJD
24. IK STRUIKEL ALS IK DE TRAP OPLOOP	☐	☐	☐	☐
25. IK BEN LANGZAAM MET OMKLEDEN (B.V. HET AANTREKKEN VAN SPORTKLEDING VOOR DE GYMLES)	☐	☐	☐	☐
26. IK MAAK VAKER PER ONGELUK IETS STUK DAN MIJN VRIEND(INN)EN	☐	☐	☐	☐
27. IK KAN MINSTENS 15 SECONDEN OP ÉÉN BEEN STAAN	☐	☐	☐	☐
28. IK VIND HET LASTIG OM OVER EEN SMALLE, RECHTE LIJN TE LOPEN	☐	☐	☐	☐
29. IN DE GYMLES VIND IK HET MOEILIJK OM EEN NIEUW SPEL TE LEREN SPELEN	☐	☐	☐	☐

CONTROLEER A.U.B. OF JE ALLE VRAGEN HEBT BEANTWOORD, BEDANKT ☺

AMCQ-Brazil:

Questionário para Avaliação da Competência Motora do Adolescente

Nome Completo:_____ Data: _____

Data de Nascimento: _____ Por gentileza marque: M / F

Nas páginas a seguir você encontrará sentenças que poderiam ser usadas para descrever a sua coordenação motora. Para cada sentença, marque um X na caixa que melhor descreve você. Responda a cada sentença, mesmo que não esteja inteiramente certo (a) da resposta. Não há respostas certas ou erradas, basta marcar um X na caixa que melhor te descreve.

	NUNCA	ÀS VEZES	FREQUENTEMENTE	SEMPRE
1. POSSO ARREMESSAR UMA ESFERA PARA ATINGIR UM ALVO	☐	☐	☐	☐
2. PREFIRO PARTICIPAR DE ESPORTES INDIVIDUAIS (COMO NATAÇÃO, ARTES MARCIAIS, ATLETISMO). RARAMENTE PARTICIPO EM EQUIPES (COMO FUTEBOL E NETBALL)	☐	☐	☐	☐
3. PREFIRO NÃO PARTICIPAR DE ESPORTES ESCOLARES	☐	☐	☐	☐
4. POSSO CHUTAR UMA BOLA PARA ATINGIR UM ALVO (EX.: FUTEBOL OU RUGBY)	☐	☐	☐	☐
5. AS PESSOAS DIZEM QUE SOU DESAJEITADO (A)	☐	☐	☐	☐
6. POSSO GUIAR UMA BICICLETA	☐	☐	☐	☐
7. ACHO FÁCIL ME ARRUMAR PARA SAIR (EX: ESCOVAR E ESTILIZAR O CABELO, FAZER MAQUIAGEM, ABOTOAR A CAMISA)	☐	☐	☐	☐
8. POSSO SEGURAR UMA BOLA CONSISTENTEMENTE (FIRME)	☐	☐	☐	☐

-

	NUNCA	ÀS VEZES	FREQUENTEMENTE	SEMPRE
9. USANDO UM BASTÃO, POSSO REBATER UMA BOLA QUE VEM EM MINHA DIREÇÃO	☐	☐	☐	☐
10. PREFIRO ASSISTIR A PARTICIPAR DE JOGOS ESPORTIVOS 11.	☐	☐	☐	☐
12. POSSO USAR UMA TESOURA APENAS PARA CORTAR UMA FIGURA DE UMA REVISTA	☐	☐	☐	☐
13. MINHA CALIGRAFIA É FÁCIL DE LER	☐	☐	☐	☐
14. SOU MAIS DESCOORDENADO (A) DO QUE MEUS AMIGOS (EX: EU ESBARRO EM OBJETOS E NAS PESSOAS)	☐	☐	☐	☐
15. ACHO DIFÍCIL USAR GARFO E FACA PARA FAZER AS REFEIÇÕES.	☐	☐	☐	☐
16. NÃO ME CONSIDERO DESAJEITADO (A)	☐	☐	☐	☐
17. FICO CONFUSO (A) ENTRE MEUS LADOS DIREITO E ESQUERDO	☐	☐	☐	☐
18. MINHA ESCRITA É RÁPIDA O SUFICIENTE PARA ACOMPANHAR O RITMO DE ESCRITA DA SALA	☐	☐	☐	☐
19. FICO NERVOSO (A) SE CHEGO POR ÚLTIMO EM UMA CORRIDA	☐	☐	☐	☐
20. PEÇO AJUDA A AMIGOS E FAMILIARES PARA REALIZAR TAREFAS QUE EXIJAM COORDENAÇÃO MOTORA (EX: USAR UM ABRIDOR DE LATAS)	☐	☐	☐	☐
21. USO COM FACILIDADE O FIO DENTAL	☐	☐	☐	☐
22. TROPEÇO QUANDO SUBO ESCADAS	☐	☐	☐	☐
23. TROCO DE ROUPA DEVAGAR (EX: VESTIR A ROUPA ESPORTIVA PARA AS AULAS DE EDUCAÇÃO FÍSICA)	☐	☐	☐	☐
24. QUEBRO OBJETOS ACIDENTALMENTE COM MAIS FREQUÊNCIA DO QUE MEUS AMIGOS	☐	☐	☐	☐

	NUNCA	ÀS VEZES	FREQUENTEMENTE	SEMPRE
25. POSSO ME EQUILIBRAR EM UM PÉ SÓ POR PELO MENOS 15 SEGUNDOS.	☐	☐	☐	☐
26. ACHO DIFÍCIL ANDAR AO LONGO DE UMA LINHA ESTREITA	☐	☐	☐	☐
27. TENHO PROBLEMAS EM APRENDER NOVOS JOGOS AO AR LIVRE	☐	☐	☐	☐

POR FAVOR CERTIFIQUE-SE QUE RESPONDEU TODAS AS QUESTÕES, OBRIGADO ☺

APPENIX B: Additional Measures

Additional adolescents' questionnaires and interview prompts:

Assessment of Identity Development in Adolescence

AIDA Assessment of Identity Development in Adolescence

On the following pages you will find statements people might use to describe their attitudes, opinions, interests, and other personal feelings. For each statement, please circle one of the following five answers based on how you feel in general. Please answer every statement, even if you are not completely sure of the answer.

Remember, there are no right or wrong answers – just select the choice which best describes how you generally feel. Some statements may seem similar to you; these items should be viewed as an opportunity to describe yourself more fully and accurately.

Name:	Age:	Birthdate:	Sex: ☐male ☐female

	Do you agree with this statement? 0 = No = I strongly disagree 1 = more No = I disagree 2 = part/part = I neither agree or disagree 3 = more Yes = I agree 4 = Yes = I strongly agree	no	more no	part/ part	more yes	yes
1	I have hobbies or interests that have become part of who I am.	0	1	2	3	4
2	I feel at home in my community, this is where I belong.	0	1	2	3	4
3	I often not sure how I feel in a situation (e.g. whether or not I am angry, happy sad, etc.).	0	1	2	3	4
4	I feel that I have different sides of my personality, which do not fit together well.	0	1	2	3	4
5	I could list a few things that I can do very well.	0	1	2	3	4
6	I often don't understand the reason why I did something	0	1	2	3	4
7	It is difficult for me to be together with 2 or 3 friends at the same time, it always causes trouble somehow.	0	1	2	3	4
8	I don't remember how I felt and thought as a child, I am now like a different person.	0	1	2	3	4
9	I often argue with my friends and switch quickly between not being friends and then being friends again.	0	1	2	3	4
10	When I look in the mirror, I am often surprised and don't like how I have changed.	0	1	2	3	4
11	I'm not sure if my friends really like me.	0	1	2	3	4
12	When people see me in new situations, they are very surprised how I can behave.	0	1	2	3	4
13	I often feel lost, as if I had no clear inner self.	0	1	2	3	4
14	Sometimes I feel like a part of me fades away in a friendship because I sacrifice my own needs	0	1	2	3	4
15	Sometimes I feel like a fake, because the way I behave outside doesn't match the way I feel inside.	0	1	2	3	4
16	I get overloaded and stressed quickly when I'm out with a large group of friends.	0	1	2	3	4
17	I can trust my conscious, it usually leads me in the right direction	0	1	2	3	4
18	I feel I don't really belong anywhere.	0	1	2	3	4
19	With many of my friends I fear that they would leave me alone when I need them.	0	1	2	3	4
20	While I'm talking to somebody, I feel very insecure if he does not approve of what I am saying.	0	1	2	3	4
21	Sometimes I feel that my interests are not really "my own", but I have just copied them from other people.	0	1	2	3	4
22	When my friends disagree with my opinion and ideas, I feel humiliated.	0	1	2	3	4

1 / 3

Do you agree with this statement? 0 = No = I strongly disagree 1 = more No = I disagree 2 = part/part = I neither agree or disagree 3 = more Yes = I agree 4 = Yes = I strongly agree		no	more no	part/ part	more yes	yes
23	I feel like I belong in my family.	0	1	2	3	4
24	I make friends with people I do not like, because I can't say no to them.	0	1	2	3	4
25	People tell me that it is difficult to know who I really am	0	1	2	3	4
26	I have a clear idea what kind of future I want for myself.	0	1	2	3	4
27	I'm often not sure whether I am doing the right thing for myself or not.	0	1	2	3	4
28	My parents think that I'm no good for anything.	0	1	2	3	4
29	Sometimes I have very strong emotions for no obvious reason.	0	1	2	3	4
30	I often see my own behaviour very differently from how my friends see it.	0	1	2	3	4
31	I am not the same person in different situations (with teachers, with friends, with strangers, family …) that others hardly recognise me.	0	1	2	3	4
32	I feel empty.	0	1	2	3	4
33	I can imagine, what kind of person I'll be in a few years	0	1	2	3	4
34	I can't help feeling either inferior or superior to other people.	0	1	2	3	4
35	I am confused about what kind of person I really am.	0	1	2	3	4
36	If someone has offended me, I stop talking to them.	0	1	2	3	4
37	Often I am surprised about my own behavior and feelings.	0	1	2	3	4
38	If I am criticized or others see me failing, I feel really worthless and devastated.	0	1	2	3	4
39	I feel comfortable in my body.	0	1	2	3	4
40	My relationships are usually unstable, begin and end abruptly.	0	1	2	3	4
41	I have had very good experiences with listening to my gut (feelings).	0	1	2	3	4
42	When I'm alone I feel helpless.	0	1	2	3	4
43	When I see myself in a mirror, I recognize myself immediately.	0	1	2	3	4
44	I'm afraid that my friends suddenly won't like me anymore and exclude me.	0	1	2	3	4
45	I often feel as if I could be "several people" rather than just one because I have so many different opinions and moods.	0	1	2	3	4
46	I find being along difficult	0	1	2	3	4
47	I often feel that I have many different moods and opinions as though I could be 'several people'.	0	1	2	3	4
48	When others appreciate me because I have succeeded it means the whole world to me	0	1	2	3	4
49	Many people are very "fake" and do not behave the way they really are.	0	1	2	3	4
50	When my mood changes suddenly, I'm totally confused and have difficulties to go back to normal again	0	1	2	3	4
51	I often have a mental blank when I ask myself why I did things.	0	1	2	3	4
52	I often feel disappointed by others, because they weren't the person I thought they would be	0	1	2	3	4
53	I need reassurance from others to not give up.	0	1	2	3	4
54	My friendships usually last only a few months.	0	1	2	3	4
55	I have nothing in common with my classmates.	0	1	2	3	4
56	I feel strong inside me no matter what is happening around me	0	1	2	3	4
57	Others often tell me that I say something but do the opposite, but I don't think I do	0	1	2	3	4
58	I can imagine that I will find my place in the world.	0	1	2	3	4

Please check, if you answered every question. Thank you!

ccc

Please fill out the second part now - Open questions AIDA

1. Please describe yourself as short and accurate as possible, just like you would in a chat or a speed-date.

A) What kind of hobbies or interests do you have, that describe you well? What exactly are you doing and how often? E.g. Reading: every day; football: 2 x week, guitar / dancing / singing 1 x week (watching TV, meeting friends, texting does not apply, unfortunately)

_____
_____
_____
_____

B) Do you feel like belonging to one or more „special groups" to which you really fit e.g. footballer or skater, computer freak, political active, bookworm, musician, artist, horse-lover, religious group, ...

_____
_____
_____

C) Please specify typical attributes of you as a person that could describe you well e.g. brave, animal-loving, posh, ...

_____
_____
_____

---

2. Please describe your best friend / partner in the same way.

A) Does he / she has hobbies or interests that describe him / her well? What exactly and how often? E.g. Reading: every day; football: 2 x week, guitar/ dancing/ singing 1 x week

_____
_____
_____
_____

B) Does he / she feel like belonging to one or more „special groups" to which he / she really fit e.g. footballer or skater, computer freak, political active, bookworm, musician, artist, horse-lover, religious group, ...

_____
_____
_____

C) Please specify typical attributes of him / her as a person that could describe him / her well e.g. brave, animal-loving, posh, ...

_____
_____
_____

Thank you!

ccci

What I Am Like

Name_____ Age____ Birthday _____ ☐ Boy ☐ Girl
Month Day (check one)

	Really True for me	Sort of True for me				Sort of True for me	Really True for me
			Sample Sentence				
a.	☐	☐	Some teenagers like to go to movies in their spare time	**BUT**	Other teenagers would rather go to sports events	☐	☐
1.	☐	☐	Some teenagers feel that they are just as smart as others their age	**BUT**	Other teenagers aren't so sure and wonder if they are as smart	☐	☐
2.	☐	☐	Some teenagers find it hard to make friends	**BUT**	Other teenagers find it pretty easy to make friends	☐	☐
3.	☐	☐	Some teenagers do very well at all kinds of sports	**BUT**	Other teenagers *don't* feel that they are very good when it comes to sports	☐	☐
4.	☐	☐	Some teenagers are *not* happy with the way they look	**BUT**	Other teenagers *are* happy with the way they look	☐	☐
5.	☐	☐	Some teenagers feel that they are ready to do well at a part-time job	**BUT**	Other teenagers feel that they are not quite ready to handle a part-time job	☐	☐
6.	☐	☐	Some teenagers feel that if they are romantically interested in someone, that person will like them back	**BUT**	Other teenagers worry that when they like someone romantically, that person *won't* like them back	☐	☐
7.	☐	☐	Some teenagers usually do the right thing	**BUT**	Other teenagers often don't do what they know is right	☐	☐
8.	☐	☐	Some teenagers are able to make really close friends	**BUT**	Other teenagers find it hard to make really close friends	☐	☐
9.	☐	☐	Some teenagers are often disappointed with themselves	**BUT**	Other teenagers are pretty pleased with themselves	☐	☐

	Really True for me	Sort of True for me				Sort of True for me	Really True for me
10.	☐	☐	Some teenagers are pretty slow in finishing their school work	**BUT**	Other teenagers can do their school work quickly	☐	☐
11.	☐	☐	Some teenagers know how to make classmates like them	**BUT**	Other teenagers don't know how to make classmates like them	☐	☐
12.	☐	☐	Some teenagers think they could do well at just about any new athletic activity	**BUT**	Other teenagers are afraid they might not do well at a new athletic activity	☐	☐
13.	☐	☐	Some teenagers wish their body was different	**BUT**	Other teenagers like their body the way it is	☐	☐
14.	☐	☐	Some teenagers feel that they *don't* have enough skills to do well at a job	**BUT**	Other teenagers feel that they *do* have enough skills to do a job well	☐	☐
15.	☐	☐	Some teenagers are *not* dating the people they are really attracted to	**BUT**	Other teenagers *are* dating those people they are attracted to	☐	☐
16.	☐	☐	Some teenagers often get in trouble because of things they do	**BUT**	Other teenagers usually *don't* do things that get them in trouble	☐	☐
17.	☐	☐	Some teenagers *don't* know how to find a close friend with whom they can share secrets	**BUT**	Other teenagers *do* know how to find a close friend with whom they can share secrets	☐	☐
18.	☐	☐	Some teenagers don't like the way they are leading their life	**BUT**	Other teenagers do like the way they are leading their life	☐	☐
19.	☐	☐	Some teenagers do very well at their classwork	**BUT**	Other teenagers *don't* do very well at their classwork	☐	☐
20.	☐	☐	Some teenagers don't have the social skills to make friends	**BUT**	Other teenagers do have the social skills to make friends	☐	☐
21.	☐	☐	Some teenagers feel that they are better than others their age at sports	**BUT**	Other teenagers don't feel they can play as well	☐	☐
22.	☐	☐	Some teenagers wish their physical appearance was different	**BUT**	Other teenagers like their physical appearance the way it is	☐	☐

	Really True for me	Sort of True for me				Sort of True for me	Really True for me
23.	☐	☐	Some teenagers feel they are old enough to get and keep a paying job	BUT	Other teenagers do not feel that they are old enough, yet, to really handle a job well	☐	☐
24.	☐	☐	Some teenagers feel that people their age will be romantically attracted to them	BUT	Other teenagers worry about whether people their age will be attracted to them	☐	☐
25.	☐	☐	Some teenagers feel really good about the way they act	BUT	Other teenagers *don't* feel that good about the way they often act	☐	☐
26.	☐	☐	Some teenagers *do* know what it takes to develop a close friendship with a peer	BUT	Other teenagers *don't* know what to do to form a close friendship with a peer	☐	☐
27.	☐	☐	Some teenagers are happy with themselves most of the time	BUT	Other teenagers are often not happy with themselves	☐	☐
28.	☐	☐	Some teenagers have trouble figuring out the answers in school	BUT	Other teenagers almost always can figure out the answers	☐	☐
29.	☐	☐	Some teenagers understand how to get peers to accept them	BUT	Other teenagers don't understand how to get peers to accept them	☐	☐
30.	☐	☐	Some teenagers don't do well at new outdoor games	BUT	Other teenagers are good at new games right away	☐	☐
31.	☐	☐	Some teenagers think that they are good looking	BUT	Other teenagers think that they are not very good looking	☐	☐
32.	☐	☐	Some teenagers feel like they could do better at work they do for pay	BUT	Other teenagers feel that they are doing really well at work they do for pay	☐	☐
33.	☐	☐	Some teenagers feel that they are fun and interesting on a date	BUT	Other teenagers wonder about how fun and interesting they are on a date	☐	☐
34.	☐	☐	Some teenagers do things they know they shouldn't do	BUT	Other teenagers hardly ever do things they know they shouldn't do	☐	☐

	Really True for me	Sort of True for me				Sort of True for me	Really True for me
35.	☐	☐	Some teenagers find it hard to make friends they can really trust	**BUT**	Other teenagers *are* able to make close friends they can really trust	☐	☐
36.	☐	☐	Some teenagers like the kind of person they are	**BUT**	Other teenagers often wish they were someone else	☐	☐
37.	☐	☐	Some teenagers feel that they are pretty intelligent	**BUT**	Other teenagers question whether they are intelligent	☐	☐
38.	☐	☐	Some teenagers know how to become popular	**BUT**	Other teenagers do not know how to become popular	☐	☐
39.	☐	☐	Some teenagers do not feel that they are very athletic	**BUT**	Other teenagers feel that they *are* very athletic	☐	☐
40.	☐	☐	Some teenagers really like their looks	**BUT**	Other teenagers wish they looked different	☐	☐
41.	☐	☐	Some teenagers feel that they are really able to handle the work on a paying job	**BUT**	Other teenagers wonder if they are really doing as good a job at work as they should be doing	☐	☐
42.	☐	☐	Some teenagers usually *don't* go out with people they would really like to date	**BUT**	Other teenagers *do* go out with people they really want to date	☐	☐
43.	☐	☐	Some teenagers usually act the way they know they are supposed to	**BUT**	Other teenagers often don't act the way they are supposed to	☐	☐
44.	☐	☐	Some teenagers *don't* understand what they should do to have a friend close enough to share personal thoughts with	**BUT**	Other teenagers *do* understand what to do to have a close friend with whom they can share personal thoughts.	☐	☐
45.	☐	☐	Some teenagers are very happy being the way they are	**BUT**	Other teenagers often wish they were different	☐	☐

Susan Harter, Ph.D., University of Denver, 2012

Adolescents' Interview Prompts:

1. Tell me something about yourself, family and an activity that you like participating in.

2. Think about your day to day life, which adults do you feel comfortable talking to?

3. Do you feel comfortable talking with your friends?

4. Do your friends act differently to the way you feel inside?

5. When you are at school, who do you like to spend most of your time with?

6. When you are not in class, who do you like to spend most of your time with?

7. What type of activities do you like to participate in outside of school?

8. What types of activities motivate you to develop who you are?

9. What type of goals do you set for yourself and have you discussed these with someone?

10. What values and beliefs are important to you?

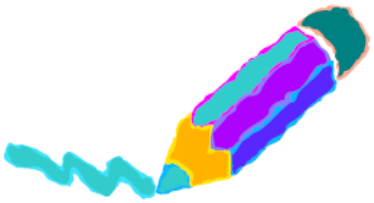
11. Who do you feel is most important to you?

12. Is this statement true to you; I feel like I belong

13. Do you think about the future?

Parent questionnaires:
The Developmental Coordination Disorder Questionnaire, 2007

THE DEVELOPMENTAL COORDINATION DISORDER QUESTIONNAIRE 2007© (DCDQ'07)



Wilson, BN, Kaplan, BJ, Crawford, SG, and Roberts, G
October 2007

Alberta Children's Hospital
Decision Support Research Team
2888 Shaganappi Trail NW
Calgary, Alberta, Canada T3B 6A8
www.calgaryhealthregion.ca/dsrt/dcdq.htm

DSRT calgary health region Alberta Children's Hospital Foundation Faculty of Medicine | University of Calgary

DSRT | calgary health region | Alberta Children's Hospital Foundation | Faculty of Medicine | University of Calgary

COORDINATION QUESTIONNAIRE (REVISED 2007)

	Year	Mon	Day
Today's Date:			
Birth Date:			
Child's Age:			

Name of Child: _____

Person completing Questionnaire: _____

Relationship to child: _____

Most of the motor skills that this questionnaire asks about are things that your child does with his or her hands, or when moving.
A child's coordination may improve each year as they grow and develop. For this reason, it will be easier for you to answer the questions if you think about other children that you know who *are the same age as your child*.
Please compare the degree of coordination your child has with other children of the same age when answering the questions.
Circle the one number that best describes your child. If you change your answer and want to circle another number, please circle the correct response twice.
If you are unclear about the meaning of a question, or about how you would answer a question to best describe your child, please call _____ at _____ for assistance.

	Not at all like your child 1	**A bit like your child 2**	**Moderately like your child 3**	**Quite a bit like your child 4**	**Extremely like your child 5**
1. Your child *throws a ball* in a controlled and accurate fashion.	1	2	3	4	5
2. Your child *catches* a small *ball* (e.g., tennis ball size) thrown from a distance of 6 to 8 feet (1.8 to 2.4 meters).	1	2	3	4	5
3. Your child *hits* an approaching *ball* or *birdie* with a bat or racquet accurately.	1	2	3	4	5
4. Your child *jumps* easily *over* obstacles found in garden or play environment.	1	2	3	4	5
5. Your child *runs* as fast and in a *similar* way to other children of the same gender and age.	1	2	3	4	5
6. If your child has a *plan* to do a motor *activity*, he/she can organize his/her body to follow the plan and effectively complete the task (e.g., building a cardboard or cushion "fort," moving on playground equipment, building a house or a structure with blocks, or using craft materials).	1	2	3	4	5

(OVER)

Decision Support Research Team
Alberta Children's Hospital
2888 Shaganappi Trail NW, Calgary, AB, Canada T3B 6A8
www.calgaryhealthregion.ca/dsrt/dcdq.htm

	Not at all like your child 1	A bit like your child 2	Moderately like your child 3	Quite a bit like your child 4	Extremely like your child 5
7. Your child's printing or *writing* or drawing in class is *fast* enough to keep up with the rest of the children in the class.	1	2	3	4	5
8. Your child's printing or *writing* letters, numbers and words is *legible*, precise and accurate or, if your child is not yet printing, he or she *colors and draws* in a coordinated way and makes pictures that you can recognize.	1	2	3	4	5
9. Your child uses appropriate *effort* or tension when printing or writing or drawing (no excessive *pressure* or tightness of grasp on the pencil, writing is not too heavy or dark, or too light).	1	2	3	4	5
10. Your child *cuts* out pictures and *shapes* accurately and easily.	1	2	3	4	5
11. Your child is interested in and *likes* participating in *sports or active* games requiring good motor skills.	1	2	3	4	5
12. Your child learns *new motor tasks* (e.g., swimming, rollerblading) easily and does not require more practice or time than other children to achieve the same level of skill.	1	2	3	4	5
13. Your child is *quick and competent* in tidying up, putting on shoes, tying shoes, dressing, etc.	1	2	3	4	5
14. Your child would ***never*** be described as a *"bull in a china shop"* (that is, appears so clumsy that he or she might break fragile things in a small room).	1	2	3	4	5
15. Your child does ***not*** *fatigue easily* or appear to slouch and "fall out" of the chair if required to sit for long periods.	1	2	3	4	5

Thank you.

Decision Support Research Team
Alberta Children's Hospital
2888 Shaganappi Trail NW, Calgary, AB, Canada T3B 6A8
www.calgaryhealthregion.ca/dsrt/dcdq.htm

Swanson, Nolan and Pelham-IV

Sample SNAP-IV Teacher and Parent Rating Scale # 6160

James M. Swanson, Ph.D.

Name:_____ Gender: _____ Age: _____ Grade: _____ Date: _____

Ethnicity (check one) ___African-American ___Asian ___Caucasian ___Hispanic ___Other _____

For teacher: Completed by: _____ Type of Class: _____ Class Size: _____

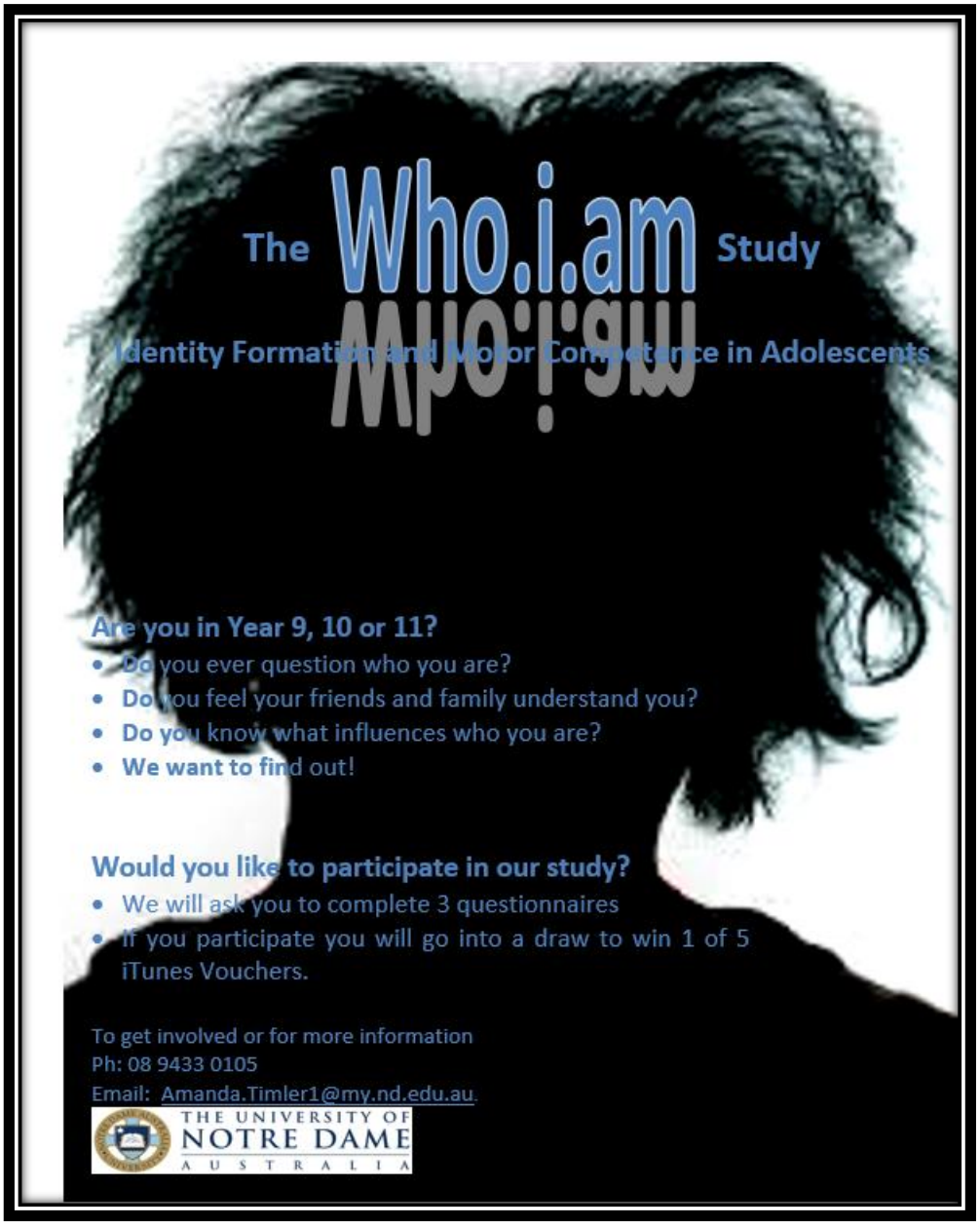
Telephone # at school: _____ Recommended times for follow-up call: _____

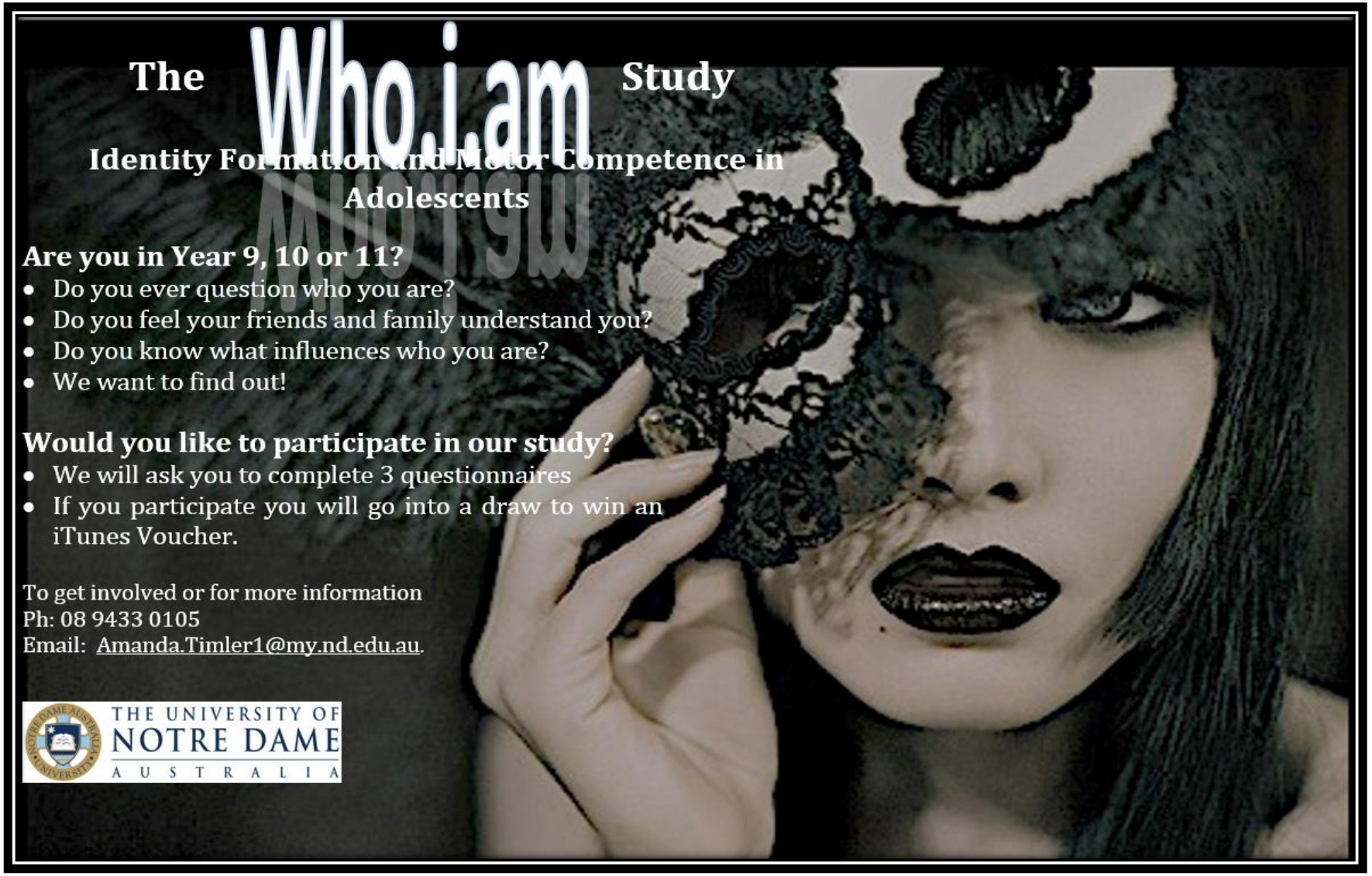
For parents: Completed by: _____ # Parents Living in Home: _____ Family Size: _____

Period of Time Covered by Rating: ___Past Week ___Past Month ___Past Year ___Lifetime ___Other_____

	For each item, select the box that best describes this child. Put only one check per item.	Not at all (0)	Just a Little (1)	Quite A Bit (2)	Very Much (3)
1.	Often fails to give close attention to details or makes careless mistakes in schoolwork, work, or other activities				
2.	Often has difficulty sustaining attention in tasks or play activities				
3.	Often does not seem to listen when spoken to directly				
4.	Often does not follow through on instructions and fails to finish schoolwork, chores, or duties				
5.	Often has difficulty organizing tasks and activities				
6.	Often avoids, dislikes, or is reluctant to engage in tasks that require sustained mental effort (e.g., schoolwork or homework)				
7.	Often loses things necessary for tasks or activities (e.g., toys, school assignments, pencils, books, or tools)				
8.	Often is distracted by extraneous stimuli				
9.	Often is forgetful in daily activities				
10.	Often fidgets with hands or feet or squirms in seat				
11.	Often leaves seat in classroom or in other situations in which remaining seated is expected				
12.	Often runs about or climbs excessively in situations in which it is inappropriate				
13.	Often has difficulty playing or engaging in leisure activities quietly				
14.	Often is "on the go" or often acts as if "driven by a motor"				
15.	Often talks excessively				
16.	Often blurts out answers before questions have been completed				
17.	Often has difficulty awaiting turn				
18.	Often interrupts or intrudes on others (e.g., butts into conversations/games)				
		Sum of Items for Each Scale	Average Rating Per Item for Each Scale	Teacher 5% Cutoff	Parent 5% Cutoff
	Average score for ADHD-Inattention (sum of items 1-9/ # of items)		_____	2.56	1.78

APPENDIX C: Flyers, participant information sheets and consent forms




The Who.i.am Study
Identity Formation and Motor Competence in Adolescents
Are you in Year 9, 10 or 11?
• Do you ever question who you are?
• Do you feel your friends and family understand you?
• Do you know what influences who you are?
• We want to find out!
Would you like to participate in our study?
• We will ask you to complete 3 questionnaires
• If you participate you will go into a draw to win an iTunes Voucher.
To get involved or for more information
Ph: 08 9433 0105
Email: Amanda.Timler1@my.nd.edu.au.
THE UNIVERSITY OF NOTRE DAME AUSTRALIA

University of Notre Dame Ethics:

THE UNIVERSITY OF NOTRE DAME AUSTRALIA

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Internet: www.nd.edu.au

ABN: 69 330 643 210
CRICOS PROVIDER CODE: 01032F

19 August 2014

Professor Beth Hands & Ms Amanda Timler
School of Health Sciences
The University of Notre Dame, Australia
Fremantle Campus

Dear Beth and Amanda,

Reference Number: 014121F

Project title: "The Who.i.am study: Identity formation and motor competence among adolescents."

Your response to the conditions imposed by the university's Human Research Ethics Committee, has been reviewed and based on the information provided has been assessed as meeting all the requirements as mentioned in the *National Statement on Ethical Conduct in Human Research* (2007). Therefore, I am pleased to advise that ethical clearance has been granted for this proposed study.

All research projects are approved subject to standard conditions of approval. Please read the attached document for details of these conditions.

On behalf of the Human Research Ethics Committee, I wish you well with your study.

Yours sincerely,

Dr Natalie Giles
Research Ethics Officer
Research Office

cc: Prof Naomi Trengove, Dean, School of Health Sciences;
A/Prof Gerard Hoyne, SRC Chair, School of Health Sciences.

THE UNIVERSITY OF NOTRE DAME AUSTRALIA

PARTICIPANT INFORMATION SHEET

PROJECT TITLE: The Who.i.am study: Identity formation and motor competence among. Pilot study (AMCQ)
CHIEF INVESTIGATOR: Professor Beth Hands
CO INVESTIGATOR: Dr Fleur McIntyre
STUDENT RESEARCHER: Amanda Timler
STUDENT'S DEGREE: PhD

Dear Parents and Participant,
Your adolescent is invited to participate in the research project described below.

What is the project about?
Late childhood and adolescence is a crucial time for identity development. It is a time when adolescents are questioning their place in the world and making sense of their surroundings. It's a time when future pursuits are being explored. It is when one form's an identity separate to their parents. Being able to participate in weekend sporting competitions and other informal physical activities are also very important for social interactions. However we don't know to what extent an adolescent's level of motor competence impacts on the formation of their identity. The results of this study will be important in helping us understand what is involved in this important process.

Who is undertaking the project?
This project is being conducted by Ms Amanda Timler and it will form the basis for her PhD at The University of Notre Dame Australia, under the supervision of Professor Beth Hands and Dr Fleur McIntyre.

What will you be asked to do?
We want to meet with you on two occasions.

1. Before we can talk to lots of adolescents about their sporting skills we need to meet with a small group to make sure we are asking the right questions. We will show you some questions and ask you to tell us if they sound all right and if there are any other questions we should include. You will be with a small group of other adolescents who attend AMPitup.

2. At a later date, once we have included all your suggestions we will ask you to complete the questionnaire again for us. We will also ask you to complete some of the other tests that you have already done as part of the AMPitup program.

How much time will the project take?
Each meeting will probably take about 45 minutes. We will aim to run them just before you start AMPitup.

Are there any risks associated with participating in this project?
There are no risks involved by participating in this study.

PARTICIPANT INFORMATION SHEET

What are the benefits of the research project?
The results of this project will help us better understand how motor competence might contribute to the way you think about yourself. It will also help us develop a new questionnaire we can use with other adolescents.

Can I withdraw from the study?
Participation in this study is completely voluntary. You are not under any obligation to participate. If you agree to participate, you can withdraw from the study at any time without adverse consequences.

Will anyone else know the results of the project?
Information gathered about you will be held in strict confidence. This confidence will only be broken in instances of legal requirements such as court subpoenas, freedom of information requests, or mandated reporting by some professionals. Confidentiality will be maintained throughout the project and no first names will be published. Data will be stored securely in the School of Health Science at The University of Notre Dame Australia for a period of five years. The study's findings will be published through journal articles and by thesis.

Will you be able to find out the results of the project?
The results of this questionnaire validation process will be written up in a journal article. Upon completion of the thesis, all findings will be available online and through the DCD website.

Who do you contact if you have questions about the project?
If you have any questions about the project, please do not hesitate to contact Amanda Timler via email: Amanda.Timler1@my.nd.edu.au.

What if you have a complaint or any concerns?
The study has been approved by the Human Research Ethics Committee at The University of Notre Dame Australia (approval number 014121F). If you wish to make a complaint regarding the manner in which this research project is conducted, it should be directed to the Executive Officer of the Human Research Ethics Committee, Research Office, The University of Notre Dame Australia, PO Box 1225 Fremantle WA 6959, phone (08) 9433 0943, research@nd.edu.au. Any complaint or concern will be treated in confidence and fully investigated. You will be informed of the outcome.

You want to participate! How do you sign up?
If you wish to participate, please sign the attached consent form and return to Amanda Timler at the University of Notre Dame, School of Health (Amanda.Timler1@my.nd.edu.au) or bring it with you to AMPitup.

Yours sincerely,

Ms Amanda Timler, Professor Beth Hands and Dr Fleur McIntyre

If participants have any complaint regarding the manner in which a research project is conducted, it should be directed to the Executive Officer of the Human Research Ethics Committee, Research Office, The University of Notre Dame Australia, PO Box 1225 Fremantle WA 6959, phone (08) 9433 0943, research@nd.edu.au

THE UNIVERSITY OF NOTRE DAME AUSTRALIA

CONSENT FORM

The Who.i.am study:
Identity formation and motor competence among adolescents. Pilot study (AMCQ).

INFORMED CONSENT FORM FOR PARENT OR GUARDIAN I, *(Parent/Guardian's name)* _____hereby consent to my child, *(Child's name)* _____being a volunteer participant in the above project.

- I have read and understood the Information Sheet and any questions have been answered to my and my child's satisfaction.
- I understand that my child may participate in this study, realising that I, or my child, may withdraw at any time without prejudice.
- I understand that all information gathered by the researcher will be treated as strictly confidential, except in instances of legal requirements such as court subpoenas, freedom of information requests, or mandated reporting by some professionals.
- I understand that the protocol adopted by the University Of Notre Dame Australia Human Research Ethics Committee for the protection of privacy will be adhered to and relevant sections of the *Privacy Act* are available at http://www.nhmrc.gov.au/
- I agree that any research data gathered for the study may be published provided my name or my child's name and other identifying information is not disclosed.
- I understand that my child will be audio - taped.

PARENT/GUARDIAN'S SIGNATURE:		**DATE:**	
CHILD'S SIGNATURE:		**DATE:**	

RESEARCHER'S FULL NAME:	AMANDA TIMLER		
RESEARCHER'S SIGNATURE:		**DATE:**	

If participants have any complaint regarding the manner in which a research project is conducted, it should be directed to the Executive Officer of the Human Research Ethics Committee, Research Office, The University of Notre Dame Australia, PO Box 1225 Fremantle WA 6959, phone (08) 9433 0943, research@nd.edu.au .

THE UNIVERSITY OF NOTRE DAME AUSTRALIA

PARTICIPANT INFORMATION SHEET

PROJECT TITLE: The Who.i.am study: Identity formation and motor competence among adolescents. Pilot study (AIDA)
CHIEF INVESTIGATOR: Professor Beth Hands
CO INVESTIGATOR: Dr Fleur McIntyre
STUDENT RESEARCHER: Amanda Timler
STUDENT'S DEGREE: PhD

Dear Participant,

You are invited to participate in the research project described below.

What is the project about?
Late childhood and adolescence is a crucial time for identity development. It is a time when adolescents are questioning their place in the world and making sense of their surroundings. It's a time when future pursuits are being explored. It is when one form's an identity separate to their parents. Being able to participate in weekend sporting competitions and other informal physical activities are also very important for social interactions. However we don't know to what extent an adolescent's level of motor competence impacts on the formation of their identity. The results of this study will be important in helping us understand what is involved in this important process.

Who is undertaking the project?
This project is being conducted by Ms Amanda Timler and it will form the basis for her PhD at The University of Notre Dame Australia, under the supervision of Professor Beth Hands and Dr Fleur McIntyre.

What will I be asked to do?
We want to meet with you on two occasions

1. Before we can talk to lots of adolescents about how they form their identity we need to meet with a small group to make sure we are asking the right questions. We will show you some questions and ask you to tell us if they sound all right and if there are any other questions we should include. You will be with a small group of other adolescents of a similar age.
2. At a later date, once we have included all your suggestions we will ask you to complete the questionnaire again for us.

How much time will the project take?
The first meeting will take approximately 45 minutes after you have finished school for the day. The second meeting will take about 15 minutes.

Are there any risks associated with participating in this project?
There are no risks involved by participating in this study.

PARTICIPANT INFORMATION SHEET

What are the benefits of the research project?

The results of this project will help us better understand how you think about yourself and your sense of identity. It will also help us to validate a new questionnaire that could be used with other adolescents within Australia.

Can I withdraw from the study?

Participation in this study is completely voluntary. You are not under any obligation to participate. If you agree to participate, you can withdraw from the study at any time without adverse consequences.

Will anyone else know the results of the project?

Information gathered about you will be held in strict confidence. This confidence will only be broken in instances of legal requirements such as court subpoenas, freedom of information requests, or mandated reporting by some professionals. Confidentiality will be maintained throughout the project and no first names will be published. Data will be stored securely in the School of Health Science at The University of Notre Dame Australia for a period of five years. The study's findings will be published through journal articles and by thesis.

Will I be able to find out the results of the project?

The results of this questionnaire tool cultural adaption will be written up in a journal article. Upon completion of the thesis, all findings will be available online.

Who do I contact if I have questions about the project?

If you have any questions about the project, please do not hesitate to contact Amanda Timler via email: Amanda.Timler1@my.nd.edu.au.

What if I have a complaint or any concerns?

The study has been approved by the Human Research Ethics Committee at The University of Notre Dame Australia (approval number 014121F). If you wish to make a complaint regarding the manner in which this research project is conducted, it should be directed to the Executive Officer of the Human Research Ethics Committee, Research Office, The University of Notre Dame Australia, PO Box 1225 Fremantle WA 6959, phone (08) 9433 0943, research@nd.edu.au. Any complaint or concern will be treated in confidence and fully investigated. You will be informed of the outcome.

I want to participate! How do I sign up?

If you wish to participate, please sign the attached consent form and return to Amanda Timler at the University of Notre Dame, School of Health (Amanda.Timler1@my.nd.edu.au).

Yours sincerely,

Ms Amanda Timler, Professor Beth Hands and Dr Fleur McIntyre

If participants have any complaint regarding the manner in which a research project is conducted, it should be directed to the Executive Officer of the Human Research Ethics Committee, Research Office, The University of Notre Dame Australia, PO Box 1225 Fremantle WA 6959, phone (08) 9433 0943, research@nd.edu.au

THE UNIVERSITY OF NOTRE DAME AUSTRALIA

PARTICIPANT INFORMATION SHEET

PROJECT TITLE: The Who.i.am study: Identity formation and motor competence among adolescents. Pilot study (AIDA) Parent
CHIEF INVESTIGATOR: Professor Beth Hands
CO INVESTIGATOR: Dr Fleur McIntyre
STUDENT RESEARCHER: Amanda Timler
STUDENT'S DEGREE: PhD

Dear Parents,

Your adolescent is invited to participate in the research project described below.

What is the project about?
Late childhood and adolescence is a crucial time for identity development. It is a time when adolescents are questioning their place in the world and making sense of their surroundings. It's a time when future pursuits are being explored. It is when one form's an identity separate to their parents. Being able to participate in weekend sporting competitions and other informal physical activities are also very important for social interactions. However we don't know to what extent an adolescent's level of motor competence impacts on the formation of their identity. The results of this study will be important in helping us understand what is involved in this important process.

Who is undertaking the project?
This project is being conducted by Ms Amanda Timler and it will form the basis for her PhD at The University of Notre Dame Australia, under the supervision of Professor Beth Hands and Dr Fleur McIntyre.

What will your adolescent be asked to do?
We want to meet with your adolescent on two occasions

1. Before we can talk to lots of adolescents about how they form their identity we need to meet with a small group to make sure we are asking the right questions. We will show your adolescent some questions and ask your adolescent to tell us if they sound all right and if there are any other questions we should include. Your adolescent will be with a small group of others of a similar age.

2. At a later date, once we have included all their suggestions we will ask your adolescent to complete the questionnaire again for us.

How much time will the project take?
The first meeting will take approximately 45 minutes after you have finished school for the day. The second meeting will take about 15 minutes.

Are there any risks associated with participating in this project?
There are no risks involved by participating in this study.

PARTICIPANT INFORMATION SHEET

What are the benefits of the research project?

The results of this project will help us better understand how your adolescent thinks about themselves and their sense of identity. It will also help us to validate a new questionnaire that could be used with other adolescents within Australia.

Can your adolescent withdraw from the study?

Participation in this study is completely voluntary. Your adolescent is not under any obligation to participate. If your adolescent agrees to participate, they can withdraw from the study at any time without adverse consequences.

Will anyone else know the results of the project?

Information gathered about your adolescent will be held in strict confidence. This confidence will only be broken in instances of legal requirements such as court subpoenas, freedom of information requests, or mandated reporting by some professionals. Confidentiality will be maintained throughout the project and no first names will be published. Data will be stored securely in the School of Health Science at The University of Notre Dame Australia for a period of five years. The study's findings will be published through journal articles and by thesis.

Will I be able to find out the results of the project?

The results of this questionnaire tool cultural adaption will be written up in a journal article. Upon completion of the thesis, all findings will be available online.

Who do I contact if I have questions about the project?

If you have any questions about the project, please do not hesitate to contact Amanda Timler via email: Amanda.Timler1@my.nd.edu.au.

What if I have a complaint or any concerns?

The study has been approved by the Human Research Ethics Committee at The University of Notre Dame Australia (approval number 014121F). If you wish to make a complaint regarding the manner in which this research project is conducted, it should be directed to the Executive Officer of the Human Research Ethics Committee, Research Office, The University of Notre Dame Australia, PO Box 1225 Fremantle WA 6959, phone (08) 9433 0943, research@nd.edu.au. Any complaint or concern will be treated in confidence and fully investigated. You will be informed of the outcome.

I want to participate! How do I sign up?

If you wish to participate, please sign the attached consent form and return to Amanda Timler at the University of Notre Dame, School of Health (Amanda.Timler1@my.nd.edu.au).

Yours sincerely,
Ms Amanda Timler, Professor Beth Hands and Dr Fleur McIntyre

If participants have any complaint regarding the manner in which a research project is conducted, it should be directed to the Executive Officer of the Human Research Ethics Committee, Research Office, The University of Notre Dame Australia, PO Box 1225 Fremantle WA 6959, phone (08) 9433 0943, research@nd.edu.au

THE UNIVERSITY OF NOTRE DAME AUSTRALIA

CONSENT FORM

The Who.i.am study:
Identity formation and motor competence among adolescents. Pilot study (AIDA)
INFORMED CONSENT FORM FOR PARENT OR GUARDIAN

I, *(Parent/Guardian's name)* _____hereby consent to my child, *(Child's name)* _____being a volunteer participant in the above project.

- I have read and understood the Information Sheet and any questions have been answered to my and my child's satisfaction.
- I understand that my child may participate in this study, realising that I, or my child, may withdraw at any time without prejudice.
- I understand that all information gathered by the researcher will be treated as strictly confidential, except in instances of legal requirements such as court subpoenas, freedom of information requests, or mandated reporting by some professionals.
- I understand that the protocol adopted by the University Of Notre Dame Australia Human Research Ethics Committee for the protection of privacy will be adhered to and relevant sections of the *Privacy Act* are available at http://www.nhmrc.gov.au/
- I agree that any research data gathered for the study may be published provided my name or my child's name and other identifying information is not disclosed.
- I understand that my child will be audio-taped.
- I am happy to be contacted to participate in the main study

My contact details:

Mobile number: _____home number: _____
Email: _____
Address: _____

PARENT/GUARDIAN'S SIGNATURE:		**DATE:**	
CHILD'S SIGNATURE:		**DATE:**	
RESEARCHER'S FULL NAME:	AMANDA TIMLER		
RESEARCHER'S SIGNATURE:		**DATE:**	

If participants have any complaint regarding the manner in which a research project is conducted, it should be directed to the Executive Officer of the Human Research Ethics Committee, Research Office, The University of Notre Dame Australia, PO Box 1225 Fremantle WA 6959, phone (08) 9433 0943, research@nd.edu.au.

THE UNIVERSITY OF NOTRE DAME AUSTRALIA

PARTICIPANT INFORMATION SHEET

PROJECT TITLE: The Who.i.am study: Identity formation and motor competence among adolescents. Adolescent
CHIEF INVESTIGATOR: Professor Beth Hands
CO INVESTIGATOR: Dr Fleur McIntyre
STUDENT RESEARCHER: Amanda Timler
STUDENT'S DEGREE: PhD

Dear Adolescent,
You and your parents are invited to participate in the research project described below.

What is the project about?
Late childhood and adolescence is a crucial time for identity development. It is a time when adolescents are questioning their place in the world and making sense of their surroundings. It's a time when future pursuits are being explored. It is when one form's an identity separate to their parents. Being able to participate in weekend sporting competitions and other informal physical activities are also very important for social interactions. However we don't know to what extent an adolescent's level of motor competence impacts on the formation of their identity. The results of this study will be important in helping us understand what is involved in this important process.

Who is undertaking the project?
This project is being conducted by Ms Amanda Timler and it will form the basis for her PhD at The University of Notre Dame Australia, under the supervision of Professor Beth Hands and Dr Fleur McIntyre.

What will you be asked to do?
We will ask you and your parents to complete some questionnaires.
We will ask you to complete 3 questionnaires: one about your identity formation (Assessment of Identity Development in Adolescents, AIDA); one about your self-perceptions (Self Perceptions Profile for Adolescents, SPPA); and one about your level of motor competence (Adolescent Motor Competence Questionnaire, AMCQ). These should take about 30 minutes. We will also ask your parents to complete 2 questionnaires about your level of motor competence (the DCDQ-07) and attention, impulsivity and activity (the SNAP IV). These should take about 15 minutes. As a thank you for participating, your name will go into a draw for a chance to win 1 in 5 iTunes Vouchers. Based on your responses we may also contact you again to participate in a Focus Group or for your parents to participate in an interview. If you do not wish to be contacted for this second phase please check the box below. □ I do not wish to be involved in the second phase of the study

Are there any risks associated with participating in this project?
There are no risks involved by participating in this study.

PARTICIPANT INFORMATION SHEET

What are the benefits of the research project?
The results from your participation in this study will make significant contributions to the research and will helpus better understand how motor competence might contribute to the way you think about yourself.

Can I withdraw from the study?
Participation in this study is completely voluntary. You are not under any obligation to participate. If you or your adolescent agrees to participate, you can withdraw from the study at any time without adverse consequences.

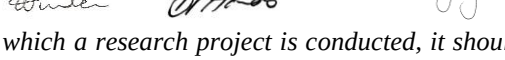
Will anyone else know the results of the project?
Information gathered about you will be held in strict confidence. This confidence will only be broken in instances of legal requirements such as court subpoenas, freedom of information requests, or mandated reporting by some professionals. Confidentiality will be maintained throughout the project and no first names will be published. Data will be stored securely in the School of Health Science at The University of Notre Dame Australia for a period of five years. The study's findings will be published through journal articles and by thesis.

Will I be able to find out the results of the project?
The results from these questionnaires will be written up in a journal article. A copy will be sent you and your parents upon request.

Who do I contact if I have questions about the project?
If you have any questions about the project, please do not hesitate to contact Amanda Timler via email: Amanda.Timler1@my.nd.edu.au.

What if I have a complaint or any concerns?
The study has been approved by the Human Research Ethics Committee at The University of Notre Dame Australia (approval number 014121F). If you wish to make a complaint regarding the manner in which this research project is conducted, it should be directed to the Executive Officer of the Human Research Ethics Committee, Research Office, The University of Notre Dame Australia, PO Box 1225 Fremantle WA 6959, phone (08) 9433 0943, research@nd.edu.au
Any complaint or concern will be treated in confidence and fully investigated. You will be informed of the outcome.

I want to participate! How do I sign up?
If you wish to participate, please sign the attached consent form and return to Amanda Timler at the University of Notre Dame, School of Health (Amanda.Timler1@my.nd.edu.au)
Yours sincerely,
Ms Amanda Timler, Professor Beth Hands and Dr Fleur McIntyre



If participants have any complaint regarding the manner in which a research project is conducted, it should be directed to the Executive Officer of the Human Research Ethics Committee, Research Office, The University of Notre Dame Australia, PO Box 1225 Fremantle WA 6959, phone (08) 9433 0943, research@nd.edu.au

THE UNIVERSITY OF NOTRE DAME AUSTRALIA

PARTICIPANT INFORMATION SHEET

PROJECT TITLE: The Who.i.am study: Identity formation and motor competence among adolescents. Parent
CHIEF INVESTIGATOR: Professor Beth Hands
CO INVESTIGATOR: Dr Fleur McIntyre
STUDENT RESEARCHER: Amanda Timler
STUDENT'S DEGREE: PhD

Dear Parents,
You and your adolescent are invited to participate in the research project described below.

What is the project about?
Late childhood and adolescence is a crucial time for identity development. It is a time when adolescents are questioning their place in the world and making sense of their surroundings. It's a time when future pursuits are being explored. It is when one form's an identity separate to their parents. Being able to participate in weekend sporting competitions and other informal physical activities are also very important for social interactions. However we don't know to what extent an adolescent's level of motor competence impacts on the formation of their identity. The results of this study will be important in helping us understand what is involved in this important process.

Who is undertaking the project?
This project is being conducted by Ms Amanda Timler and it will form the basis for her PhD at The University of Notre Dame Australia, under the supervision of Professor Beth Hands and Dr Fleur McIntyre.

What will you be asked to do?
We will ask you and your adolescent to complete some questionnaires.
We will ask you to complete 2 questionnaires about your child's level of motor competences (the DCDQ-07) and attention, impulsivity and activity (the SNAP IV). These should take about 15 minutes.
We will also ask your adolescent to complete 3 questionnaires: one about their identity formation (Assessment of Identity Development in Adolescents, AIDA); one about their self-perceptions (Self Perceptions Profile for Adolescents, SPPA); and one about their level of motor competence (Adolescent Motor Competence Questionnaire, AMCQ). These should take about 30 minutes. As a thank you for participating, your adolescent's name will go into a draw for a chance to win 1 in 5 iTunes Vouchers.
Based on your adolescent's responses we may contact you again to participate in an interview or for your adolescent to participate in a focus group. If you do not wish to be contacted for this second phase please check the box below. □ I do not wish to be involved in the second phase of the study

PARTICIPANT INFORMATION SHEET

Are there any risks associated with participating in this project?
There are no risks involved by participating in this study.

What are the benefits of the research project?
The results from your participation in this study will make significant contributions to the research and will help us better understand how motor competence might contribute to the way your adolescent thinks about themselves.

Can I withdraw from the study?
Participation in this study is completely voluntary. You are not under any obligation to participate. If you or your adolescent agrees to participate, you can withdraw from the study at any time without adverse consequences.

Will anyone else know the results of the project?
Information gathered about you will be held in strict confidence. This confidence will only be broken in instances of legal requirements such as court subpoenas, freedom of information requests, or mandated reporting by some professionals. Confidentiality will be maintained throughout the project and no first names will be published. Data will be stored securely in the School of Health Science at The University of Notre Dame Australia for a period of five years. The study's findings will be published through journal articles and by thesis.

Will I be able to find out the results of the project?
The results from these questionnaires will be written up in a journal article. A copy will be sent you upon request.

Who do I contact if I have questions about the project?
If you have any questions about the project, please do not hesitate to contact Amanda Timler via email: Amanda.Timler1@my.nd.edu.au.

What if I have a complaint or any concerns?
The study has been approved by the Human Research Ethics Committee at The University of Notre Dame Australia (approval number 014121F). If you wish to make a complaint regarding the manner in which this research project is conducted, it should be directed to the Executive Officer of the Human Research Ethics Committee, Research Office, The University of Notre Dame Australia, PO Box 1225 Fremantle WA 6959, phone (08) 9433 0943, research@nd.edu.au
Any complaint or concern will be treated in confidence and fully investigated. You will be informed of the outcome.

I want to participate! How do I sign up?
If you wish to participate, please sign the attached consent form and return to Amanda Timler at the University of Notre Dame, School of Health (Amanda.Timler1@my.nd.edu.au)
Yours sincerely,
Ms Amanda Timler, Professor Beth Hands and Dr Fleur McIntyre

If participants have any complaint regarding the manner in which a research project is conducted, it should be directed to the Executive Officer of the Human Research Ethics Committee, Research Office, The University of Notre Dame Australia, PO Box 1225 Fremantle WA 6959, phone (08) 9433 0943, research@nd.edu.au

THE UNIVERSITY OF NOTRE DAME AUSTRALIA

CONSENT FORM

The Who.i.am study:Identity formation and motor competence among adolescents. Questionnaire completion

INFORMED CONSENT FORM FOR PARENT OR GUARDIAN I, *(Parent/Guardian's name)* _____hereby consent to my child, *(Child's name)* _____being a volunteer participant in the above project.

- I have read and understood the Information Sheet and any questions have been answered to my and my child's satisfaction.
- I understand that my child may participate in this study, realising that I, or my child, may withdraw at any time without prejudice.
- I understand that all information gathered by the researcher will be treated as strictly confidential, except in instances of legal requirements such as court subpoenas, freedom of information requests, or mandated reporting by some professionals.
- I understand that the protocol adopted by the University Of Notre Dame Australia Human Research Ethics Committee for the protection of privacy will be adhered to and relevant sections of the *Privacy Act* are available at http://www.nhmrc.gov.au/
- I agree that any research data gathered for the study may be published provided my name or my child's name and other identifying information is not disclosed.
- Further contact maybe made for participation in a focus group

Participants contact details:

Mobile number: _____home number: _____

Email: _____

Address: _____

- Due to the large sample size, I understand that I might be contacted to participate in a focus group

☐ I do not want to be contacted to participate in the study

☐ I, (Parent/Guardian) would like to be contacted for participation in this study, at a later date

Mobile number: _____home number: _____

Email: _____

PARENT/GUARDIAN'S SIGNATURE:		**DATE:**	
CHILD'S SIGNATURE:		**DATE:**	
RESEARCHER'S FULL NAME:	AMANDA TIMLER		
RESEARCHER'S SIGNATURE:		**DATE:**	

If participants have any complaint regarding the manner in which a research project is conducted, it should be directed to the Executive Officer of the Human Research Ethics Committee, Research Office, The University of Notre Dame Australia, PO Box 1225 Fremantle WA 6959, phone (08) 9433 0943, research@nd.edu.au .

THE UNIVERSITY OF NOTRE DAME AUSTRALIA

PARTICIPANT INFORMATION SHEET

PROJECT TITLE: The Who.i.am study: Identity formation and motor competence among adolescents. Adolescent Focus Group
CHIEF INVESTIGATOR: Professor Beth Hands
CO INVESTIGATOR: Dr Fleur McIntyre
STUDENT RESEARCHER: Amanda Timler
STUDENT'S DEGREE: PhD

Dear Participant,

You have already participated in the first phase of the research project described below.

What is the project about?
Late childhood and adolescence is a crucial time for identity development. It is a time when adolescents are questioning their place in the world and making sense of their surroundings. It's a time when future pursuits are being explored. It is when one form's an identity separate to their parents. Being able to participate in weekend sporting competitions and other informal physical activities are also very important for social interactions. However we don't know to what extent an adolescent's level of motor competence impacts on the formation of their identity. The results of this study will be important in helping us understand what is involved in this important process. This is the second phase of the study. Thank you for your contribution to date.

Who is undertaking the project?
This project is being conducted by Ms Amanda Timler and it will form the basis for her PhD at The University of Notre Dame Australia, under the supervision of Professor Beth Hands and Dr Fleur McIntyre.

What will you be asked to do?
You are invited to participate in a focus group. The researcher, Amanda, would like to talk to you about what factors you feel have been important in developing your sense of identity. The focus group will take about 90 minutes and will take place at the University of Notre Dame. The focus group will be audio recorded then transcribed to help the researcher ensure an accurate record of your responses.

Are there any risks associated with participating in this project?
There are no risks associated with participating in this project. Further support and information will be provided for you if needed.

PARTICIPANT INFORMATION SHEET

What are the benefits of the research project?

Participating in this project will help to inform other adolescents about personal experiences in one's sense of identity. It will also allow the researchers to better understand the support networks that are important to you.

Can I withdraw from the study?

Participation in this study is completely voluntary. You are not under any obligation to participate. If you agree to participate, you can withdraw from the study at any time without adverse consequences.

Will anyone else know the results of the project?

Information gathered about you will be held in strict confidence. This confidence will only be broken in instances of legal requirements such as court subpoenas, freedom of information requests, or mandated reporting by some professionals. Confidentiality will be maintained throughout the project and no first names will be published. Data will be stored securely in the School of Health Science at The University of Notre Dame Australia for a period of five years. The study's findings will be published through journal articles and by thesis.

Will I be able to find out the results of the project?

The results of this study will be written up in a journal article. A copy can be made available to you on request.

Who do I contact if I have questions about the project?

If you have any questions about the project, please do not hesitate to contact Amanda Timler via email: Amanda.Timler1@my.nd.edu.au.

What if I have a complaint or any concerns?

The study has been approved by the Human Research Ethics Committee at The University of Notre Dame Australia (approval number 014121F). If you wish to make a complaint regarding the manner in which this research project is conducted, it should be directed to the Executive Officer of the Human Research Ethics Committee, Research Office, The University of Notre Dame Australia, PO Box 1225 Fremantle WA 6959, phone (08) 9433 0943, research@nd.edu.au

Any complaint or concern will be treated in confidence and fully investigated. You will be informed of the outcome.

I want to participate! How do I sign up?

If you wish to participate, please sign the attached consent form and return to Amanda Timler at the University of Notre Dame, School of Health (Amanda.Timler1@my.nd.edu.au).

Yours sincerely,
Ms Amanda Timler, Professor Beth Hands and Dr Fleur McIntyre



If participants have any complaint regarding the manner in which a research project is conducted, it should be directed to the Executive Officer of the Human Research Ethics Committee, Research Office, The University of Notre Dame Australia, PO Box 1225 Fremantle WA 6959, phone (08) 9433 0943, research@nd.edu.au

THE UNIVERSITY OF NOTRE DAME AUSTRALIA

PARTICIPANT INFORMATION SHEET

PROJECT TITLE: The Who.i.am study: Identity formation and motor competence among adolescents. Adolescent Focus Groups (Parent)
CHIEF INVESTIGATOR: Professor Beth Hands
CO INVESTIGATOR: Dr Fleur McIntyre
STUDENT RESEARCHER: Amanda Timler
STUDENT'S DEGREE: PhD

Dear Parents,
Your adolescent has already participated in the first phase of the research project described below.

What is the project about?
Late childhood and adolescence is a crucial time for identity development. It is a time when adolescents are questioning their place in the world and making sense of their surroundings. It's a time when future pursuits are being explored. It is when one form's an identity separate to their parents. Being able to participate in weekend sporting competitions and other informal physical activities are also very important for social interactions. However we don't know to what extent an adolescent's level of motor competence impacts on the formation of their identity. The results of this study will be important in helping us understand what is involved in this important process.

This is the second phase of the study. Thank you for your contribution to date.

Who is undertaking the project?
This project is being conducted by Ms Amanda Timler and it will form the basis for her PhD at The University of Notre Dame Australia, under the supervision of Professor Beth Hands and Dr Fleur McIntyre.

What will you be asked to do?
Your adolescent is now invited to participate in a focus group. The researcher, Amanda, would like to talk to your adolescent about what factors they feel have been important in developing their sense of identity. The focus group will take about 90 minutes and will take place at the University of Notre Dame. The focus group will be audio recorded then transcribed to help the researcher ensure an accurate record of their responses.

Are there any risks associated with participating in this project?
There are no risks associated with participating in this project. Further support and information will be provided for your adolescent if needed.

PARTICIPANT INFORMATION SHEET

What are the benefits of the research project?

Participating in this project will help to inform other adolescents about personal experiences in one's sense of identity. It will also allow the researchers to better understand support networks that are important to your adolescent.

Can you withdraw from the study?

Participation in this study is completely voluntary. Your adolescent is not under any obligation to participate. If your adolescent agrees to participate, he/she can withdraw from the study at any time without adverse consequences.

Will anyone else know the results of the project?

Information gathered about your adolescent will be held in strict confidence. This confidence will only be broken in instances of legal requirements such as court subpoenas, freedom of information requests, or mandated reporting by some professionals. Confidentiality will be maintained throughout the project and no first names will be published. Data will be stored securely in the School of Health Science at The University of Notre Dame Australia for a period of five years. The study's findings will be published through journal articles and by thesis.

Will you be able to find out the results of the project?

The results of this study will be written up in a journal article. A copy can be made available to you on request.

Who do I contact if I have questions about the project?

If you have any questions about the project, please do not hesitate to contact Amanda Timler via email: Amanda.Timler1@my.nd.edu.au.

What if I have a complaint or any concerns?

The study has been approved by the Human Research Ethics Committee at The University of Notre Dame Australia (approval number 014121F). If you wish to make a complaint regarding the manner in which this research project is conducted, it should be directed to the Executive Officer of the Human Research Ethics Committee, Research Office, The University of Notre Dame Australia, PO Box 1225 Fremantle WA 6959, phone (08) 9433 0943, research@nd.edu.au. Any complaint or concern will be treated in confidence and fully investigated. You will be informed of the outcome.

I want to participate! How do I sign up?

If you wish to participate, please sign the attached consent form and return to Amanda Timler at the University of Notre Dame, School of Health (Amanda.Timler1@my.nd.edu.au)

Yours sincerely,

Ms Amanda Timler, Professor Beth Hands and Dr Fleur McIntyre



If participants have any complaint regarding the manner in which a research project is conducted, it should be directed to the Executive Officer of the Human Research Ethics Committee, Research Office, The University of Notre Dame Australia, PO Box 1225 Fremantle WA 6959, phone (08) 9433 0943, research@nd.edu.au

THE UNIVERSITY OF NOTRE DAME AUSTRALIA

CONSENT FORM

The Who.i.am study:
Identity formation and motor competence among adolescents. Focus Groups.
INFORMED CONSENT FORM FOR PARENT OR GUARDIAN

I, *(Parent/Guardian's name)* _____hereby consent to my child, *(Child's name)* _____being a volunteer participant in the above project.

- I have read and understood the Information Sheet and any questions have been answered to my and my child's satisfaction.
- I understand that my child may participate in this study, realising that I, or my child, may withdraw at any time without prejudice.
- I understand that all information gathered by the researcher will be treated as strictly confidential, except in instances of legal requirements such as court subpoenas, freedom of information requests, or mandated reporting by some professionals.
- I understand that the protocol adopted by the University Of Notre Dame Australia Human Research Ethics Committee for the protection of privacy will be adhered to and relevant sections of the *Privacy Act* are available at http://www.nhmrc.gov.au/
- I agree that any research data gathered for the study may be published provided my name or my child's name and other identifying information is not disclosed.
- I understand that my child will be audio-taped.

PARENT/GUARDIAN'S SIGNATURE:		**DATE:**	
CHILD'S SIGNATURE:		**DATE:**	

RESEARCHER'S FULL NAME:	AMANDA TIMLER		
RESEARCHER'S SIGNATURE:		**DATE:**	

If participants have any complaint regarding the manner in which a research project is conducted, it should be directed to the Executive Officer of the Human Research Ethics Committee, Research Office, The University of Notre Dame Australia, PO Box 1225 Fremantle WA 6959, phone (08) 9433 0943, research@nd.edu.au

Department of Education ethics:

Government of **Western Australia**
Department of **Education**

Your ref :
Our ref : D15/0484633
Enquiries :

Ms Amanda Timler
School of Health Sciences
University of Notre Dame
PO Box 1225
FREMANTLE WA 6959

Dear Ms Timler

Thank you for your application received 19 May 2015 to conduct research on Department of Education sites.

The focus and outcomes of your research project, *The Who.i.am study: Identity formation and motor competence in adolescents,* are of interest to the Department. I give permission for you to approach principals to invite their participation in the project as outlined in your application. It is a condition of approval that upon conclusion the results of this study are forwarded to the Department at the email address below.

Consistent with Department policy, participation in your research project will be the decision of the schools invited to participate, the children in those schools and their parents. A copy of this letter must be provided to principals when requesting their participation in the research.

Responsibility for quality control of ethics and methodology of the proposed research resides with the institution supervising the research. The Department notes a copy of a letter confirming that you have received ethical approval of your research protocol from The University of Notre Dame Human Research Ethics Committee.

Any proposed changes to the research project will need to be submitted for Department approval prior to implementation.

Please contact Dr Adriaan Wolvaardt, Coordinator Research Applications, on (08) 9264 5512 or researchandpolicy@education.wa.edu.au if you have further enquiries.

Very best wishes for the successful completion of your project.

Yours sincerely

ALAN DODSON
DIRECTOR
EVALUATION AND ACCOUNTABILITY

16 November 2015

151 Royal Street, East Perth Western Australia 6004

THE UNIVERSITY OF NOTRE DAME AUSTRALIA

PARTICIPANT INFORMATION SHEET

PROJECT TITLE: The Who.i.am study: Identity formation and motor competence among adolescents. Parent
CHIEF INVESTIGATOR: Professor Beth Hands
CO INVESTIGATOR: Dr Fleur McIntyre
STUDENT RESEARCHER: Amanda Timler
STUDENT'S DEGREE: PhD

Dear Parents and students,
You and your child are invited to participate in the research project described below.

What is the project about?

Late childhood and adolescence is a crucial time for identity development. It is a time when adolescents are questioning their place in the world and making sense of their surroundings. It's a time when future pursuits are being explored. It is when one forms an identity separate to their parents. Being able to participate in weekend sporting competitions and other informal physical activities are also very important for social interactions. However we don't know to what extent an adolescent's level of motor competence impacts on the formation of their identity. The results of this study will be important in helping us understand what is involved in this important process.

Who is undertaking the project?

This project is being conducted by Ms Amanda Timler and it will form the basis for her PhD at The University of Notre Dame Australia, under the supervision of Professor Beth Hands and Dr Fleur McIntyre.

What will you be asked to do?

We will ask you and your adolescent to complete some questions found within the links provided below. We will ask parents to complete questions about their child's level of motor competence (The Coordination Questionnaire) and attention, impulsivity and activity (the SNAP IV). The last question will ask parents to generate a unique code to ensure consent has been given. This will take about 15 minutes. Parents use this link:https://qtrial2015az1.az1.qualtrics.com/SE/?SID=SV_a4aNKVHfYxCM6kB
We will also ask adolescents to complete questions about their identity formation (Assessment of Identity Development in Adolescents, AIDA); their self-perceptions (Self Perceptions Profile for Adolescents, SPPA); and their level of motor competence (Adolescent Motor Competence Questionnaire, AMCQ). This will take about 30 minutes. Adolescent link: https://qtrial2015az1.az1.qualtrics.com/SE/?SID=SV_3mcNhqpGC0TxC3b. As a thank you for participating, your adolescent's name will go into a draw for a chance to win a $50 iTunes Vouchers. Based on your adolescent's responses we may contact you again to participate in an interview or for your adolescent to participate in a focus group. If you wish to be contacted for this second phase please check the box on the consent form.

Are there any risks associated with participating in this project?

This may be the first time you have been asked questions about your adolescent's motor competence or attention levels. Please note these questions are self-report screening tools, not diagnostic tools. Therefore, some of the questions may cause you to feel distressed.

Support, counseling and information can be made available to you and your adolescent. Please contact Amanda Timler at Amanda.Timler1@my.nd.edu.au for further information.

What are the benefits of the research project?

The results from your participation in this study will make significant contributions to the research and will help us better understand how motor competence might contribute to the way *adolescents think* about themselves.

Can I withdraw from the study?

Participation in this study is completely voluntary. You are not under any obligation to participate. If you or your adolescent agrees to participate, you can withdraw from the study at any time without adverse consequences.

Will anyone else know the results of the project?

Information gathered about you will be held in strict confidence. This confidence will only be broken in instances of legal requirements such as court subpoenas, freedom of information requests, mandated reporting by some professionals or in the circumstances that require reporting under the Department of Education Child Protection policy. Confidentiality will be maintained throughout the project and no names (first, second or surnames) or the name of your adolescent's school will be published. Data will be stored securely in the School of Health Science at The University of Notre Dame Australia for a period of five years. The study's findings will be published through journal articles and by thesis.

Will I be able to find out the results of the project?

The results from these questions will be written up in a journal article. A copy will be sent you upon request.

Who do I contact if I have questions about the project?

If you have any questions about the project, or you would prefer to receive hardcopies of the questionnaires please do not hesitate to contact Amanda Timler via email: Amanda.Timler1@my.nd.edu.au.

What if I have a complaint or any concerns?

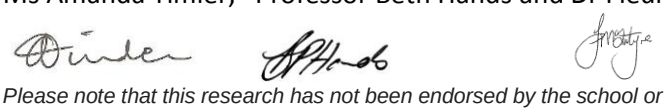
The study has been approved by the Human Research Ethics Committee at The University of Notre Dame Australia (approval number 014121F). If you wish to make a complaint regarding the manner in which this research project is conducted, it should be directed to the Executive Officer of the Human Research Ethics Committee, Research Office, The University of Notre Dame Australia, PO Box 1225 Fremantle WA 6959, phone (08) 9433 0943, research@nd.edu.au. Any complaint or concern will be treated in confidence and fully investigated. You will be informed of the outcome.

I want to participate! How do I sign up?

If you and or son or daughter wish to participate, please sign the consent form, complete the links provided.

Yours sincerely,

Ms Amanda Timler, Professor Beth Hands and Dr Fleur McIntyre



Please note that this research has not been endorsed by the school or the Department of Education. If you are interested in participating in this research you must deal directly with the researcher. Before deciding to participate in this research you should inform yourself of its appropriateness and suitability for you.If participants have any complaint regarding the manner in which a research project is conducted, it should be directed to the Executive Officer of the Human Research Ethics Committee, Research Office, The University of Notre Dame Australia, PO Box 1225 Fremantle WA 6959, phone (08) 9433 0943, research@nd.edu.au

THE UNIVERSITY OF NOTRE DAME AUSTRALIA

CONSENT FORM

The Who.i.am study:
Identity formation and motor competence among adolescents.
Questionnaire completion

INFORMED CONSENT FORM FOR PARENTS OR GUARDIAN

I, *(Parent/Guardian's name)* _____hereby consent to my child, *(Child's name)* _____being a volunteer participant in the above project.

- I have read and understood the Information Sheet and any questions have been answered to my and my child's satisfaction.
- I understand that my child may participate in this study, realising that I, or my child, may withdraw at any time without prejudice.
- I understand that all information gathered by the researcher will be treated as strictly confidential, except in instances of legal requirements such as court subpoenas, freedom of information requests, or mandated reporting by some professionals.
- I understand that the protocol adopted by the University Of Notre Dame Australia Human Research Ethics Committee for the protection of privacy will be adhered to and relevant sections of the *Privacy Act* are available at http://www.nhmrc.gov.au/
- I agree that any research data gathered for the study may be published provided my name or my child's name and other identifying information is not disclosed.
- Further contact maybe made for participation in a focus group

Participants contact details for questionnaire completion (phase one):

Mobile number: _____home number: _____
Email: _____
Address: _____

- This project also has a phase two (adolescent focus group or parent interview) Therefore, I understand that if I tick the box below that I might be contacted to participate in phase two

☐ I want to be contacted to participate in phase two of this study

☐ I, (Parent/Guardian) would like to be contacted for participation in this study, at a later date

Mobile number: _____home number: _____

Email: _____

PARENT/GUARDIAN'S SIGNATURE:		**DATE:**	
CHILD'S SIGNATURE:		**DATE:**	
RESEARCHER'S FULL NAME:	AMANDA TIMLER		
RESEARCHER'S SIGNATURE:		**DATE:**	

Please note that this research has not been endorsed by the school or the Department of Education. If you are interested in participating in this research you must deal directly with the researcher. Before deciding to participate in this research you should inform yourself of its appropriateness and suitability for you.If participants have any complaint regarding the manner in which a research project is conducted, it should be directed to the Executive Officer of the Human Research Ethics Committee, Research Office, The University of Notre Dame Australia, PO Box 1225 Fremantle WA 6959, phone (08) 9433 0943, research@nd.edu.au

THE UNIVERSITY OF NOTRE DAME AUSTRALIA

PARTICIPANT INFORMATION SHEET

PROJECT TITLE: The Who.i.am study: Identity formation and motor competence among adolescents. Adolescent Focus Group

CHIEF INVESTIGATOR: Professor Beth Hands

CO INVESTIGATOR: Dr Fleur McIntyre

STUDENT RESEARCHER: Amanda Timler

STUDENT'S DEGREE: PhD

Dear Participant,

You have already participated in the first phase of the research project described below.

What is the project about?

Late childhood and adolescence is a crucial time for identity development. It is a time when adolescents are questioning their place in the world and making sense of their surroundings. It's a time when future pursuits are being explored. It is when one forms an identity separate to their parents. Being able to participate in weekend sporting competitions and other informal physical activities are also very important for social interactions. However we don't know to what extent an adolescent's level of motor competence impacts on the formation of their identity. The results of this study will be important in helping us understand what is involved in this important process. This is the second phase of the study. Thank you for your contribution to date.

Who is undertaking the project?

This project is being conducted by Ms Amanda Timler and it will form the basis for her PhD at The University of Notre Dame Australia, under the supervision of Professor Beth Hands and Dr Fleur McIntyre.

What will you be asked to do?

Based on your responses to the questionnaires in the first phase, you are invited to participate in a small focus group of 6-8 other adolescents. The researcher, Amanda, would like to talk to you about what factors you feel have been important in developing your sense of identity. The focus group will take about 90 minutes and will take place at a location close to your school. The focus group will be audio recorded then transcribed to help the researcher ensure an accurate record of your responses. Amanda will also talk with one of your parents and may share with them your questionnaire results.

Are there any risks associated with participating in this project?

This may be the first time you have been asked questions about your self-perceptions and their motor competence level. Further support and information will be provided for you if needed.

What are the benefits of the research project?

Participating in this project will help to inform other adolescents about personal experiences in one's sense of identity. It will also allow the researchers to better understand the support networks that are important to you.

PARTICIPANT INFORMATION SHEET

Can I withdraw from the study?

Participation in this study is completely voluntary. You are not under any obligation to participate. If you agree to participate, you can withdraw from the study at any time without adverse consequences.

Will anyone else know the results of the project?

Your questionnaire results may be shared with your parents. All other information gathered about you will be held in strict confidence. This confidence will only be broken in instances of legal requirements such as court subpoenas, freedom of information requests, or mandated reporting by some professionals. Confidentiality will be maintained throughout the project and no first names will be published. Data will be stored securely in the School of Health Science at The University of Notre Dame Australia for a period of five years. The study's findings will be published through journal articles and by thesis.

Will I be able to find out the results of the project?

The results of this study will be written up in a journal article. A copy can be made available to you on request.

Who do I contact if I have questions about the project?

If you have any questions about the project, please do not hesitate to contact Amanda Timler via email: Amanda.Timler1@my.nd.edu.au.

What if I have a complaint or any concerns?

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I want to participate! How do I sign up?

If you wish to participate, please sign the attached consent form and return to Amanda Timler at the University of Notre Dame, School of Health (Amanda.Timler1@my.nd.edu.au).

Yours sincerely,
Ms Amanda Timler, Professor Beth Hands and Dr Fleur McIntyre

Please note that this research has not been endorsed by the school or the Department of Education. If you are interested in participating in this research you must deal directly with the researcher. Before deciding to participate in this research you should inform yourself of its appropriateness and suitability for you. If participants have any complaint regarding the manner in which a research project is conducted, it should be directed to the Executive Officer of the Human Research Ethics Committee, Research Office, The University of Notre Dame Australia, PO Box 1225 Fremantle WA 6959, phone (08) 9433 0943, research@nd.edu.au

THE UNIVERSITY OF NOTRE DAME AUSTRALIA

PARTICIPANT INFORMATION SHEET

PROJECT TITLE: The Who.i.am study: Identity formation and motor competence among adolescents. Adolescent Focus Groups (high motor competent group)
CHIEF INVESTIGATOR: Professor Beth Hands
CO INVESTIGATOR: Dr Fleur McIntyre
STUDENT RESEARCHER: Amanda Timler
STUDENT'S DEGREE: PhD

Dear Parents,

You and your adolescent has already participated in the first phase of the research project described below.

What is the project about?
Late childhood and adolescence is a crucial time for identity development. It is a time when adolescents are questioning their place in the world and making sense of their surroundings. It's a time when future pursuits are being explored. It is when one form's an identity separate to their parents. Being able to participate in weekend sporting competitions and other informal physical activities are also very important for social interactions. However we don't know to what extent an adolescent's level of motor competence impacts on the formation of their identity. The results of this study will be important in helping us understand what is involved in this important process.

This is the second phase of the study. Thank you for your contribution to date.

Who is undertaking the project?
This project is being conducted by Ms Amanda Timler and it will form the basis for her PhD at The University of Notre Dame Australia, under the supervision of Professor Beth Hands and Dr Fleur McIntyre.

What will you be asked to do?
Your adolescent is now invited to participate in a focus group. The primary researcher, Amanda, would like to talk to them about what factors they feel have been important in developing their sense of identity. The focus groups will involve 6-8 adolescents whose scores on the questionnaire indicated they have high motor competence. The focus group will take about 90 minutes and will be at a location close to your child's school. It will be audio recorded then transcribed to help the researcher ensure an accurate record of the session.

Are there any risks associated with participating in this project?
There are no perceived risks although may be the first time your adolescent has had the opportunity to discuss aspects of their self-perceptions and motor competence. Further information will be provided if needed.

PARTICIPANT INFORMATION SHEET

What are the benefits of the research project?

Participating in this project will help to inform other adolescents about personal experiences in one's sense of identity. It will also allow the researchers to better understand support networks that are important to your adolescent.

Can you withdraw from the study?

Participation in this study is completely voluntary. Your adolescent is not under any obligation to participate. If your adolescent agrees to participate, he/she can withdraw from the study at any time without adverse consequences.

Will anyone else know the results of the project?

Information gathered about your adolescent will be held in strict confidence. This confidence will only be broken in instances of legal requirements such as court subpoenas, freedom of information requests, or mandated reporting by some professionals. Confidentiality will be maintained throughout the project and no first names will be published. Data will be stored securely in the School of Health Science at The University of Notre Dame Australia for a period of five years. The study's findings will be published through journal articles and by thesis.

Will you be able to find out the results of the project?

The results of this study will be written up in a journal article. A copy can be made available to you on request.

Who do I contact if I have questions about the project?

If you have any questions about the project, please do not hesitate to contact Amanda Timler via email: Amanda.Timler1@my.nd.edu.au.

What if I have a complaint or any concerns?

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Any complaint or concern will be treated in confidence and fully investigated. You will be informed of the outcome.

I want to participate! How do I sign up?

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Yours sincerely,
Ms Amanda Timler, Professor Beth Hands and Dr Fleur McIntyre

Please note that this research has not been endorsed by the school or the Department of Education. If you are interested in participating in this research you must deal directly with the researcher. Before deciding to participate in this research you should inform yourself of its appropriateness and suitability for you. If participants have any complaint regarding the manner in which a research project is conducted, it should be directed to the Executive Officer of the Human Research Ethics Committee, Research Office, The University of Notre Dame Australia, PO Box 1225 Fremantle WA 6959, phone (08) 9433 0943, research@nd.edu.au

THE UNIVERSITY OF NOTRE DAME AUSTRALIA

PARTICIPANT INFORMATION SHEET

PROJECT TITLE: The Who.i.am study: Identity formation and motor competence among adolescents. Adolescent Focus Groups (low motor competent group)

CHIEF INVESTIGATOR: Professor Beth Hands

CO INVESTIGATOR: Dr Fleur McIntyre

STUDENT RESEARCHER: Amanda Timler

STUDENT'S DEGREE: PhD

Dear Parents,

You and your adolescent has already participated in the first phase of the research project described below.

What is the project about?

Late childhood and adolescence is a crucial time for identity development. It is a time when adolescents are questioning their place in the world and making sense of their surroundings. It's a time when future pursuits are being explored. It is when one form's an identity separate to their parents. Being able to participate in weekend sporting competitions and other informal physical activities are also very important for social interactions. However we don't know to what extent an adolescent's level of motor competence impacts on the formation of their identity. The results of this study will be important in helping us understand what is involved in this important process. This is the second phase of the study. Thank you for your contribution to date.

Who is undertaking the project?

This project is being conducted by Ms Amanda Timler and it will form the basis for her PhD at The University of Notre Dame Australia, under the supervision of Professor Beth Hands and Dr Fleur McIntyre.

What will your adolescent be asked to do?

Your adolescent is now invited to participate in a focus group. The primary researcher, Amanda, would like to talk to your adolescent about what factors they feel have been important in developing their sense of identity. The focus group will take about 90 minutes and will be at a location close to your child's school. It will be audio recorded then transcribed to help the researcher ensure an accurate record of their responses. The group will involve 6-8 adolescents whose scores on the AMCQ questionnaire were at the lower end of the motor competence spectrum. Generally this is nothing to be concerned about.

What will you be asked to do?

The primary researcher would like to interview you about your perceptions surrounding the development of your adolescent's identity and issues related to their motor competence. The researcher will also be able to discuss your adolescent's test results, strategies to support them and answer any other questions. The interview should take approximately 60 minutes at a convenient location.

Are there any risks associated with participating in this project?

As this may be the first time your adolescent has been asked questions about their self-perceptions and their motor competence level, you may wish to seek additional support or information. This is available from the research team. For example, your child may be eligible to participate in the AMPitup exercise program currently running at UNDA

(http://www.nd.edu.au/research/ihrr/ampitup_index.shtml) or for more general information about low motor competence please visit http://www.movegrowengage.com.au/ or https://www.canchild.ca/.

What are the benefits of the research project?

Participating in this project will help to inform other adolescents about personal experiences in one's sense of identity. It will also allow the researchers to better understand support networks that are important to your adolescent.

Can you withdraw from the study?

Participation in this study is completely voluntary. Your adolescent is not under any obligation to participate. If your adolescent agrees to participate, he/she can withdraw from the study at any time without adverse consequences.

Will anyone else know the results of the project?

Information gathered about your adolescent will be held in strict confidence. This confidence will only be broken in instances of legal requirements such as court subpoenas, freedom of information requests, or mandated reporting by some professionals. Confidentiality will be maintained throughout the project and no first names will be published. Data will be stored securely in the School of Health Science at The University of Notre Dame Australia for a period of five years. The study's findings will be published through journal articles and by thesis.

Will you be able to find out the results of the project?

The results of this study will be written up in a journal article. A copy can be made available to you on request.

Who do I contact if I have questions about the project?

If you have any questions about the project, please do not hesitate to contact Amanda Timler via email: Amanda.Timler1@my.nd.edu.au.

What if I have a complaint or any concerns?

The study has been approved by the Human Research Ethics Committee at The University of Notre Dame Australia (approval number 014121F). If you wish to make a complaint regarding the manner in which this research project is conducted, it should be directed to the Executive Officer of the Human Research Ethics Committee, Research Office, The University of Notre Dame Australia, PO Box 1225 Fremantle WA 6959, phone (08) 9433 0943, research@nd.edu.au. Any complaint or concern will be treated in confidence and fully investigated. You will be informed of the outcome.

I want to participate! How do I sign up?

If you wish to participate, please sign the attached consent form and return to Amanda Timler at the University of Notre Dame, School of Health (Amanda.Timler1@my.nd.edu.au)

Yours sincerely,

Ms Amanda Timler, Professor Beth Hands and Dr Fleur McIntyre

Please note that this research has not been endorsed by the school or the Department of Education. If you are interested in participating in this research you must deal directly with the researcher. Before deciding to participate in this research you should inform yourself of its appropriateness and suitability for you.

If participants have any complaint regarding the manner in which a research project is conducted, it should be directed to the Executive Officer of the Human Research Ethics Committee, Research Office, The University of Notre Dame Australia, PO Box 1225 Fremantle WA 6959, phone (08) 9433 0943, research@nd.edu.au

THE UNIVERSITY OF NOTRE DAME AUSTRALIA

CONSENT FORM

The Who.i.am study: Identity formation and motor competence among adolescents. Focus Groups.

INFORMED CONSENT FORM FOR PARENTS OR GUARDIAN

I, *(Parent/Guardian's name)* _____hereby consent to my child, *(Child's name)* _____being a volunteer participant in the above project.

- I have read and understood the Information Sheet and any questions have been answered to my and my child's satisfaction.
- I understand that my child may participate in this study, realising that I, or my child, may withdraw at any time without prejudice.
- I understand that all information gathered by the researcher will be treated as strictly confidential, except in instances of legal requirements such as court subpoenas, freedom of information requests, or mandated reporting by some professionals.
- I understand that the protocol adopted by the University Of Notre Dame Australia Human Research Ethics Committee for the protection of privacy will be adhered to and relevant sections of the *Privacy Act* are available at http://www.nhmrc.gov.au/
- I agree that any research data gathered for the study may be published provided my name or my child's name and other identifying information is not disclosed.
- I understand that my child will be audio-taped.

PARENT/GUARDIAN'S SIGNATURE:		**DATE:**	
CHILD'S SIGNATURE:		**DATE:**	
RESEARCHER'S FULL NAME:	AMANDA TIMLER		
RESEARCHER'S SIGNATURE:		**DATE:**	

Please note that this research has not been endorsed by the school or the Department of Education. If you are interested in participating in this research you must deal directly with the researcher. Before deciding to participate in this research you should inform yourself of its appropriateness and suitability for you.
If participants have any complaint regarding the manner in which a research project is conducted, it should be directed to the Executive Officer of the Human Research Ethics Committee, Research Office, The University of Notre Dame Australia, PO Box 1225 Fremantle WA 6959, phone (08) 9433 0943, research@nd.edu.au

Draft email to parents (Department of Education):

SCHOOL OF HEALTH SCIENCE

THE WHO.I.AM STUDY; IDENTITY FORMATION AND MOTOR COMPETENCE IN ADOLESCENTS

School Principal Information

Dear [Insert Principles name],

Adolescence is a crucial time for identity development as often they are questioning their place in the world and making sense of their surroundings. During this time, being able to participate in weekend sporting competitions and other informal physical activities are also very important for social interactions, peer relationships which can influence how adolescents form who they are. We want to examine how motor competence impacts identity formation in adolescence.

In this project we will investigate the relationship between self-perceptions, identity formation and motor competence in boys and girls between the ages of 14 to 16 years. This project asks your school to help recruit participants by placing an advertisement in the school newsletter and sending an email to the parents of the appropriate age group. If distributing information by email is not appropriate, alternatively you could distribute a hard copy information letter which includes links to the surveys.

The adolescents and their parents will both need to participate by completing a few questionnaires that are available online. The adolescents will complete three questionnaires around their self-perceptions, identity formation and motor competence. This should take about 30 minutes to complete. Their parents will complete two questionnaires around their child's motor coordination and impulsivity and hyperactivity. This should take about 15 minutes. Participating will not interrupt school classes as the questionnaires can be completed outside of school hours, and be completed online or if preferred by handing out hardcopies. The adolescents who participate in the study will go into a draw to win a $50 iTunes voucher.

In addition, a small subsample of participants who nominate on the consent form will be contacted a second time to participate in an adolescent focus group or a parent interview (these will not take place at school). This is to gather more indepth information about who may be impacting identity formation during adolescence.

If required, I, the Chief Investigator can arrange a time that is convenient to meet and discuss the project with the appropriate teacher of the 9, 10 and 11 year groups. In addition, I would require the school to email parents with a covering email that will provide the links in which they could assess if they wish to participate.

Would your school like to help us recruit participants for this project?

Your school is under no obligation to help recruit for this study but if you are willing to help, please contact me on 0439 966 943 or email Amanda.Timler1@my.nd.edu.au. To answer any questions, I will ring you in a few days.

You can be assured that this information will be treated confidentially and that the data collected will remain anonymous. Data will be stored securely in the School of Health Science at The University of Notre Dame Australia for a period of five years. The study's findings will be published through journal articles and by thesis.

If you have any questions regarding this research please do not hesitate to contact me.

Thank you for considering your schools involvement.

Amanda Timler

Chief Investigator

Professor Beth Hands, and Dr Fleur McIntyre

Co-Investigators

PARTICIPANT INFORMATION SHEET

THE UNIVERSITY OF NOTRE DAME AUSTRALIA

Consent Form

- I have read this document and understand the aims, procedures, and risks of this project, as described within it.
- For any questions I may have had, I have taken up the invitation to ask those questions, and I am satisfied with the answers I received.
- I am willing for *Atwell College* to become involved in the research project, as described.
- I understand that participation in the project is entirely voluntarily.
- I understand that *Atwell College* is free to withdraw its participation at any time, without affecting the relationship with the research team or the University of Notre Dame.
- At any point data can be withdrawn from the study
- I understand that this research may be published in a journal, provided that the participants or the school are not identified in any way.
- I understand that *Atwell College* will be provided with a copy of the findings from this research upon its completion.

Name of Site Manager/Principal (printed): _____

Signature: _____ Date: / /

PARTICIPANT INFORMATION SHEET

The Who.i.am Study

Identity Formation and Motor Competence in Adolescents

Interested in doing some Research to find more about your motor skills and who.i.am?

Early adolescence is a crucial time for identity development. It is a time when adolescents are questioning their place in the world and making sense of their surroundings. It's a time when future pursuits are being explored. It is when one forms an identity separate to their parents. Being able to participate in weekend sporting competitions and other informal physical activities are also very important for social interactions. However we don't know to what extent an adolescent's level of motor competence impacts on the formation of their identity. These results will be important in helping us understand what is involved in this important process.

Who can participate?

Adolescents in year 9, 10 & 11 will complete questions around:

1. Self-perceptions
2. Identity formation
3. Motor competence (these should take about 30 minutes).

Their parents will complete:

1. Motor competence questionnaire
2. Attention, impulsivity and activity questionnaire (these should take about 15 minutes).

As a thank you for participating, your name will go into a draw to *win a $50 iTunes Voucher*.

You can also chose to participate in Phase 2; Focus Group discussion with adolescents or an interview for parents.

Interested to get involved? Click on the links below:

The first link is for **Parents,** please complete your questions first.
The last question will ask you to generate a unique code to ensure that you have given consent for your child to participate. Give this code to your child and tell them to replace the last letter with an A.
https://qtrial2015az1.az1.qualtrics.com/SE/?SID=SV_a4aNKVHfYxCM6kB

Below is the link for your **child(ren)**:
https://qtrial2015az1.az1.qualtrics.com/SE/?SID=SV_3mcNhqpGC0TxC3b

Please contact me if you have any difficulties with the links or if you would prefer to receive hardcopies of the questionnaires.

Chief Investigator,
Amanda Timler

THE UNIVERSITY OF NOTRE DAME AUSTRALIA

This project is being conducted by Ms Amanda Timler and it will form the basis for her PhD, under the supervision of Professor Beth Hands & Dr Fleur McIntyre.

Please note that this research has not been endorsed by the school or the Department of Education. If you are interested in participating in this research you must deal directly with the researcher. Before deciding to participate in this research you should inform yourself of its appropriateness and suitability for you.

PARTICIPANT INFORMATION SHEET

THE WHO.I.AM STUDY: IDENTITY FORMATION AND MOTOR COMPETENCE IN ADOLESCENTS

Dear Parents,

Adolescence is a crucial time for identity development as often they are questioning their place in the world and making sense of their surroundings. During this time, being able to participate in weekend sporting competitions and other informal physical activities are also very important for social interactions, peer relationships can influence how adolescents form who they are. We want to examine how motor competence impacts identity formation in adolescence.

Amanda Timler is completing her PhD through the University of Notre Dame and is recruiting 14 to 16 year olds and their parents to complete a couple of questions. Parents will be asked questions around their child's motor coordination and impulsivity and hyperactivity. Their children will be asked around self-perceptions, identity formation and motor competence. All participants who complete both the parent and the adolescent part will go into a draw to win a $50 iTunes voucher. To participate click on the links provided below, or email Amanda Timler on Amanda.timler1@my.nd.edu.au to receive hard copies of the surveys.

The first link is for **Parents,** please complete your questions first.
The last question will ask you to generate a unique code to ensure that you have given consent for your child to participate. Give this code to your child and tell them to replace the last letter with an A. (this will only take 15 minutes to complete)

https://qtrial2015az1.az1.qualtrics.com/SE/?SID=SV_a4aNKVHfYxCM6kB

Below is the link for your **child(ren)**: (this will take 30 minutes to complete)

https://qtrial2015az1.az1.qualtrics.com/SE/?SID=SV_3mcNhqpGC0TxC3b

Please do not hesitate to contact me if you have any difficulties in using these links or any further questions regarding the study.

Kind Regards,

Amanda

Please note that this research has not been endorsed by the school or the Department of Education. If you are interested in participating in this research you must deal directly with the researcher. Before deciding to participate in this research you should inform yourself of its appropriateness and suitability for you.

APPENDIX D: Media

Wednesday 14 September 2016

Getting physical key to a greater sense of self in adolescents

Research by Notre Dame's Institute for Health Research reveals motor coordination development is integral to the creation of a positive identity in adolescents.

Studies by PhD candidate, Amanda Timler, show that adolescents with higher levels of motor coordination (HMC) form a healthier and more integrated identity than those with lower levels of motor coordination (LMC).

"Regardless of motor coordination levels, men reported healthier identities because they participated in many sports or physical activities. On the other hand, women with LMC experienced the greatest barriers to developing a healthy, coherent identity as they experienced greater pressure and stress about their future goals," Amanda said.

"Women compared themselves negatively to others on many occasions and experienced fractured friendships. We also found that most parents only had a moderate understanding of their child's level of motor coordination, especially those with daughters.

"However, adolescents with HMC may also exhibit unhealthy identity development signs to those with LMC if they have low levels of social

support or lack of confidence. This may also be compounded if their parents do not support their future goals and ambitions, or place upon them unnecessary stress."

One reason for this is the increased levels of social support received by the HMC group compared with the LMC group. Amanda's research also shows differences between male and female adolescents with women more negatively impacted by LMC.

Data for the study was sourced from 160 adolescents aged between 14-16 years who completed three surveys about their self-perception and identity development. Parents of adolescents with low motor coordination were also surveyed.

The survey results not only showed that peer groups and social support levels were influential factors in the construction of an adolescent's identity, but also that parents needed guidance to recognise adolescents with LMC or experiencing stress and anxiety.

"Parents should be encouraged to ensure their son or daughter is involved in a range of social activities that are of interest to them and provide the opportunity to develop effective and robust peer relationships," Amanda said.

"Parents can help by providing their children with positive reassurance and support towards their future goals and allow them to explore their interests across a range of social settings. They also need to provide their children with a level of independence so they can develop their own unique identity."

Titled: 'The who.i.am study: Motor competence and Identity Formation in Adolescence' Amanda is due to complete her PhD research in December 2016. Amanda is being supervised in her research by Professor Beth Hands and Associate Professor Fleur McIntyre from The University of Notre Dame Australia's Fremantle Campus.

The DCD12 International Conference (Developmental Coordination Disorder) is being hosted in Fremantle from 5-8 July 2017. Please visit www.dcd12.com.au for more information.

To explore Notre Dame's Institute for Health Research and its research projects, please visit nd.edu.au/ihr.

Ends

Media Exposure:

Radio Station	Time	Presenter	Show	Date
ABC Perth	6.15 am	Alex Hyman	Physical activity participation among adolescents (Amanda Timler) and the elderly (Professor Celia Cornwell).	September 22nd 2016
ABC Kimberly	8.00 am	Jacqueline Wright (Saturday Morning Show)	Identity heath and sport among adolescents (20 minutes pre-recorded interview).	September 30th 2016

APPENDIX E: Publications and presentations forming part of this thesis

Timler, A., McIntyre, F., Cantell, M., Crawford, S. & Hands, B. (2016). The development and evaluation of the psychometric properties of the Adolescent Motor Competence Questionnaire (AMCQ) for Adolescents. *Research in Developmental Disabilities*, 59, 127-137. Doi:http://dx.doi.org/10.1016/j.ridd.2016.08.005

Research in Developmental Disabilities 59 (2016) 127–137

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Research in Developmental Disabilities

Development and evaluation of the psychometric properties of the Adolescent Motor Competence Questionnaire (AMCQ) for Adolescents

Amanda Timler [a,*], Fleur McIntyre [b], Marja Cantell [c], Susan Crawford [d], Beth Hands [a]

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Developmental Coordination Disorder

ABSTRACT

Background: There are no valid and reliable self-report measures designed to identify level of motor competence and suspected motor difficulties among 12–18 year old adolescents.
Aim: This paper reports the development and evaluation of a self-report questionnaire (Adolescent Motor Competence Questionnaire; AMCQ) to address this need.
Method: The project proceeded in 3 phases; (A) item development, (B) content evaluation, and (C) examination of reliability and validity of the final questionnaire. Each phase was informed by criteria A and B in the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5), comments from a sample of 10 adolescents aged between 12 and 18 years with a range of movement skills, key informants and international experts. A convenience sample of 38 adolescents completed the final version of the AMCQ. The McCarron Assessment of Neuromuscular Development (MAND) was used to investigate concurrent validity.
Results: The final version of the AMCQ comprised 26 items scored using a 4 point Likert scale with a maximum score of 104. Analyses revealed the questionnaire has an acceptable internal consistency (0.902) and 7 day test-retest reliability (0.956). A moderate positive correlation between the AMCQ and the MAND of 0.491 ($p < 0.002$) provides some evidence of concurrent validity.
Conclusion: The development of the AMCQ was exploratory in nature and has the potential to be a reliable and valid tool for measuring motor competence in Australian adolescents.

What this paper adds

This paper reports the development of a new measure, the Adolescent Motor Competence Questionnaire (AMCQ), designed to identify suspected motor difficulties in adolescents aged between 12 and 18 years. The protocol used to develop the questionnaire allowed for a large pool of items to be developed and evaluated. The inclusion and exclusion of these

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http://dx.doi.org/10.1016/j.ridd.2016.08.005
0891-4222/

items are discussed and the preliminary results presented. The evidence indicates that the AMCQ has the potential to be used to investigate the level of motor competence in adolescents. Further examination of the measure using data with a larger sample is required.

1. Introduction

Adolescents with Developmental Coordination Disorder (DCD) are unable to perform motor tasks with the same level of proficiency as most of their peers (Kirby, Edwards, & Sugden, 2011a). This impacts on the performance of many activities of daily living including self-care, and participation in recreation and sporting activities (Kirby, Edwards, & Sugden, 2011b). Common synonyms used in the literature for DCD include low motor competence (LMC), motor difficulties, motor impairment, poor coordination and suspected motor difficulties (SMD). For many years, it was thought that DCD was primarily evident during childhood with a prevalence between 5 and 10% (American Psychiatric Association [APA], 2013). However, a number of studies have reported that between 50 and 70% of those identified during childhood still experience motor difficulties into adolescence (Cantell, Smyth, & Ahonen, 2003; Losse et al., 1991) and adulthood (Kirby, Sugden, Beveridge, & Edwards, 2008). Consequently, for the first time the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5; APA, 2013) included central features and information about adolescents and adults with DCD.

Given its impact on many aspects of an individual's health and well-being it is important to identify those with SMD as early as possible. Unfortunately, motor difficulties often go undetected and many children enter adolescence without any recognition of their condition. Adolescence is a particularly important phase of development for a number of reasons. Many health-related behaviours, such as participation in physical activity and sports are important social occasions (Cairney et al., 2010; Hands & Larkin, 2002; Okely, Booth, & Patterson, 2001; Raz-Silbiger et al., 2015), and for those with SMD, sedentary activities become preferred over physical activities (Cairney et al., 2010; Hands & Larkin, 2002; Raz-Silbiger et al., 2015). They avoid participating in physical activity opportunities, such as community sports, which reduces their opportunities to socialize which may impact their peer relationships (Fitzpatrick & Watkinson, 2003; Kirby, Edwards, Sugden, & Rosenblum, 2010) and lead to social isolation (Piek, Baynam, & Barrett, 2006; Poulsen, Ziviani, & Cuskelly, 2007). In addition, peer victimization or bullying may lead to increased anxiety and depression (Pratt & Hill, 2011). Many families, teachers and even health professionals are unaware of the condition, consequently many adolescents remain undiagnosed and do not access support networks that could provide information, advice and a sense of belonging (Lingam, Novak, Emond, & Coad, 2013). A timely identification of motor difficulties before adulthood is therefore important for minimising these negative consequences, gathering support, building self-confidence and assisting in negotiating future pursuits such as employment opportunities.

At present, clinical tests or parent questionnaires are primarily used to identify adolescents with SMD. The most common clinical tests for adolescents are the Bruininks-Oseretsky Test of Motor Proficiency, Second Edition (BOT-2) which accommodates 4- to 21-year-olds (Bruininks & Bruininks, 2005), the Movement Assessment Battery for Children, Second Edition (MABC-2) designed for 3- to 16-year-olds (Henderson, Sugden, & Barnett, 2007) and the McCarron Assessment of Neuromuscular Development (MAND; McCarron, 1997) suitable for 3.5-year-olds to young adult. Given the cost to purchase test kits, train testers and implement the assessment (generally between 20 and 30 min) these tests are not suitable for large studies (Hands, Licari, & Piek, 2015). One alternative is to use a valid and reliable questionnaire which is cheaper to print or purchase, generally does not require tester training, is easier to administer to large groups, and may identify individuals in need of support and intervention (Clark, Thomas, Khattab, & Carr, 2013). The most widely used questionnaire is the Developmental Coordination Disorder Questionnaire (DCDQ'07; Wilson et al., 2009) which is designed for parents of children aged between 5 to 15 years. However, this is not ideal for adolescents as parents may try to report on aspects they may not fully understand nor be aware of. For example, adolescents may experience negative social interactions, such as bullying or teasing by peers but they refrain from telling parents as it may become worse once parents get involved (Missiuna et al., 2008b).

Self-report questionnaires enable adolescents to report on their own movement abilities (Missiuna, Gaines, Soucie, & McLean, 2006; Tal-Saban, Ornoy, Grotto, & Parush, 2012). To date, three questionnaires have been published for older adolescents and adults. The Adult Developmental Coordination Disorders/Dyspraxia Checklist (ADC) was based on the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV; American Psychiatric Association, 1994). It is a 40 item questionnaire designed for 17- to 42-year-olds (Kirby et al., 2010) and distinguishes between DCD, at risk DCD and no DCD (Kirby et al., 2010). It requires participants to report on current movement difficulties, as well as movement history. The psychometric properties of the ADC showed good internal consistency, construct and concurrent validity and discriminant validity. The Functional Difficulties Questionnaire-9 items (FDQ-9; Clark et al., 2013) is an adult questionnaire developed for 18–65 year-olds using the guidelines from the International Statistical Classification of Diseases and Related Health Problems 10 revision (ICD-10; World Health Organisation, 2007) and the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (DSM-IV-TR; American Psychiatric Association [APA], 2000). The FDQ-9 used three different samples ranging from 257 to 30 participants to establish initial psychometric properties which reported an acceptable internal consistency, construct validity, diagnostic accuracy and an identified cut-off score. Finally, the Adolescents and Adults Coordination Questionnaire (AAC-Q; Tal-Saban et al., 2012) was based on criteria A and B from the DSM-IV-TR (APA, 2000). It is a 12 item questionnaire developed for 16- to 35-year-olds and had acceptable internal consistency, construct validity and discriminant validity. The development of the AAC-Q used data from a large sample of 2379 adolescents (aged between 19

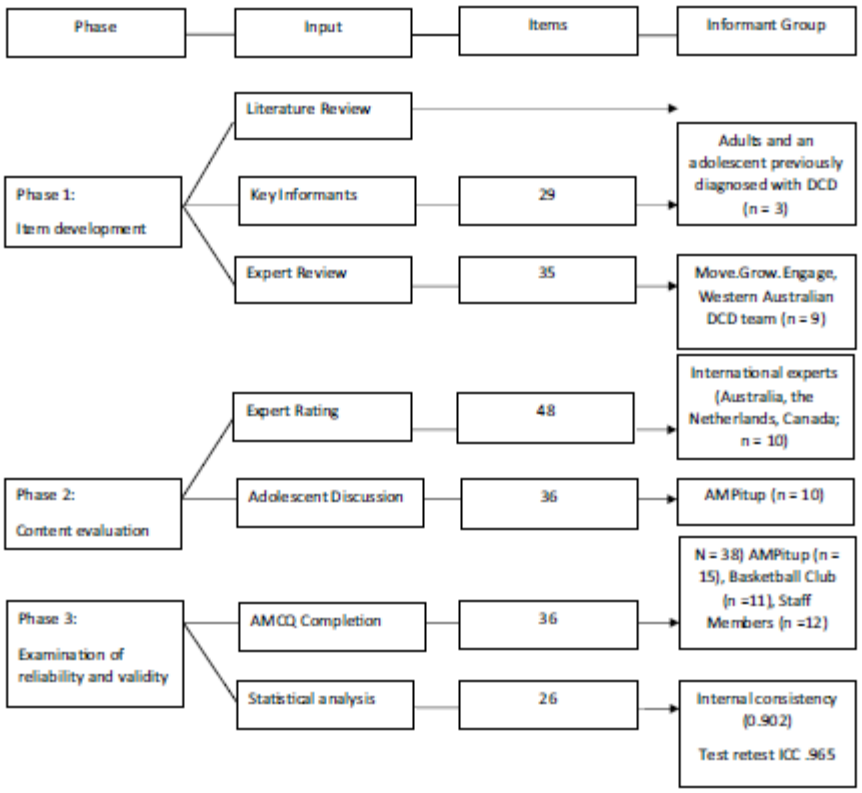

Fig. 1. The inclusion and exclusion of items during the three phases undertaken to develop the AMCQ.

to 25-years) and identified diagnostic cutoff scores to identify DCD for both clinical and research use (5th–15th percentile, 1.00–1.65 *SD*). Evidence of concurrent validity was not reported for the FDQ-9 or the AAC-Q.

None of these questionnaires have been specifically developed for adolescents aged between 12 and 18 years. An important time for motor difficulties to be recognised as they experience many social, behavioural and emotional challenges during this time. In addition, activities of daily living and sports participation are often different from those undertaken by older adults. These issues have been noted in the DSM-5 (APA, 2013). For example, during adolescence a high importance is placed on self-image (e.g. getting ready to go out, putting on make-up) and participation in after school and weekend sporting opportunities. Criterion B also mentions daily activities such as dressing, engaging in new games and using classroom tools (scissors or rulers) that may impact differently on an adolescent (APA, 2013).

The purpose of this paper is to report on the development and evaluation of a self-report questionnaire, the Adolescent Motor Competence Questionnaire (AMCQ; Timler, McIntyre, Cantell, Crawford, & Hands, 2015) to identify SMD in 12- to 18-year-olds. It is not considered to be an exclusive diagnostic tool for DCD as it was not possible to include items relating to criteria C and D from the DSM-5 which refer to intellectual disabilities or visual impairments. Although this questionnaire can contribute to a diagnosis, a clinical test and expert advice is also needed. A range of items involving age-appropriate functional tasks, activities of daily living, common motor skills and informed by the DSM-5 were considered (APA, 2013; Kwan, Cairney, Hay, & Faught, 2013).

2. Methods and results

The development of the questionnaire proceeded in three phases. An overview of the steps taken to develop the AMCQ and the number of items included or excluded in each phase is shown in Fig. 1. This project was approved by the Human Research Ethics Committee of the University of Notre Dame in Perth, Western Australia.

2.1. Phase 1: AMCQ content development

Item development of the AMCQ used a mixed method approach to maximise ecological and content validity (Onwuegbuzie, Bustamante, & Nelson, 2010; Polit & Beck, 2006; Wilson, Emslie, Hazel, Alderman, & Burgess, 2010). Poten-

Table 1
Sample items from the AMCQ.

Questions	Never	sometimes	frequently	always
I PREFER TO PARTICIPATE IN INDIVIDUAL SPORTS (SUCH AS SWIMMING, MARTIAL ARTS, ATHLETICS) RATHER THAN TEAM SPORTS (SUCH AS FOOTBALL AND NETBALL) (+)				
I CAN RIDE A BICYCLE				
I FIND IT HARD TO USE A FORK OR A KNIFE WHEN EATING A MEAL (+)				
MY HAND WRITING IS FAST ENOUGH TO KEEP UP WITH THE REST OF THE CLASS				
I BREAK OBJECTS ACCIDENTLY MORE OFTEN THAN MY FRIENDS (+)				
I HAVE TROUBLE LEARNING NEW OUTDOOR GAMES (+)				
I CAN CATCH A BALL CONSISTENTLY				
I WOULD RATHER BE A SPECTATOR THAN PARTICIPATE IN THE SPORTS GAME (+)				
I CAN EASILY FLOSS BETWEEN MY TEETH				
I HAVE TROUBLE LEARNING NEW OUTDOOR GAMES (+)				
I CAN USE SCISSORS TO NEATLY CUT OUT A PICTURE FROM A MAGASINE				

(+) means that the items is positively worded, and has been reverse scored.

tial test items were initially identified by an extensive literature search using the search terms; DCD, motor competence, motor difficulties, adolescents and adults. Both qualitative and quantitative studies were examined to identify questionnaires related to motor competence (Clark et al., 2013; Kirby et al., 2011b; Tal-Saban et al., 2012; Wilson et al., 2009), and the language and terminology typically used by adolescents (Barnett, Dawes, & Wilmut, 2013; Fitzpatrick & Watkinson, 2003; Kirby et al., 2011b). Given the diagnostic criteria of DCD described in the DSM-5 (APA, 2013), items were included that reflected a range of skills involving aspects of sports, schooling, self-care, activities of daily living, and fine or gross motor tasks typical of adolescents (APA, 2013; Cousins & Smyth, 2003; Fitzpatrick & Watkinson, 2003; Kirby et al., 2011b; Losse et al., 1991; Missiuna et al., 2008a). An initial 29 items were developed (see Fig. 1) using a Likert scale response format of Never (1), Sometimes (2), Frequently (3), and Always (4; see Table 1). In order to avoid response bias, fourteen of the 29 items were reverse scored. The four point Likert scale was chosen rather than an odd numbered response (such as 5 points) to avoid a neutral, undecided midpoint (Lynn, 1986; Polit & Beck, 2006).

Three key informants (2 adults and an older adolescent) who had been diagnosed with DCD, reviewed each item using personal insight based on their lived experience. Consequently, another six items were added and additional examples for some items included, such as, putting on makeup, doing up zip-lock bags, and using a can opener (see Fig. 1). These 35 items were subsequently reviewed by nine experts (psychologists, academics, and members of Western Australian DCD research collaboration team move.grow.engage who have all specialised in the area of DCD) for language, terminology, user-friendliness, ecological and content validity and to ensure a balance of tasks that represented both Criteria A and B from the DSM-5 (APA, 2013). A further 13 items were subsequently included resulting in 48 items. These included items involving social elements like shying away from social events such as dances, feeling neat and tidy on social occasions, keeping up with friends while walking or running and preferring not to participate in physical education classes.

2.2. Phase 2: content validation and item assessment

Content validation of the 48 items was undertaken by an international panel of 10 experts (psychologists, epidemiologists, physiotherapists and academics who specialised in the area of DCD) from Australia, the Netherlands and Canada. Each rated the relevance of each item on a scale of 1 (not relevant) to 4 (highly relevant) to derive a Content Validity Index (CVI) for each item. This was calculated by dichotomizing the items into relevant and not relevant (Polit & Beck, 2006) by grouping those that scored a 3 or 4, and those that scored a 2 or 1. The number of experts who rated an item as relevant was divided by the total number of experts to create a CVI for each item ranging from 0.01 to 1.0. Eight items scored total agreement (CVI = 1.0) and 14 items received 9 out of 10 agreement (CVI = 0.9). Twelve items with a CVI of 0.6 or below were eliminated (Polit & Beck, 2006) resulting in 36 items (see Fig. 1). The eliminated items included: feeling uncomfortable when running, using a computer rather than a pen and a paper to write, running as fast as friends, facing challenges when multitasking, participating in recreational verse competitive sports, feeling neat and tidy on social occasions, keeping the bedroom organised and tidy, naming right and left sides, shying away from social events like school dances, avoiding compulsory school activities like sports carnivals, spending leisure time on their own rather than with friends, and flinching when a hard or fast ball is thrown.

Informal, one-on-one interviews and small group discussions to consider these 36 items were undertaken with 10 adolescents (6 boys and 4 girls) diagnosed with DCD and aged between 12 and 18 years (mean age = 14.89 years). They were recruited through AMPitup, a physical fitness program for adolescents with DCD (http://movegrowengage.com.au/). The participants sat with the primary researcher and discussed each item considering comprehensibility and age-appropriateness. They provided further suggestions for items and in some cases rephrased them to be more age-appropriate (e.g. *I can walk as fast as my friends* changed to *I can keep up with my friends when walking*).

Table 2
Descriptive statistics [M,(SD)] of the participants involved in Phase 2 of AMCQ development.

	Total $N = 38$ (28 males) M, (*SD*)	SMD (≤85) $n = 23$ (16 males) M, (*SD*)	TD (> 85) $n = 15$ (12 males) $n = 3$ females) M, (*SD*)	Group Difference (p)
Age (yrs)	14.18, (*1.43*)	13.87, (*1.18*)	14.67, (*1.67*)	0.093
NDI	96.92, (*24.91*)	114.36, (*14.30*)	71.33, (*10.46*)	0.001
AMCQ	82.71, (*11.62*)	87.39,(8.77)	75.53, (*12.04*)	0.001

SMD—Suspected motor difficulties; TD—typically developing; NDI—Neuromuscular Developmental Index (M = 100, SD = 15); AMCQ – Adolescent Motor Competence Questionnaire (total score = 104).

2.3. Phase 3: reliability and validity of the AMCQ

In this phase the internal consistency, test-retest reliability, and concurrent validity of the 36-item AMCQ was examined and a preliminary cut score for the identification of SMD identified. A convenience sample of 38 Australian adolescents with a range of motor competence was recruited (Table 2). To ensure some experienced motor difficulties, 15 diagnosed with DCD were recruited from AMPitup, others were children of university staff members (n = 12); of unknown motor competence ability, and a local basketball sporting club (n = 11) considered to have higher motor competence skills. Ages ranged from 12- to 17- years, (M_{age} = 14.18 years, SD = 1.43; 74% male, 26% female). The inclusion criteria also specified English as the first language and no other diagnosed movement-related disability such as autism spectrum disorder (ASD), cerebral palsy, learning difficulties or muscular dystrophy.

Participants completed the 36 item AMCQ and the MAND at the same test occasion (McCarron, 1997). The time of completion for the AMCQ was less than 10 min (average 4.53 min). The MAND was administered by Exercise and Sports Science professionals with over 10 years' experience in identifying motor difficulties. The MAND is a standardised assessment tool that is widely used to identify mild to severe motor disability (McCarron, 1997). It comprises five fine and five gross motor items, which involve both qualitative and quantitative components, and takes about 25 min to administer. Raw scores are standardised and summed to derive a Neuromuscular Development Index (NDI; M = 100, SD = 15). NDI scores between 85 and 70 indicate mild motor disability and below 70 indicates a severe motor disability. Evidence of reliability, and content, construct, predictive and concurrent validity is provided by McCarron (1997). Its concurrent validity, as indicated by sensitivity and positive predictive value for identifying 5- to 11-year-olds with SMD, was assessed as good when compared with BOTMP-SF (Bruininks, 1978) by Tan, Parker and Larkin (2001). McCarron (1997) has reported test-retest reliability coefficients of 0.99. In Australia, the MAND has been used as a measure of motor coordination in children (Brantner, Piek, & Smith, 2009; Hands, Kendall, Larkin, & Parker, 2009a), and adolescents (Hands, Kendall, Larkin, & Parker, 2009a; Hands et al., 2009b; Hands, Larkin, & Rose, 2013; Hands, Parker, Rose, & Larkin, 2015b; Hands et al., 2015a; McIntyre, Chivers, Rose & Hands, 2015; Rose, Larkin, Parker, & Hands, 2015). To date, however, no studies have reported evidence of validity with an adult sample.

In the current study, based on the MAND NDI scores, the sample comprised a broad range of motor competence; 23 (61%) had no motor disability (>85), 10 (26%) had a mild disability (85-70) and five (13%) had a severe motor disability (<70). The total scores of the AMCQ ranged between 62 and 102 (total possible score 26–104). Significant group differences for both the NDI and AMCQ scores were found between the adolescents identified not to have SMD (typically developing group; TD; >85) and the SMD group (≤85; Table 2).

2.3.1. Test-retest reliability

Eighteen of the 38 participants completed the 36-item AMCQ version seven days after the initial administration. A 7 day test-retest interval was used as this time frame is most commonly used by others (Polit, 2014). Unfortunately, due to missing responses and non-applicable options for some items, only 26 of the 36 items in the final version of the AMCQ were able to be included in the analysis. The intra-class correlation coefficient (ICC; two-way mixed model, absolute-agreement) between the total scores for these items was 0.956 (95% confidence interval: 0.888–0.983; $p < 0.001$), which is above the recommended minimum standard of 0.7 (Terwee et al., 2007). A Kappa coefficient for each item ranged between 0.90–0.17. The item with the lowest score related to flossing between teeth. There was no significant difference between the total AMCQ scores between Occasion 1 (M = 87.94, SD = 10.34) and Occasion 2 scores (M = 88.82, SD = 10.05; t (16) = −1.22, $p < 0.001$).

2.3.2. Internal consistency

Cronbach's alpha was calculated to examine the internal consistency of the 36-item AMCQ. The best fit was determined through the inclusion and exclusion of test items to achieve an acceptable alpha of >0.7 (Cronbach & Meehl, 1955). Ten items with a corrected item-total correlation of less than 0.3 (Pallant, 2013) were removed resulting in 26 items (see Table 1 for a sample of items) with a high internal consistency (α = 0.902). The removed items related to movement skills such as driving a manual car, being tired when physically active, food preparation skills and self-care skills such as shaving.

Table 3
Table of derived cut scores, sensitivity and specificity.

Cut score	C-value	Sensitivity	Specificity
80	68%	53%	78%
81	69%	60%	74%
82	71%	73%	72%
83	74%	80%	70%
84	71%	80%	65%
85	68%	87%	56%

C-Value represents the total proportion of agreement between the AMCQ and the NDI score from the MAND.

Table 4
The decision of agreement between the Adolescent Motor Competence Questionnaire (AMCQ) and the McCarron Assessment of Neuromuscular Development (MAND).

		MAND (criterion measure)		
AMCQ (cut score = 83)		NDI ≤85	NDI >85	Total
	AMCQ score ≤83	12 (a)	7 (b)	19
	AMCQ score >83	3 (c)	16 (d)	19
	Total	15	23	38
	Proportion of agreement = 0.74			

a = classification agreement, b = classification disagreement against MAND, c = classification disagreement against AMCQ, d = classification agreement. Proportion of agreement = {[(a + d)/total sample] × 100}.

2.3.3. Preliminary cut score for identifying suspected motor difficulties

A potential cut point to identify adolescents with SMD was derived based on the total score for the final 26-item AMCQ version (Crawford, Wilson, & Dewey, 2001; Riggen, Ulrich, & Ozmun, 1990). Using the NDI from the MAND (McCarron, 1997) as the criterion measure, the decision of agreement proportion (represented as a C-value in Table 3) was calculated for a range of cut scores from the AMCQ (80–85). The average total score (out of 104) for those participants with an NDI of ≤85 was used to inform this range of cut scores. A relatively conservative preliminary score of 83 was identified as the most valid cutoff score (Table 3), as it showed the highest discrimination accuracy based on the sensitivity (true-positive rate) and specificity (true-negative rate) data (Safrit & Wood, 1995). The sensitivity of the AMCQ was consistent in classifying 80% [a/(a + c)] of adolescents identified with SMD by the MAND (see Table 3). The specificity of the AMCQ was lower with 70% [d/(b + d)] of adolescents identified as TD by the MAND, and classified as TD by the AMCQ (see Table 3). Nineteen of the 38 participants (a + b; 50%) scored ≤83 on the AMCQ (Table 4). The overall proportion of agreement between the two tests was 74% {[(a + d)/total sample] × 100}. Of the 38 adolescents, 15 (a + c) were classified as having SMD based on the NDI (score ≤85), and 12 of those cases were also identified by the AMCQ (AMCQ score ≤83). Three adolescents were classified with SMD by the MAND and not by the AMCQ. Seven adolescents were classified with SMD by the AMCQ and not by the MAND.

2.3.4. Concurrent validity

The total score for the AMCQ was compared with the NDI from the MAND to examine concurrent validity. The MAND is a widely used standardised test designed to assess motor competence. Fig. 2 depicts the line of best fit and the 95% confidence limits between the scores for these two measures. It reveals a moderate positive correlation ($r = 0.491$, $p < 0.002$) between the two scores, with only the score for one participant slightly outside the lower limit of 95. The positive correlation demonstrates that the higher the NDI (>85 = TD), the higher the total score on the AMCQ (>83 = TD). The TD group had a significantly higher AMCQ score ($M = 87.39$, $SD = 8.77$) than the SMD group ($M = 75.53$, $SD = 12.04$; $t(36) = -3.5$, $p < 0.001$).

To further investigate the ability of the items to discriminate between levels of motor competence, the mean scores for each item were ranked based on the mean score differences between the TD group and SMD group (Fig. 3). These ranged from −0.23 (item 18) to +0.96 (item 20). The three items that were significantly different between the TD and SMD groups related to individual over team sports (item 2, $p = 0.008$), speed of writing (item 17; $p = 0.002$) and flossing teeth (item 20; $p = 0.002$).

3. Discussion

The development of the AMCQ was exploratory in nature and followed a robust process. It was undertaken over three phases and the results indicate that the 26 item questionnaire has the potential to be a valid and reliable measure for adolescents to self-report on their level of motor competence. The development of the AMCQ was examined in a number of ways to ensure the ecological presence of the condition was captured (Wilson et al., 2010) and that the criteria for the diagnosis of DCD were considered. The time to complete the questionnaire was acceptable. It took adolescents less than 10 min to complete thereby minimising response fatigue that may cause poor motivation or loss of attention (Moser & Kalton, 1971). Other adult and older adolescent questionnaires also reported similar completion times of up to 10 min (Kirby et al., 2010; Tal-Saban et al., 2012).

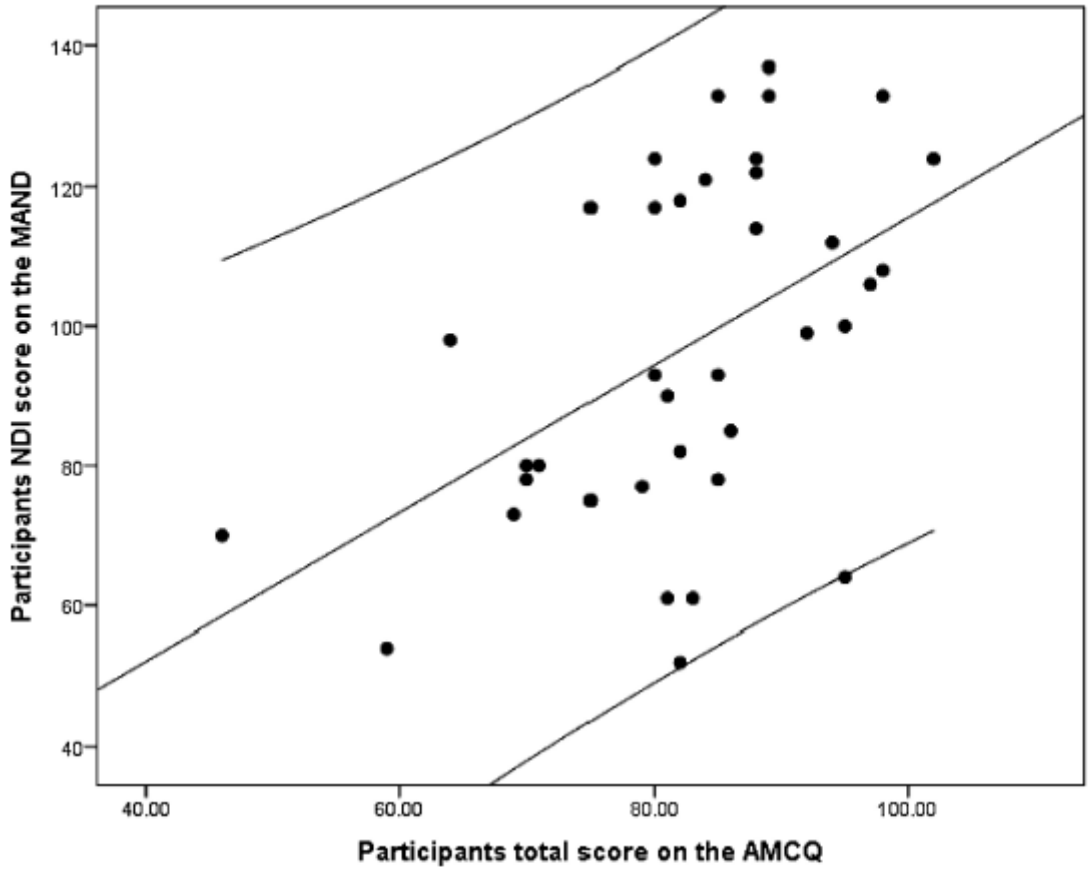

Fig. 2. The distribution of the total scores on the AMCQ (total score = 104) and the NDI (≤85 mild to severe difficulty >85 no motor difficulty) score from the MAND, based on the line of best fit and 95% confidence intervals.

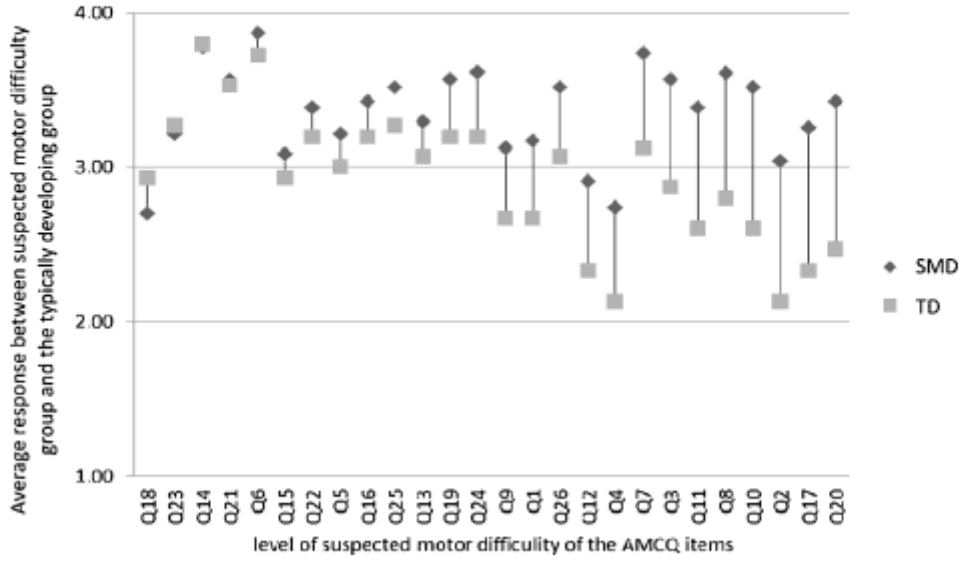

Fig. 3. Mean AMCQ scores for the suspected motor difficulty (SMD; NDI ≤ 85) and the typically developing (TD; NDI > 85) groups. Items are sequenced based on the mean difference between the TD group. 1 = never and 4 = always.

The items considered for inclusion were drawn from a number of sources. These included the range of motor skills used as exemplars in the DSM-5 (APA, 2013), suggestions from adolescents with SMD, and experts from the field. The consultation process to validate the content was similar to that followed by other developers of motor difficulty questionnaires (Kirby et al., 2010; Tal-Saban et al., 2012). Consequently, items relating to sport, academics, fine and gross motor skills and activities of daily living, personal care, peer comparisons and co-occurring characteristics were included. Assumptions are often made that items measuring motor competence in children can simply be modified in a variety of ways to accommodate an older age group (Hands et al., 2015a,b). However, during the validation process we found this was not the case and the inclusion or exclusion of items are discussed below. The final version of the AMCQ is able to discriminate between adolescents with and without SMD as evidenced by the significant difference between both NDI and AMCQ scores for the SMD and TD groups (Table 2).

Physical activities such as kicking, catching and throwing a ball (Clark et al., 2013; Tal-Saban et al., 2012; Wilson et al., 2009; van der Linde et al., 2014), jumping (Wilson et al., 2009), participating in extreme sports, dancing, riding a bicycle (Tal-Saban et al., 2012), or participating in team games (Clark et al., 2013; Kirby et al., 2010) have been included in other questionnaires as they are considered to be difficult for those with SMD. Therefore, the AMCQ also includes items involving ball skills such as kicking (item 4), catching (item 8) and throwing (item 1) as well as static (on one foot; item 24) and dynamic balance (walking on a narrow straight line; item 25). Such tasks are important for both younger children and adolescents (APA, 2013). The mean scores for all of these items in the AMCQ clearly distinguish between the SMD group and the TD group (Fig. 3). On the other hand, items more relevant to adolescence and not childhood related to playing ball games like team sports (APA, 2013).

Difficulties with fine motor skills such as utensil or scissor use, learning a musical instrument, threading a needle or hammering a nail (Clark et al., 2013; Kirby et al., 2010; Wilson et al., 2009; van der Linde et al., 2014) are also common for individuals with motor difficulties. Consequently, most motor assessment questionnaires include items related to handwriting (van der Linde et al., 2014), fast or legible writing (Kirby et al., 2010; Tal-Saban et al., 2012; Wilson et al., 2009), quality of the hand writing (Clark et al., 2013) and appropriate tension while writing (Wilson et al., 2009). Such items are very relevant given slowness or inaccuracy of handwriting may be experienced throughout the lifespan (Bo et al., 2014; Kirby et al., 2008; Prunty, Barnett, Wilmut, & Plumb, 2014), and may impact on academic productivity and achievement of future goals (APA, 2013). Therefore, The AMCQ also included handwriting items about ease of reading (item 12) and speed of writing (item 17) as well as the use of scissors (item 11) and flossing between teeth (item 20). These latter two items attracted some of the largest mean differences in scores between the SMD and TD groups and may be of particular relevance among adolescents (Fig. 3).

Personal and self-care is a central feature of criterion B of the DSM-5 (APA, 2013) and need to be considered when assessing motor difficulties. For example, one parent report questionnaire included items related to washing hands, drying after a shower, and putting on socks (DCDDaily-Q; van der Linde et al., 2014) while another designed for adults included difficulty tying shoelaces, fastening buttons, doing zips, and shaving or putting on make-up (ADC; Kirby et al., 2010). The AMCQ included items about getting ready to go out (item 7) and speed of changing clothes (item 22). These items were suggested by the target group so are probably more age-appropriate in content and wording than the wording in other questionnaires.

DCD is often diagnosed concurrently with other developmental disorders such as Autism Spectrum Disorder, learning difficulties or Attention Deficit Hyperactivity Disorder (ADHD; Loh, Piek, & Barrett, 2011; van Damme, Sabbe, van West, & Simons, 2015). When examining item content of other questionnaires used with this age group, it appeared some items related to symptoms associated with these co-occurring conditions rather than DCD. Examples include organizational skills (Clark et al., 2013; Tal-Saban et al., 2012), finding new buildings or things in the bedroom, ability to sit still (Kirby et al., 2010), not fatigue, and slouching (Wilson et al., 2009). In the first phase, items that strongly related to possible co-occurring disorders (facing challenges while multitasking, keeping the bedroom neat and tidy), were included however the only item that remained in the final version related to confusion between right and left sides (item 16). This highlights the value of discussing and validating the content of questionnaire items with the target audience rather than only parents or academics. For example, in this study, the adolescents advised that they did not value neat and tidy bedrooms as it was a space for personal expression.

The AMCQ has several unique features. It includes items about perceptions of sports participation as many adolescents avoid participating in activities that expose their weaknesses and highlight their difficulties, even from a young age (Cairney et al., 2010; Fitzpatrick & Watkinson, 2003; Kwan et al., 2013; Raz-Silbiger et al., 2015). For example, being a spectator (item 10), learning new games (item 26) and the preference for participation in individual sports over team sports (item 2) are coping strategies adopted by adolescents with motor difficulties. Fitzpatrick and Watkinson (2003) found adolescents with motor difficulties still wanted to participate in physical activities for social reasons so they often volunteered for jobs such as organizer or team manager. Adolescents with motor difficulties reflecting on their childhood reported that learning new motor tasks was difficult (Missiuna et al., 2008a) and that fear of failure was the greatest barrier to participating in new activities as they grew older (Barnett, Dawes, & Wilmut, 2013; Fitzpatrick & Watkinson, 2003). As with the fine motor items, scores for items relating to peer comparison in sports participation had greater mean differences between the SMD group and the TD group (Fig. 3). Most adolescents develop their friendship groups primarily based on the socializing opportunities associated with sports participation (Missiuna et al., 2008a; Payne et al., 2013). Such peer-related items are important to include with this age group yet have been overlooked in other questionnaires. It is possible that during later adolescence

and into adulthood, peer relationships are developed around more sedentary social activities as they enter the workforce or later education (Kirby et al., 2011a; Kirby et al., 2011b).

Surprisingly, the SMD group had similar or more positive mean scores than the TD group for three items (items 14, 18, 23; Fig. 3), although none were significantly different. Responses to Item 18 (nervous about coming last in a running race) suggest that the TD group experience greater feelings of nervousness about their performance when running than the SMD group. This could be because the SMD group know they are not going to perform well, as they have experienced coming last for most of their school life. It could also be that participation in running races during athletic carnivals becomes optional in secondary school, and the SMD group choose not to participate. Rose et al. (2015) found that many adolescents with motor difficulties withdrew from physical activities involving social comparison. Barnett, Cliff, Morgan, and van Beurden (2013) reported that a common motivator for individuals with SMD to participate in sport or physical activity was related more to social engagement than competition. Another item relating to breaking objects accidently more than friends (item 23) also attracted similar scores. This is surprising as the AMPitup participants consulted in the second Phase considered this item reflected their poor co-ordination. However, the result could reflect a number of strategies put in place by the adolescent and/or his family to minimise breakages (Summers, Larkin, & Dewey, 2008). Finally, both groups scored similarly for Item 14 (difficulty using a fork and knife) which suggests that adolescents with SMD used utensils in a way that masked their motor difficulties, or their difficulty was accepted by the family, and this activity was not an issue (Fitzpatrick & Watkinson, 2003; Missiuna et al., 2008a). It is also possible that as the item did not adequately describe what was considered acceptable practice (e.g. not using a shoveling technique). These three items were retained in the AMCQ as the internal consistency measure remained high. However, their inclusion may be reconsidered after analyzing data from a larger sample.

A consideration of the content of excluded items also contributes to a better understanding of the impact of motor difficulties during adolescence. These related to difficulties using video game controllers, keeping up with friends while walking and tiring easily when being physically active. Unfortunately, these could be experienced by many unfit, low active, yet typically developing adolescents. Other items excluded related to fine motor skills such as using a vegetable peeler, possibly because adolescents with SMD avoided these tasks when helping with meal preparation. Finally, items that were mainly relevant for older adolescents such as shaving or learning to drive were removed.

3.1. Study limitations and strengths

Given this was an exploratory study, the sample size used to derive the preliminary cut score was small and therefore a limitation. Further research involving a larger sample may confirm the most valid cut score for identifying those with motor difficulties. At the same time, further evidence of the concurrent validity of the tool could be gathered by simultaneously assessing motor competence using the MAND. This study also had a number of strengths. The wide range of methods used for item generation and content validation, including consultation with local and international experts, and individual interviews and discussions with the target audience resulted in a rich selection of potential items. The in-depth discussions with the adolescents ensured the content and wording of each item captured the ecological presence of motor competence difficulties in this age group. The preliminary results reported here provide evidence of internal consistency, test-retest reliability and concurrent validity. It is the first self-report questionnaire developed to assist in identifying young adolescents with SMD.

4. Conclusions

The AMCQ has the potential to assist in future research and is a useful addition to the range of tools used to assess motor competence. Further research is needed to explore possible clinical applications of the questionnaire, for example to examine if a childhood diagnosis of DCD is still present during adolescence or to identify the extent of SMD in adolescents with other developmental disabilities such as ASD, ADHD or learning disabilities. Responses from the AMCQ will provide information to researchers about adolescent's perceptions of their SMD and may also be useful for families and health professionals to better understand the condition in this age group.

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Article Title: Factors Contributing to Australian Adolescents' Self-Report of Their Motor Skill Competence

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Abstract

An adolescents motor skill competence can affect areas such as sports participation, social activities and future academic or employment decisions. The Adolescent Motor Competence Questionnaire (AMCQ) is a 26-item questionnaire that uses a four point Likert response (never, sometimes, frequently, always) to assess motor-related activities during adolescence. This study aims to provide evidence of the construct validity using Principle Component Analysis (PCA) and to identify factors that contributed to Australian adolescent self-reported motor competence. A final aim was to determine whether individual item responses differed between males and females. The AMCQ was completed by 160 adolescents (M_{age} = 14.45 *SD* = .75, 12 to 16). The PCA using varimax rotation extracted four factors (Eiqenvalue of 1.21 or above) explaining 52% of variance and representing Participation in Physical Activity and Sports, Activities of Daily Living, Public Performance, and Peer Comparison. Overall males reported higher AMCQ scores compared to females. Females responded negatively (sometimes/never) to all items particularly those on Physical Activity and Sports and Public Performance. Males who responded negatively had lower AMCQ scores than the females. These findings indicate male and female adolescents may judge their motor competence on different factors, which should be considered when planning physical activity interventions.

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Factors that contribute to an adolescent's judgement or perception of their competence differ across settings or domains such as academic capability, social engagement, athletic prowess, physical appearance, and close friendships (Harter, 2012). One domain of particular importance during adolescence is level of motor competence. Harter (2012) describes motor competence as an adolescent's perceived athletic ability and preference to participate in sports and physical activity such as outdoor games. An adolescent's perceived judgement of their motor competence may influence their ability to participate in activities of daily living and socially desirable activities such as sports and recreational activities (Okely, Booth, & Patterson, 2001; Ullrich-French & Smith, 2009) and is influenced by cultural and societal norms (Harter, 2012; Rose, Hands, & Larkin, 2011). For example, Timler and colleagues (2016) found Australian adolescents' level of motor competence affected their participation in sports and social occasions, the way they compared themselves to their peers, completed school-based activities such as handwriting and other fine motor tasks as well as many activities of daily living. The impact of differences in proficiency of motor performance may be driven by cultural influences such as the value placed on sporting prowess (Hagger, Asci, & Lindwall, 2004).

In Australia, a high value is placed on participating in physical activity and sporting achievements, therefore it is likely that an adolescent's perceived motor competence may be closely linked to their actual motor competence (Stodden et al., 2008) which influences their willingness to be involved in physical activity, as well as their level of self-esteem, self-confidence and even social support (Harter, 2012; Phillips & Pittman, 2007; Vannatta, Gartstein, Zeller, & Noll, 2009). The consequences for those adolescents who experience or perceive themselves to have poor coordination or a lower motor competence, is that they are less likely to join in school or community sporting opportunities and potentially risk lower psychosocial outcomes such as self-concept (Harter, 2012), social support (Barnett, Cliff, Morgan, & van Beurden, 2013), goal orientation (Moreno-Murcia, Sicilia, Cervello, Huescar, & Dumitru, 2011) and self-efficacy

(Cairney et al., 2005). Some may volunteer for sedentary roles such as spectator, team organizer, team manager or score keeper (Fitzpatrick & Watkinson, 2003; Missiuna, Moll, King, Stewart, & Macdonald, 2008). Others may prefer participating in individual sports (Timler et al., 2016) or choose to withdraw from all physical activity opportunities (Fitzpatrick & Watkinson, 2003). Consequently this may affect social support mechanisms (family, sporting, school and issues related to health systems) and even lead to health issues such as higher stress and anxiety (Campbell, Missiuna, & Vaillancourt, 2012; Missiuna, Moll, King, King, & Law, 2006).

An additional factor to be considered is gender difference (Cliff et al., 2009; Reed et al., 2004; Ziviani et al., 2009), as the level of participation in physical activity and the importance they place on their motor competence differs between males and females throughout their lifespan (Cairney, Hay, Faught, Mandigo, & Flouris, 2005; Hands, Larkin, Parker, Straker, & Perry, 2009; Hands, Parker, Rose, & Larkin, 2015; Hill, Brown, & Sorgardt, 2011; Piek, Baynam, & Barrett, 2006). For example, males usually participate in a variety of sporting activities throughout their lifespan as this provides them with many social opportunities. Females tend to participate in physical activity during childhood which tends to become less important during adolescence and into adulthood (Hands et al., 2016). Regardless of level of motor competence, males usually place greater importance on their motor competence and participate in more high intensity physical activity such as sport (Cairney, Kwan, Hay, & Faught, 2013; Hands et al., 2015), while females often participate in less vigorous activity as they place greater importance on looking presentable and being physically attractive (Harter, 2012; Vannatta et al., 2009). For example, Hands et al. (2015) found 14-year-old males rated involvement in physical activity as important as it gave them a chance to compete, to win, and spend time with friends. On the other hand, the 14-year-old females felt physical activity prevented them from doing other things that they liked (Hands et al., 2015).

During this emotionally fragile phase of adolescence it is important to develop a better understanding about what factors contribute to an adolescent's judgement of their own motor competence (Harter, 2012; Hill et al., 2011; Kroger, 2007; Timler et al., 2016). Apart from involvement in sports and recreational activities and activities of daily living, it is unclear what other influences contribute to an adolescent's judgement of their motor competence. Few measures have been designed to gather this information. One such tool is the Adolescent Motor Competence Questionnaire (AMCQ) which is designed for 12 to 18 year olds and has evidence of internal consistency, test-retest reliability and concurrent, but not construct validity with this age group. The aims of this study, therefore, were to use PCA to provide evidence of the construct validity of the AMCQ and secondly to identify factors that contributed to Australian adolescent self-reported motor competence. A final aim was to determine whether individual item responses differed between males and females.

Method

Participants

A sample of 160 Australian adolescents (103 males, M_{age} = 14.44 years, SD = 0.75) completed the Adolescent Motor Competence Questionnaire (AMCQ). They were recruited through personal contacts (n = 6), an adolescent movement clinic (n = 4), community sporting clubs [Australian Rules Football League (AFL; n = 69), netball (n = 6) and basketball clubs (n = 7)] and local schools [independent (n = 60) and government (n = 8)]. The inclusion criteria specified adolescents to be aged between 12 and 16 years; have English as their first language, good linguistic and cognitive ability sufficient to comprehend questions and no other diagnosed disability such as cerebral palsy, learning difficulties or muscular dystrophy. This project was approved by the Human Research Ethics Committee of the University of Notre Dame in Perth, Western Australia.

Measures

The Adolescent Motor Competence Questionnaire (AMCQ; Timler et al., 2016) is a self-report motor competence questionnaire developed for adolescents between the ages of 12- and 18-years of age. It consists of 26 items examining the ecological presence of motor tasks and functional activities of daily living and was informed by the DSM-V criteria for Developmental Coordination Disorder (DCD; American Psychiatric Association [APA], 2013). Participants respond on a 4-point Likert scale of Never (1), Sometimes (2), Frequently (3), and Always (4). The maximum AMCQ score is 104, with a higher score indicating a higher level of motor competence. A score of 83 and below indicates suspected motor difficulties. To account for response bias, fifteen items are negatively worded. These are reverse scored for the analyses to Never (4), Sometimes (3), Frequently (2) and Always (1). The questionnaire was originally designed in consultation with adolescents diagnosed with DCD to ensure the items discriminated between high and low motor competence. The questionnaire has evidence of concurrent validity against the McCarron Assessment of Neuromuscular Development (MAND; McCarron, 1997), test re-test reliability (intra-class correlation coefficients = 0.956), internal consistency ($\alpha = 0.902$; Timler et al., 2016) and can be completed in less than 10 minutes.

Procedures

Data collection took place over a two year period. The questionnaire and written consent forms were distributed to personal contacts (n = 6), an adolescents movement program (n = 4), and sporting clubs [one AFL club (140), two basketball clubs (50) and one netball club (20) were approached and agreed to participate]. The questionnaire and consent form responses were collected two weeks later (response rate 92 returned /210 distributed = 44%). Additional clubs including scouts, a sailing club, a performing arts theatre, and a photography club were contacted in regards to the study, however these clubs did not agree to assist in the recruitment process. Two music schools distributed flyers to age appropriate

participants, although no one agreed to participate. The primary researcher also contacted the Occupational Therapy Association in Perth Western Australia for potential participants, however no response was received.

Students in years 9, 10 and 11 attending schools in the Perth metropolitan were also contacted. A total of 34 government (34/137 schools in Perth = 25%), 54 Independent (54/62 schools in Perth = 87%) and 9 Catholic (9/25 schools in Perth= 36%) schools were contacted within the metropolitan area. However, only 5 government and 7 independent schools agreed to assist in recruiting participants. Potential participants who indicated an interest in being involved were then provided with consent forms and questionnaire, which they could complete online or as a hard copy. Schools that opted for hard copies obtained written consent before the adolescents completed the AMCQ during an allocated class (response rate 38 returned /65 = 58%). One Independent school handed out hardcopies of the questionnaires and consent form with a paid-reply envelope so participants could complete and place both items in the mail at a time convenient for them (response rate 30 returned /140 = 21%). Online completion enabled teachers and year group coordinators to email parents about the study (n = 19 completed). This method was adopted for six schools. The overall response rate was 39% (Total of 160 returned /415). Adolescents were able to complete the questionnaire and online consent form at a time convenient to them.

Data Analysis

SPSS version 23 (SPSS Inc., Chicago, IL, USA) was used to analyse the data. Descriptive statistics were derived for the total sample, males and females. The data were tested for normality, and the skewness (+/-1) and kurtosis (+/-1) values indicated that parametric tests could be used for analyses (Pallant, 2013). Firstly, a Principal Component Analysis (PCA) of the participant's responses was conducted using varimax rotation to examine construct validity and how many factors would emerge from

the 26 items. This was chosen as PCA is a form of factor analysis that is commonly used during scale development and evaluation (Pallant, 2013). A second order analysis was completed to examine if one higher order factor occurred. The factors were named according to the best representation of similar items. As 15 items were negatively worded, scores were reversed and reworded into positive language. The authors grouped the responses into negative (sometimes and never) or positive (frequently and always). Treating the responses at this nominal level made it easier to interpret individual item responses. These terms were chosen to represent responses where activities or experiences were easy or positive compared to difficult or negative (e.g. coming last in a running race). Individual item responses were compared between males and females within each factor. With the total AMCQ score as the dependent variable, a General Linear Model (GLM) analysis was completed separately for each of the 26 items controlling for response category (positive or negative) and gender. Finally a chi square analysis compared the percentage of positive and negative responses by males and females for each item. Given the same dataset was used for multiple statistical analyses, to reduce the chance of Type 1 error statistical significance was set at p<.001.

Results

The mean score for the AMCQ was 86.55 (*SD* = 11.41). Males had a higher AMCQ score (*M* = 89.29, *SD* = 10.86) than the females (*M* = 81.60, *SD* = 10.78; *t* (158) = 4.30, *p* <.001). There was no significant difference between hardcopy (*M* = 86.98, *SD* = 10.61) and online AMCQ scores (*M* = 83.37, *SD* = 16.20; *t* (158) = 1.30, *p* = .09)

Factors contributing to self-reported motor competence

The PCA using varimax rotation extracted four factors with an Eigenvalue of 1.21 or above explaining 52.31% of variance, and supported by the scree plot. The Kaiser-Meyer-Olkin value was .871 (*p* <.001) which indicated the sample was suitable for analysis (Pallant, 2013) as it exceeded the

recommended value of .6. Items loading onto Factor 1 represented *Participation in Physical Activity and Sports* (Table 1). This factor comprised ten items asking about participating in the sports game, ball skills, outdoor games, individual versus team sports, bicycle riding and balancing on one foot. The second factor, *Activities of Daily Living* was represented by eight items related to flossing teeth, getting ready to go out, handwriting, using scissors, changing clothes, and walking in a straight line. The third factor comprised five items addressing *Public Performance* such as stumbling upstairs, being called clumsy, breaking objects, confusion between left and right and difficulty using a fork or a knife. The fourth factor included items related to *Peer Comparisons* such as being able to complete tasks (asking for help), coordinated like their friends, not thinking they are clumsy and not coming last in a running race. Factor loadings for all items ranged between .876 and .348. Some items such as balance, walking along a straight line and coordinated like friends loaded to a similar extent onto several factors. To investigate the construct validity of the AMCQ a second order analysis was undertaken using the first four first order factors. This yielded a one factor solution explaining 59.54% of the variance with factor loadings ranging between .735 and .796.

Group differences for individual items

Not surprisingly, there were significant differences (p<.001) in the participants' mean AMCQ scores between response categories (positive or negative) for all items (Table 2). Those who responded negatively to items had lower Total AMCQ scores than those who responded positively. Significant differences (p<.001) in mean AMCQ scores were also evident between males and females for 12 items (Table 2), in all cases favouring the males. Seven of these items loaded onto the Activities of Daily Living factor. Males scored lower in some items, but these were not significant.

A number of interactions between response category (positive or negative) and gender (p<.05) emerged for eight items from the Participation in Physical Activities and Sports factor (participate in sports

game $p = .007$, participate in sports at school $p = .037$, catch a ball consistently $p = .005$, learn new outdoor games $p = .006$, ride a bicycle $p = .006$, balance $p = .005$) and Public Performance factor (right and left sides identified $p = <.001$, use a fork and knife $p = .001$). In these instances, the mean AMCQ scores for the males who responded negatively were lower than the mean scores for the females who also responded negatively. Figure 1 shows the interaction between male and female responses for the item 'use a fork and knife' as an example.

The chi square analyses were significant for a number of items (Table 2/3). A higher percentage of the females compared to males responded negatively to seven items, primarily relating to Participation in Physical Activities and Sports (in particular, ball skills such as hit, kick, and throw) and Peer Comparison. For example, 37% of females compared to 14% males responded negatively to being able to hit a ball with a bat. Most males responded positively to the test items.

Discussion

The PCA of the AMCQ scores identified four factors that contributed to Australian adolescent self-report of their motor skill competence. These were related to Participation in Physical Activities and Sports, Activities of Daily Living, Public Performance and Peer Comparison. The males in the sample had higher mean AMCQ scores than the females and were more likely to respond positively to many of the questionnaire items compared to the females. In particular items relating to Participation in Physical Activities and Sports and Public Performance.

The four factors from the AMCQ were named according to the best representation of items and based on evidence of factors developed for other questionnaires such as Fine Motor/Handwriting, Gross Motor/Planning and General Coordination (Wilson et al., 2009), Fine and Gross Motor Function and Writing, Activities of Daily Living, and Organization Skills (Tal-Saban, Ornoy, Grotto, & Parush, 2012). However, a couple of items on the AMCQ loaded onto a number of factors. For example, 'use of fork and

knife' loaded onto the Public Performance factor even though it is an activity of daily living. Clearly, to use these utensils efficiently a degree of coordination is required. 'Balance' loaded onto Participation in Physical Activities and Sport, however it is also needed during activities of daily living such as dressing and tying shoelaces and can be observed through peer comparisons. 'Walking along a straight line' loaded onto Activities of Daily Living. This activity also requires coordination and can be easily observed by peers. 'Co-ordinated like friends' loaded onto Peer Comparisons, however an adolescent's participation in physical activities and sport and their level of co-ordination are also important for this item. Although some items loaded onto a couple of factors, all four factors converged into one higher order factor of motor competence. This is an important finding to acknowledge as it demonstrates the AMCQ has construct validity.

These results highlight the greater perceived importance placed by males on participation and sport based activities and physical activity than females (Harter, 2012; Ullrich-French, & Smith 2009). It has been suggested that cultural norms often dictate what each gender "should" focus on regarding certain activities, which in turn affects self-perceptions. These different expectations and social norms for men and women are then reinforced through environmental influences, including the media and parents (Harter, 1993). This is supported given the strong sporting culture in Australia and the level of adoration afforded to our sporting heroes, particularly male athletes (Vandello, Bosson, Cohen, Burnaford, & Weaver, 2008). Unfortunately, female athletes are often not given the same level of recognition (Angelini, 2008). Parents of boys have also been reported to hold higher perceptions of their competence in physical tasks and consider sport as more important, in comparison to girls (Fredricks & Eccles, 2005). Even from a young age, Australian males see participation in physical activities as an opportunity to win, compete and hang out with their friends (Hands et al., 2015; Rose et al., 2011). In this study, even the males with self-reported low levels of motor competence responded positively to most

items relating to sport participation. Cairney et al. (2013) also found that Canadian males, regardless of motor skill competence, were more likely to participate in physical activities. It is possible that males benefit from sports participation to a greater extent than females as studies have found that males prefer competitive orientated activities (Mehta & Strough, 2010), experience positive social involvement in organized physical activities which improves resiliency skills (Zimmerman et al., 2013), and develop larger social support networks with team mates and adult figures (Guan & Fuligni, 2016; Ullrich-French & Smith, 2009). This contributes to a positive sense of self and a healthy identity (Doumen et al., 2012). In our study, more females, regardless of level of perceived motor competence, responded negatively towards participation in physical activities such as ball skills, and participating in sports. This finding is not surprising as adolescent females tend to participate in less physical activity (Cairney et al., 2005; Cairney et al., 2013). They tend to place greater importance on close friendships, emotional support, activities relating to their appearance (Byrd-Craven & Geary, 2007; Harter, 2012; Rose et al., 2011) and participate in co-operative rather than competitive activities (Hands et al., 2015; Labbrozzi, Robazza, Bertollo, Bucci, & Bortoli, 2013; Mehta & Strough, 2010; Rose et al., 2011). Consequently factors that contribute to their perceived motor competence are not strongly related to sports participation. Studies have shown that only females with high levels of actual and perceived motor competence continue to participate in sports during their adolescence (Barnett, Dawes, & Wilmut, 2013). This may be dependent on the changes in a female's motor proficiency from childhood through to adolescence (Barnett, van Beurden, Morgan, Brooks, & Beard, 2010). For example, many begin to place greater focus on developing close friendships rather than physical activities (Tatlow-Golden & Guerin, 2017).

It is unclear from the results whether females have a more realistic view of their own ability, assess themselves more negatively compared to their male counterparts or males overrate their motor competence. The gender interactions for six items involving participating in sports, catching a ball,

learning new outdoor games, riding a bicycle and balancing revealed that those males who responded negatively had a lower overall AMCQ score compared to the females who responded negatively. This suggests that those males with lower self-reported motor competence were more aware of their inability to complete these physical performance tasks than other factors.

There is some evidence that females receive health benefits from lighter physical activity and do not require the same intensity and amount of physical activity compared to males (Hands, Parker, Larkin, Cantell, & Rose, 2016), and are often less motivated to participate (Labbrozzi et al., 2013). Other studies have also suggested that perceived competence plays a role in engagement of physical activity (Ferrer-Caja & Weiss, 2000; Sollerhed et al., 2008), therefore girls may choose to participate less due to feelings of poor competency in physical activity tasks and place less value on sports participation (Fredricks & Eccles, 2005; Slater & Tiggemann, 2011). Furthermore, males and females may experience contrasting views towards sporting stereotypes (Schmalz & Davison, 2006) and gender identity roles (Spoor & Hoye, 2014) as well as use different coping strategies to deal with their perceived inadequacies in their motor competence (Harter, 2012; Miyahara & Cratty, 2004). These include placing themselves out of sight during team sport selections, using humour to diffuse the situation (Fitzpatrick & Watkinson, 2003; Missiuna et al., 2008), devalue the area/domain of disadvantage, select a reference group that suits their perceptions and discount any negative attitudes directed towards them (Crocker & Major, 1989). It is possible that females base their judgement of their own motor competence on factors associated with activities of daily living rather than participation in sport and deal with the impact in different ways to males.

The ability to efficiently complete some activities of daily living emerged as a factor influencing adolescent self-report motor competence. The males had higher AMCQ mean scores, when controlling for response category, for all items relating to activities of daily living than the females. The males may

be discounting the importance of performing these activities well compared to females who tend to place more importance on their personal appearance and body image (Harter, 2012; Kilpatrick, Herbert, & Bartholomew, 2005; Weiss & Smith, 2002), fine motor skills such as neat and fast handwriting and creative activities such as arts and crafts (Barnett, Henderson, Scheib, & Schulz, 2011). Furthermore, social norms place greater pressure on females to perform well in daily activities (Vandello et al., 2008).

Not surprisingly, Public Performance emerged as a factor evidenced by stumbling upstairs, being called clumsy, frequently breaking objects, confusing left and right sides, and having difficulty using a fork or a knife. This result suggests that an adolescent's perceived and actual motor competence may be closely related. These movement difficulties are very public and reinforce to the adolescent their own inadequacies (Cairney et al., 2005; Fitzpatrick, & Watkinson, 2003; Stodden et al., 2008). Interestingly, only males with very low perceived competence reported having difficulty distinguishing between right and left side and using eating utensils. This may be a result of many males discounting the importance of these skills, whereas the females may be more accepting of their difficulties.

Finally, issues associated with Peer Comparisons emerged as an important factor. Those with lower motor competence were aware they were more uncoordinated than their friends, they knew they would come last in a running race, thought they were clumsy and often had to ask for help. Peer acceptance and spending time with friends becomes very important during adolescence (Guan & Fuligni, 2016). Several qualitative studies have found that level of motor competence affects social acceptance during this time (Barnett et al., 2013; Payne, Ward, Turner, Clare Taylor, & Bark, 2013). Rose and colleagues (2015) also found that self-perceptions around close friendships, social acceptance, romantic appeal and physical appearance were dependent upon level of motor competence among Australian adolescents.

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Not surprisingly, Public Performance emerged as a factor evidenced by stumbling upstairs, being called clumsy, frequently breaking objects, confusing left and right sides, and having difficulty using a fork or a knife. This result suggests that an adolescent's perceived and actual motor competence may be closely related. These movement difficulties are very public and reinforce to the adolescent their own inadequacies (Cairney et al., 2005; Fitzpatrick, & Watkinson, 2003; Stodden et al., 2008). Interestingly, only males with very low perceived competence reported having difficulty distinguishing between right and left side and using eating utensils. This may be a result of many males discounting the importance of these skills, whereas the females may be more accepting of their difficulties.

Finally, issues associated with Peer Comparisons emerged as an important factor. Those with lower motor competence were aware they were more uncoordinated than their friends, they knew they would come last in a running race, thought they were clumsy and often had to ask for help. Peer acceptance and spending time with friends becomes very important during adolescence (Guan & Fuligni, 2016). Several qualitative studies have found that level of motor competence affects social acceptance during this time (Barnett et al., 2013; Payne, Ward, Turner, Clare Taylor, & Bark, 2013). Rose and colleagues (2015) also found that self-perceptions around close friendships, social acceptance, romantic appeal and physical appearance were dependent upon level of motor competence among Australian adolescents.

competence scores compared to females. Males self-reported responses showed that they were particularly influenced by their ability to participate in sports and physical activities. On the other hand, activities related to daily living and the impact of Public Performance were more influential for the females. These gender differences in responses to aspects of motor performance should be considered when designing interventions or building support networks for adolescents with motor difficulties. For example, males place greater importance on sporting prowess and should be provided with competitive and noncompetitive options to be physically active, whereas females place more importance on completing activities of daily living. Programs should facilitate the promotion of an active lifestyle rather than a focus on participation and competition in team based sports and physical activities.

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"Factors Contributing to Australian Adolescents' Self-Report of Their Motor Skill Competence"
by Timler A, McIntrye F, Hands B
Journal of Motor Learning and Development

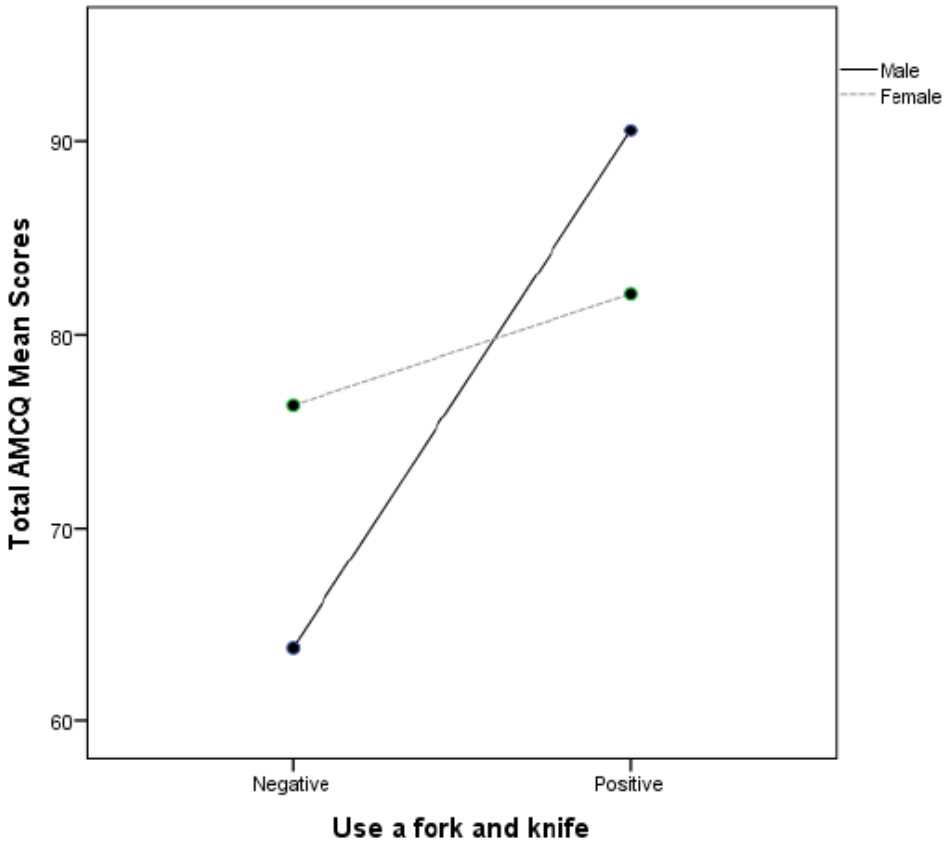

Figure 1.

"Factors Contributing to Australian Adolescents' Self-Report of Their Motor Skill Competence"
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Table 1: *Factor analysis (principal components with varimax rotation) and loading factors of the AMCQ*

Factor	Items	component			
		1	2	3	4
Participation in physical activity and sports	Participate in sports game	,876			
	Hit a ball with bat	,803			
	Kick a ball	,802			
	Participate in sports at school	,792			
	Throw a ball	,728			
	Catch a ball consistently	,717	,315		
	Learn new outdoor games	,653	,304		
	Participate in team sports	,544			
	Ride a bicycle	,427		,303	
	Balance	,348	,345		,330
Activities of Daily Living	Easy to floss teeth		,657		
	Easy to get ready to go out		,664		
	Easy to read handwriting		,637		
	Easy to use scissors		,635		
	Fast handwriting		,578		
	Change clothes easily		,510		
	Walk along a straight line		,485	,381	,314
Public Performance	Do not stumble upstairs			,756	
	People do not say I am clumsy	,338		,636	,400
	Do not break objects		,327	,632	
	Right and left sides identified			,618	
	Use a fork and knife			,592	
Peer comparison	Complete tasks				,688
	Co-ordinated like friends	,472		,317	,548
	Do not think I am clumsy			,401	,484
	Do not come last in a running race				,366
% of variance		20.55	12.36	11.46	7.9

Note: Loadings <.3 have been removed

All items have been changed in to positive worded items

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Table 2: *Mean total AMCQ scores [M(SD)] for positive and negative responses to each item for the total sample (N = 160),and for males (n = 103) and females (n = 57).*

Factor	Item	Response category				Gender	
		Positive	n	Negative	n	Male	Female
Participation in physical activity and sport	Participate in sports game	89.43 (8.63)	132	72.96 (13.17)	28	80.72 (1.53)	79.70 (1.31)
	Hit a ball with bat	89.93 (8.37)	125	74.49 (12.71)	35	84.17 (1.13)	79.75 (1.25)
	Kick a ball	91.20 (7.22)	112	75.71 (12.09)	48	84.01 (1.08)	82.77 (1.20)
	Participate in sports at school	89.32 (8.91)	131	74.03 (13.15)	29	82.29 (1.45)	79.60 (1.36)
	Throw a ball	89.45 (8.02)	135	70.88 (14.16)	25	82.09 (1.25)	78.15 (1.27)
	Catch a ball consistently	88.90 (8.30)	145	63.87 (12.73)	15	74.82 (1.91)	75.62 (1.45)
	Learn new outdoor games	88.21 (9.21)	149	64.09 (14.85)	11	75.20 (2.06)	75.53 (1.94)
	Participate in team sports	89.22 (9.90)	124	77.36 (11.64)	36	**85.71 (1.19)**	**80.05 (1.35)**
	Ride a bicycle	87.96 (9.91)	149	67.45 (13.64)	11	75.72 (2.44)	77.10 (1.93)
	Balance	87.72 (10.11)	149	70.73 (16.16	11	75.89 (2.94)	78.47 (1.91)
Activities of Daily Living	Easy to floss teeth	88.79 (8.96)	126	78.24 (15.27)	34	**86.30 (1.09)**	**77.96 (1.44)**
	Easy to get ready to go out	88.03 (9.72)	144	73.25 (16.47)	16	**83.24 (1.38)**	**74.82 (1.70)**
	Easy to read handwriting	88.50 (9.30)	111	82.12 (14.29)	49	**88.19 (1.04)**	**79.34 (1.45)**
	Easy to use scissors	89.11 (9.07)	128	76.31 (14.00)	32	**85.43 (1.11)**	**77.94 (1.39)**
	Fast handwriting	88.64 (9.52)	121	80.08 (14.21)	39	**87.10 (1.12)**	**79.43 (1.44)**
	Change clothes easily	88.18 (9.31)	141	74.42 (17.31)	19	**84.09 (1.37)**	**76.84 (1.59)**
	Walk along a straight line	87.90 (10.04)	145	73.53 (15.53)	15	**83.71 (1.60)**	**77.28 (1.66)**
Public Performance	Do not stumble upstairs	88.35 (8.99)	148	64.33 (14.88)	12	**79.12 (1.53)**	**73.10 (1.59)**
	People do not say I am clumsy	88.75 (8.86)	141	70.21 (14.83)	18	81.78 (1.45)	77.40 (1.41)
	Do not break objects	87.97 (9.67)	146	71.79 (17.13)	14	**82.70 (1.53)**	**75.44 (1.71)**
	Right and left sides identified	87.54 (10.01)	149	73.18 (19.44)	11	73.15 (2.88)	80.77 (1.87)
	Use a fork and knife	87.65 (9.93)	150	70.10 (18.62)	10	77.20 (2.25)	79.25 (2.29)
Peer Comparison	Complete tasks	88.07 (10.18)	136	77.96 (14.18)	24	**85.77 (1.29)**	**78.20 (1.57)**
	Co-ordinated like friends	88.71 (8.80)	144	67.13 (13.98)	16	80.03 (1.52)	76.25 (1.42)
	Do not think I am clumsy	90.46 (8.50)	104	79.29 (12.59)	56	86.79 (1.07)	82.02 (1.31)
	Do not come last in a running race	89.15 (9.35)	103	81.86 (13.26)	57	**88.00 (1.10)**	**81.54 (1.39)**

Bold: Gender difference p<.001

Note: All items have been positively worded

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Table 3: *The number and proportion of positive and negative responses for males (n = 103) and females (n = 57) for each item*

Factor	Item	Gender				
		Male Positive n (%)	Negative n (%)	Female Positive n (%)	Negative n (%)	x^2
Participation in physical activity and sport	Participate in sports game	**93 (91)**	**10 (10)**	**39 (68)**	**18 (32)**	**.001**
	Hit a ball with bat	**89 (86)**	**14 (14)**	**36 (63)**	**21 (37)**	**.001**
	Kick a ball	**88 (85)**	**15 (15)**	**33 (58)**	**24 (42)**	**<.001**
	Participate in sports at school	91 (88)	12 (12)	40 (70)	17 (30)	.005
	Throw a ball	**95 (92)**	**8 (8)**	**40 (70)**	**17 (30)**	**<.001**
	Catch a ball consistently	98 (95)	5 (5)	47 (82)	10 (18)	.009
	Learn new outdoor games	98 (95)	5 (5)	51 (89)	6 (11)	.179
	Participate in team sports	87 (84)	16 (16)	37 (65)	20 (35)	.005
	Ride a bicycle	99 (96)	4 (4)	50 (88)	7 (12)	.046
	Balance	100 (97)	3 (3)	49 (86)	8 (14)	.008
Activities of Daily Living	Easy to floss teeth	79 (77)	24 (23)	47 (82)	10 (18)	.382
	Easy to get ready to go out	91 (88)	12 (12)	53 (92)	4 (7)	.342
	Easy to read handwriting	66 (64)	37 (36)	45 (79)	12 (21)	.048
	Easy to use scissors	83 (81)	20 (19)	45 (79)	12 (21)	.823
	Fast handwriting	78 (76)	25 (24)	43 (75)	14 (25)	.989
	Change clothes easily	92 (89)	11 (11)	49 (86)	8 (14)	.542
	Walk along a straight line	97 (94)	6 (6)	48 (84)	9 (16)	.019
Public Performance	Do not stumble upstairs	98 (95)	5 (5)	50 (88)	7 (12)	.091
	People do not say I am clumsy	**98 (95)**	**5 (5)**	**43 (75)**	**14 (25)**	**<.001**
	Do not break objects	95 (92)	8 (8)	51 (89)	6 (11)	.565
	Right and left sides identified	100 (97)	3 (3)	49 (86)	8 (14)	.008
	Use a fork and knife	98 (95)	5 (5)	52 (91)	5 (8.8)	.334
Peer Com-parison	Complete tasks	88 (85)	15 (15)	48 (84)	9 (16)	.634
	Co-ordinated like friends	**100 (97)**	**3 (3)**	**44 (77)**	**13 (23)**	**<.001**
	Do not think I am clumsy	**78 (75)**	**25 (24)**	**26 (46)**	**31 (54)**	**<.001**
	Do not come last in a running race	74 (72)	29 (28)	29 (51)	28 (49)	.007

Bold: p<.001

Note: All items have been positively worded

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Adolescents' self-reported motor assessments may be more realistic than those of their parents

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Abstract

Introduction: Adolescents' motor competence influences their physical, social and emotional development. Parent-reported assessments may not be truly representative of their adolescent's motor difficulties. This study examined the congruency between parent- and self-reported motor competence in 133 parent-adolescent dyads.

Method: The adolescent-reported Adolescent Motor Competence Questionnaire (AMCQ; ≤83) and the parent-reported Developmental Coordination Disorder Questionnaire 2007 (DCDQ-07; ≤57) cut scores classified 133 (M_{age} = 14.5 years) adolescents into high and low motor competence. Parents also completed the Swanson, Nolan and Pelham IV (SNAP-IV) for descriptive purposes.

Findings: A moderate correlation ($r = 0.56$, $P < 0.001$) was found between the AMCQ and the DCDQ-07 scores. Overall, 42 low motor competence cases were identified by both measures (AMCQ and DCDQ-07). Parents identified more boys (11) than girls (9) with low motor competence, whereas more female adolescents (22) self-reported low motor competence than boys (18). A high proportion agreement (0.82) was seen, which was principally due to the 91 (68.4% of sample) high motor competence case agreements.

Conclusion: Parents identified fewer motor difficulties in their adolescent, especially for girls. Self-report motor assessments may be more realistic for adolescents as they are aware of their own capabilities. Such measures are also more likely to identify previously undiagnosed adolescents with low motor competence.

Keywords

Parents, adolescence, low motor competence

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People with low motor competence (LMC) are unable to perform many motor tasks with the same level of proficiency as their peers. They experience difficulties in performing many activities of daily living (ADL) such as dressing and using eating utensils (Dunford et al., 2005). This condition may be formally diagnosed as developmental coordination disorder (DCD; American Psychiatric Association, 2013; Kirby et al., 2011) when all criteria in the Diagnostic and Statistical Manual (fifth edition; DSM-5) are met. Some will outgrow the condition (American Psychiatric Association, 2013; Kirby et al., 2011); however, between 50% and 70% of those identified during childhood still experience motor difficulties into adolescence and adulthood (Purcell et al., 2015).

The adolescent phase is thought to span from 12 to 22 years of age (Harter, 2012) and is considered to be when an individual develops an independent identity separate from their parents (Kroger, 2007). Therefore, adolescence is an important time for those with LMC to receive support as they face many social-emotional and physical challenges during this phase (Hill et al., 2011; O'Dea and Connell, 2016) and may conceal their motor difficulties from their parents. Unfortunately, many remain undiagnosed or unsupported for a number of reasons. Parents may be unaware of the existence of the disorder or visit many health professionals before receiving a diagnosis (Missiuna et al., 2006a). Other parents may place their concerns on the 'back burner' as motor difficulties are able to be managed at home (Missiuna et al., 2006b), or their child is given a different diagnosis due to symptoms being similar to other developmental disorders such as autism spectrum disorder, learning difficulties or attention deficit hyperactivity disorder (ADHD; Kirby et al., 2007). Finally, adolescents with LMC may adopt coping mechanisms that mask or hide their difficulties (Fitzpatrick and Watkinson, 2003), particularly from their parents or peers in order to fit in (Hill et al., 2011). For example, many conceal bullying or peer-victimisation from their parents, which may lead to fewer social opportunities and lower levels of social support (Missiuna et al., 2008). The lack of peer support experienced by some (O'Dea and

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Connell, 2016; Payne et al., 2013) may contribute to lower levels of self-worth (Skinner and Piek, 2001) and associated internalising behaviours (Cairney et al., 2013). The recognition of motor difficulties by parents during adolescence would attract support in the development of strategies to negotiate social-emotional challenges (Payne et al., 2013; Rose et al., 2015; Skinner and Piek, 2001), and improve life satisfaction and employment opportunities as they enter adulthood (Kirby et al., 2013).

A parent's awareness of their child's level of motor skill competence may differ between male and female children (Liong et al., 2015). This could be related to differences in social expectations, physical activity preferences (Cairney et al., 2012) or skill proficiency. A longitudinal study found age-related gender differences in motor skill proficiency (Barnett et al., 2010). Proficiency of kicking, catching and throwing improved for boys from childhood to adolescence to a greater extent than girls (Barnett et al., 2010). This could be related to different social experiences as boys tend to socialise more through vigorous ball-related physical activities and competitive sports, whereas girls are more likely to socialise during sedentary activities such as talking with friends or shopping (Cairney et al., 2005; Hill et al., 2011; Lingam et al., 2013; Payne et al., 2013). Consequently, movement difficulties experienced by adolescent girls may not be recognised by their peers or parents.

Some parents may realise their child has motor difficulties due to their poorer performance and lower levels of participation in physical tasks or limited social interactions (Cairney et al., 2005; Cairney et al., 2012). Many, however, have difficulties understanding their child's motor delay, which may cause feelings of uncertainty about their parenting and lower levels of confidence in providing support (Barnett et al., 2013). Others may over-assist by completing daily tasks for their child (Missiuna et al., 2006b) or experience feelings of helplessness when their young person refuses assistance (Kirby et al., 2011). Brown and Lane (2014) found parents accurately reported their child's fine motor control and manual coordination when compared to a performance-based measure but were not able to identify issues accurately in other domains such as upper-limb coordination. During adolescence, peer comparisons become more important regardless of the level of motor competence; however, among those with LMC this may have a negative impact (Payne et al., 2013). Therefore, it is important to consider the type of motor assessment tools designed for adolescents as parents may not fully understand nor be aware of the personal challenges or school-based issues faced by their young person (Hill et al., 2011; Pannekoek et al., 2012). Parents may be unaware that their adolescent has LMC as many avoid sharing or revealing difficulties they experience regarding school-based issues or interpersonal relationships with their parents (Gagnon-Roy et al., 2016). Alternatively, some parents may simply think their son or daughter is not sporty and not realise the level of angst being experienced by them and the impact LMC can have on a range of health outcomes (Missiuna et al., 2008). A parent who is aware of their child's motor competency may be able to assist them in negotiating these personal and social difficulties (Kirby et al., 2011). The purpose of this study, therefore, is to compare a parent-reported assessment of adolescent motor competence and associated difficulties to self-reported assessment by the adolescent.

Method

Study sample

The sample comprised 133 adolescent and parent dyads. The participants were recruited through personal contacts ($n=6$), an adolescents' movement clinic ($n=4$), community sporting clubs (Australian Rules Football League (AFL, $n=62$), netball ($n=5$) and basketball clubs ($n=4$)) and local schools (independent ($n=47$) and government ($n=5$)) over a 2-year period. The inclusion criteria for adolescents were: aged between 12 and 16 years, English as a first language, good linguistic and cognitive ability sufficient to comprehend questions, and no other diagnosed disability such as cerebral palsy, learning difficulties or muscular dystrophy. No inclusion criteria were specified for parents or guardians. Parents were asked if their adolescent had sufficient language and cognitive capabilities to comprehend the questions and if they had any other diagnosed disabilities. This project was approved by the Human Research Ethics Committee of the University of Notre Dame in Perth, Western Australia.

Measures

Motor competence. **Adolescents**: The Adolescent Motor Competence Questionnaire (AMCQ; Timler et al., 2016) is a self-report measure of motor competence. The 26-item questionnaire was developed for adolescents between the ages of 12 to 18 years to examine the ecological (skill level in physical surroundings) presence of motor tasks and functional ADL and was informed by the DSM-5 criteria for DCD (American Psychiatric Association, 2013). Responses are based on a 4-point Likert scale of: never (1), sometimes (2), frequently (3) and always (4), resulting in a maximum score of 104; a higher score represents higher motor competence. Concurrent validity of the questionnaire was established against the McCarron Assessment of Neuromuscular Development (MAND; McCarron, 1997; $r=0.49$, $P<0.002$, proportion of agreement 74%, sensitivity 80%, specificity 70%). A score of 83 or below on the AMCQ indicates that motor difficulties may be present. This was matched to the cut score for LMC on the MAND (Timler et al., 2016). The AMCQ has test–retest reliability (intra-class correlation coefficients 0.96), and internal consistency ($\alpha=0.90$; Timler et al., 2016) and can be completed in less than 10 min.

Parents: Parent-reported adolescent motor competence was measured by the Developmental Coordination Disorder Questionnaire 2007 (DCDQ-07; Wilson et al., 2009). The DCDQ-07 is designed for parents of children

5–15 years old. Parents are asked to compare their child's motor performance to that of their child's peers. It consists of 15 items which represent three subscales (control during movement, fine motor/handwriting and general coordination) and uses a 5-point Likert scale of: not at all like your child (1), a bit like your child (2), moderately like your child (3), quite a bit like your child (4) and extremely like your child (5). A maximum score is 75. For children aged between 10 and 15 years, scores below 57 indicate motor difficulties or suspected motor difficulties (Wilson et al., 2009). Evidence of internal consistency ($\alpha = 0.95$) and concurrent validity ($r = 0.34$, $P = 0.001$) has been established with an Australian adolescent sample (Pannekoek et al., 2012).

Adolescent impulsivity and hyperactivity. As ADHD often co-occurs with DCD (Kirby et al., 2007), the Swanson, Nolan and Pelham-IV (SNAP-IV teacher and parents rating scale; Gau et al., 2008) was used to screen for this condition. The SNAP-IV is an 18-item norm-referenced checklist and uses a 4-point Likert scale of: not at all (0), just a little (1), quite a bit (2) and very much (3). It consists of three subscales (ADHD-inattention, ADHD-hyperactivity-impulsivity and ADHD-combined). The score for each subscale is calculated, and the average rating per item is compared to the 5% cut-off scores. The scale has evidence of test–retest reliability (intraclass correlation coefficients $0.59 \sim 0.72$), internal consistency ($\alpha = 0.88 \sim 0.90$) and concurrent validity (Gau et al., 2008).

Procedures

This study employed a quantitative design. The AMCQ was used for the adolescent sample as it is the only self-report motor competence measure available for this age range. The DCDQ-07 is the most widely used and recognised parent report measure for assessing motor competence. The development of both questionnaires was informed by the DCD criteria outlined in the DSM (fourth version, text revision; DCDQ-07; fifth version; AMCQ) and contain similar items that capture every day and sports-based motor performance activities. Recruitment took place over a 2-year period. Questionnaires and written consent forms were distributed to sporting clubs and collected 2 weeks later (response rate 71/162; 44%). Depending on the school, the questionnaires and consent forms were completed as hard copies or online. Schools that opted for hard copies obtained written consent before the adolescents completed the AMCQ during an allocated class (response rate 52/162; 32%). The parent questionnaires (DCDQ-07 and SNAP-IV) were sent home to be completed and returned to school the following day. Twenty-nine parent questionnaires were not returned; however, a high overall response rate was achieved (adolescents response rate 133/162; 82%, parents response rate 133/141; 94%). Six schools used the online version, which enabled teachers and year group coordinators to email parents about the study. Adolescents and parents ($n = 14$) were able to complete questionnaires and online consent forms at a convenient time to them. It took adolescents 10 min, and parents approximately 15 min to complete questionnaires. The overall response rate for returned adolescent questionnaires was 39% (162/415). Of the 162 adolescent questionnaires returned, only 133 parents also responded, thereby reducing the total sample included in the analysis to 133.

Data analysis

SPSS version 23 (SPSS Inc., Chicago, IL, USA) was used to analyse the data. Descriptive statistics were derived for the total sample, boys and girls. The data (AMCQ, DCDQ-07 and SNAP-IV) were tested for normality and based on acceptable skewness and kurtosis values the appropriate parametric tests were used. For the analysis only the total DCDQ-07 score was used and the SNAP-IV subscales were combined to group the sample into those with and without ADHD for descriptive purposes. The sample was also grouped into high motor competence (HMC) and LMC based on the total AMCQ (cut score ≤ 83) and DCDQ-07 (cut score ≤ 57) scores. Case agreement calculations for the two groupings were derived. Pearson's correlation was used to examine the relationship between the total DCDQ-07 and AMCQ scores. Independent t-tests were completed to examine differences between scores for male and female adolescents, mother and father responses, hardcopy and online completion and those whose parents reported their child did or did not have ADHD.

Results

Descriptive data for 133 pairs of adolescent (66.2 % boys, $M_{age} = 14.49$ years, $SD = 0.794$, 12–16 years; 88 boys, 45 girls) and parent motor competence measures are reported in Table 1. A total of 103 mothers and 30 fathers participated in the study. Overall, boys had higher AMCQ scores compared to girls. There were no significant differences between scores for male ($M = 66.24$, $SD = 10.98$) and female adolescents ($M = 64.07$, $SD = 12.36$; $t\ (129) = 0.96$, $P = 0.303$) or questionnaire scores completed by fathers ($M = 68.67$, $SD = 7.53$) and mothers ($M = 64.58$, $SD = 12.25$; $t\ (131) = -1.73$, $P = 0.096$) on the DCDQ-07.

SNAP-IV scores were derived for 131 of the 133 adolescents. Of these, 14 parents (10.7%; 10 boys and four girls) reported their child had some form of ADHD (Table 2). The data for these cases were retained in the study, as DCD is often diagnosed alongside ADHD (Kirby et al., 2007). There were no significant differences between hardcopy and online versions for the AMCQ scores ($P = 0.06$) or the DCDQ-07 ($P = 0.21$). Overall 114 hardcopy (85.7%) questionnaires and 19 online questionnaires (14.3%) were completed.

There was a moderate positive correlation ($r = 0.56$, $P < 0.001$) between the total AMCQ and the total DCDQ-07 scores. The overall proportion of agreement

Table 1. Descriptive statistics (M (SD)) for age, AMCQ, and DCDQ-07 measures for total sample, boys and girls.

Measures	Total ($N=133$) M (SD)	Boys ($n=88$) M (SD)	Girls ($n=45$) M (SD)	Gender *P* value
Age	14.49 (0.79)	14.44 (0.80)	14.58 (0.78)	0.357
AMCQ	87.15 (11.33)	89.68 (11.08)	82.20 (10.24)	0.001
DCDQ-07	65.50 (11.46)	66.24 (10.98)	64.07 (12.36)	0.303

AMCQ: Adolescent Motor Competence Questionnaire; DCDQ-07: Developmental Coordination Disorder Questionnaire 2007.

Table 2. Descriptive statistics (M (SD)) for SNAP-IV ($N=131$) results between ACMQ and DCDQ-07.

SNAP-IV measure	Non-ADHD 117 (89) M (SD)	ADHD 14 (11) M (SD)	Group *P* value
AMCQ	88.33 (10.43)	76.50 (13.84)	0.007
DCDQ-07	67.33 (8.7)	49.29 (18.10)	0.003

SNAP-IV: Swanson, Nolan and Pelham IV; AMCQ: Adolescent Motor Competence Questionnaire; DCDQ-07: Developmental Coordination Disorder Questionnaire 2007; ADHD: attention deficit hyperactivity disorder.

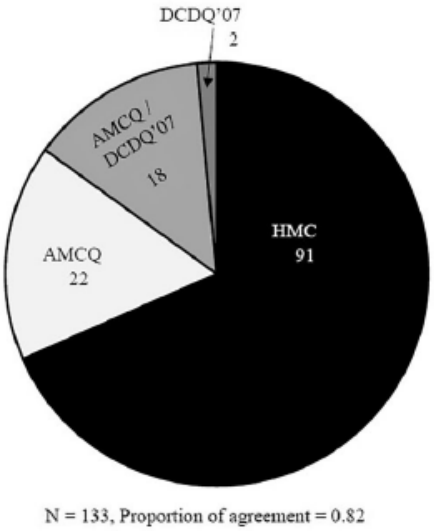

Figure 1. The proportion of agreement between these identified with low motor competence (LMC) by the Adolescent Motor Competence Questionnaire (AMCQ) and the Developmental Coordination Disorder Questionnaire 2007 (DCDQ-07). HMC: high motor competence.

between the DCDQ-07 and the AMCQ was 0.82 (Figure 1). This was primarily due to the high proportion of case agreements for those with HMC ($n=91$; 68.4% of sample). On the other hand, 42 cases were identified with LMC by either the DCDQ-07 or the AMCQ. Of these, only 18 parent (DCDQ-07) and adolescent (eight girls and 10 boys; AMCQ) dyads agreed. The AMCQ scores identified more cases with LMC. Twenty-two cases were identified by the AMCQ only and two cases by the DCDQ-07 only.

Overall a total of 20 (18 case agreements and two DCDQ-07 only) LMC cases were identified by parents, 11 were boys and nine were girls. Whereas a total of 40 (18 case agreements, and 22 AMCQ only) adolescents self-reported LMC, 18 were boys and 22 were girls. Most of the 22 adolescents who were not identified by parents were girls ($n=14$).

An examination of questionnaire responses for the 18 case agreements revealed similar responses to items relating to lower levels of participation in sports and physical activities, general coordination, a tendency to bump into things, break objects or be called clumsy. Parents also identified their child's poor running skills, while the adolescents were more likely to be aware of their poor ball and fine motor skills.

The two adolescents (one boy, one girl) identified with LMC by their parents, but not themselves, had self-reported AMCQ scores very close to the cut point (84, 89). Their parents observed their poor handwriting and clumsiness (especially for the boy). The parent of the female adolescent noted her poor jumping and running skills. When examining these two adolescents' responses to the AMCQ, only the male adolescent reported lower handwriting scores, similar to his parents' DCDQ-07 responses.

Discussion

Compared to the adolescent self-reports, parents recognised fewer children with LMC. They were more likely to acknowledge motor difficulties among their sons than daughters, whereas more girls than boys self-reported with LMC. These results are surprising and could be explained in several ways.

First, some parents may not be aware that LMC is an issue and therefore not relate to their child's poor motor ability (Missiuna et al., 2006a). Environmental influences including family sociocultural factors (such as parents' physical activity levels; Barnett et al., 2013), social stresses (internalising behaviours; Cairney et al., 2013) and peer support (Payne et al., 2013) may also contribute to the parents' ability to recognise motor competence. Parents may over-assist their young person when completing a task, such as laying out and organising clothing before school. In addition, parents' own physical activity level and the importance they place on participation may affect their confidence when providing support to their child (Barnett et al., 2013). Some adolescents may not want to share or acknowledge their LMC to their parents due to personal frustrations which cause them to bottle up their emotions (Hill et al., 2011), or lead to poor social support as a result of shying away from social or physical activity participation (Fitzpatrick and Watkinson, 2003; O'Dea and

Connell, 2016). Green and Wilson (2008) found a low level of agreement between parent report (Developmental Coordination Disorder Questionnaire, DCDQ) and self-report (Co-ordination Skills Questionnaire, CSQ) motor skill assessments across a block of interventions. However, parents were only given the opportunity to respond to specific motor skills, whereas children were able to rank themselves across a wider range of skills including ADL (Green and Wilson, 2008).

In this study, more girls than boys self-reported with LMC. This is different from the male:female ratio reported in the DCD diagnostic criteria (2:1; American Psychiatric Association, 2013) and other studies that have examined these gender differences (Cairney et al., 2013). This outcome could be due to a number of factors. Girls are less motivated to participate in team sports (Fredricks and Eccles, 2005; Labbrozzi et al., 2013), prefer cooperative activities (Hands et al., 2015; Rose et al., 2011) or place greater importance on ADL. Consequently, their poor motor skills may be less apparent or concerning to their parents. On the other hand, boys place importance on sports participation and physical activities as they value a chance to compete, to win and hang out with their friends, compared to girls who felt physical activities prevented them from doing the things that they liked (Vedul-Kjelsås et al., 2012). For example, Vedul-Kjelsås et al. (2012) found physical fitness and self-perceptions among 11–12 year olds differed, male perceptions correlated with athletic competence, whereas female perceptions were more closely related to social acceptance. Girls also tend to place greater importance on close friendships and emotional support as their self-esteem is affected by their degree of body satisfaction, self-image and appearance to a greater extent than boys (Rose et al., 2011).

Another reason for the greater identification of boys than girls by parents may relate to lower expectations of daughters' motor competence and placing less importance on their physical activity participation (Cairney et al., 2012). Parents often consider sport more important and have higher expectations of boys' competence in physical tasks in comparison to their expectations for girls (Fredricks and Eccles, 2005). We found that parents were more likely to place higher scores ('extremely like your child') for their son's ball skill competence, running and jumping skills. Similarly, Liong et al. (2015) also found parents were more able to perceive their son's (5–8 year olds) level of object control skills accurately. The higher participation in physical tasks involving speed, strength and endurance by boys compared to girls (Cairney et al., 2005) makes it easier for parents to observe and recognise the level of motor competence in their sons as they tend to participate regardless of their motor competence level. Parents' perceptions of their adolescents' motor skill competence may be influenced by gender-specific characteristics as boys are often viewed as strong, robust, autonomous and self-reliant compared to girls, who are described as loving, loyal and family orientated.

Assessing motor competence reliably can be challenging given developmental fluctuations (improvements during adolescence and poorer coordination during adulthood (Hands et al., 2015)), the range of skills (locomotion, object control and balance) considered to assess motor competence accurately and the tendency to include gender-biased items in tests of motor skill (Hands and Larkin, 1997). This could be due the type of items typically included in motor assessments which focus on tasks preferred by males, such as ball skills or females being less skilled in these activities (Hands and Larkin, 1997). The higher proportion of boys diagnosed in most studies with motor difficulties compared to girls (American Psychiatric Association, 2013; Cairney et al., 2012) therefore, could also explain this gender bias.

Another factor that could account for the lack of congruency in identifying those with LMC between the parent-report and self-report results is the questionnaire design. For example, the DCDQ-07 asks parents to compare their child's motor ability against similar aged peers, whereas the AMCQ asks adolescents to reflect on how their own coordination impacts performance on motor-related activities (Timler et al., 2016; Wilson et al., 2009). The DCDQ-07 was designed for a wider age range (5–15 year olds) and therefore is more limited with the type of ADL that could be included (handwriting and scissor use; Wilson et al., 2009). The AMCQ was designed for 12–18 year olds and therefore includes more age-relevant items relating to peer comparison, social interactions and participation (individual versus team sports; Timler et al., 2016). The AMCQ also has a greater number of ADL items that are developmentally appropriate such as flossing between teeth, putting on make-up, changing clothes for physical education classes and getting ready to go out (Timler et al., 2016). Consequently, the adolescents can respond to activities that are relevant for them as greater value is placed on peer opinions and acceptance and looking presentable during this phase (Rose et al., 2011). The items on the AMCQ enable girls to have a greater voice and an opportunity to report on their motor difficulties. The gender differences identified in this study suggest the content of the assessments used by parents and adolescents need further exploration. Therefore, the findings from this study indicate that assessing adolescent motor competence is best undertaken using a self-report rather than a parent-report measure.

Strengths and limitations

There are a number of limitations and strengths of the current study. While the sample size was adequate, generalisation of the results to the broader Australian population is not possible due to recruitment difficulties. Participants were drawn from a range of sources. In order to ensure an adequate representation of adolescents with LMC, it was important not to over-recruit participants through sporting associations, which was the easiest way to access adolescents outside school. As expected, significant differences in the total AMCQ scores were found between those recruited through sporting clubs ($M = 92.63$, $SD = 5.86$) compared to

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those recruited elsewhere ($M = 82.64$, $SD = 12.71$; $t\ (105.40) = 5.98$, $P < 0.001$). This latter group comprised adolescents attending a movement clinic as well as many community contacts. Fewer girls participated in the study, which may be due to the recruitment process and the level of interest in participating; however, some interesting differences still emerged. The demographics of the family and parents were not collected, which limited an exploration of environmental and family dynamics. Further analysis could not be completed with the SNAP-IV data given the small proportion of those identified with ADHD. The data were collected in two ways: online and hardcopy surveys; however, this did not affect the results as no significant differences were found for both the total AMCQ and DCDQ-07 scores.

This study adds to previous literature published on the measurement of DCD and the relevance of self-report compared to parent-report questionnaires. Adolescents are capable of describing their own motor competence. The findings of this study highlight the importance of age-appropriate motor competence measures and the need for further research using adolescent-specific measures. The higher number of girls identified with LMC in this study suggest that future research should consider the girl:boy ratio of a DCD diagnosis (American Psychiatric Association, 2013). It is possible that gender-biased items and measures being used to gather information about motor competence are affecting results. It is important to provide adolescents with a voice at this critical phase of development. During this phase they are trying to define their own personal identity and become more independent from their parents. Providing them with an opportunity to identify their own motor difficulties may be essential to helping find support or an intervention programme before they enter adulthood.

Conclusion

Adolescents are aware of, and are able to identify, their level of motor competence in comparison to their peers, whereas parents may not appreciate all aspects of their adolescent's experiences. Self-report questionnaires, such as the AMCQ, may be more sensitive measures of motor competence for this age group, especially among girls. Further research involving interviews with parents and their adolescent would gather more in-depth information of parent and child differences in perceptions of motor ability. Education about the impact of LMC during adolescence may build awareness and support among parents as well as teachers, practitioners and healthcare professionals.

Key findings

- Parents identified more boys than girls with LMC.
- Girls self-reported more LMC than boys.

What the study has added

It may be more realistic for self-report motor assessments to be used for adolescents as they are aware of their own capabilities.

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Research ethics

This project was approved by the Human Research Ethics Committee of the University of Notre Dame in Perth, Western Australia (014121F, 2014). All participants provided written informed consent.

Declaration of conflicting interests

The authors confirm that there is no conflict of interest.

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Timler A, McIntyre F, Cantell M, et al. (2016) Development and evaluation of the psychometric properties of the Adolescent Motor Competence Questionnaire (AMCQ) for Adolescents. *Research in Developmental Disabilities* 59: 127–137.

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APPENDIX F: Additional publications relevant to, but not forming part of this thesis

Timler, A., McIntre, F., Cantell, M., Crawford, S. & Hands, B. (2015) Abstracts: 11th International Conference on Developmental Coordination Disorder (DCD-11) Developmental coordination disorder and other neurodevelopmental disorder: A focus on comorbidity, *Journal of Comorbidity, 5* (23), 32-109 DOI: 10.15256/joc.2015.5.52

JOURNAL OF COMORBIDITY

Journal of Comorbidity 2015;5:32–109 doi: 10.15256/joc.2015.5.52

Abstracts*

11th International Conference on Developmental Coordination Disorder (DCD11)

Developmental coordination disorder and other neurodevelopmental disorders: a focus on comorbidity

Toulouse, France, July 2–4, 2015

DCD11 Organizing Committee

Jean-Michel Albaret, University of Toulouse; Christophe Barré, University of Toulouse; Maëlle Biotteau, University of Toulouse; Mélody Blais, University of Toulouse; Yves Chaix, Neuropediatric Unit, University Medical Centre of Toulouse; Marianne Jover, Aix-Marseille University; Caroline Karsenty, University Medical Centre of Toulouse; Jennifer Lareng-Armitage, University of Toulouse; Agnès Laurent, University of Toulouse; Anaïs Mazella, University of Toulouse; Régis Soppelsa, University of Toulouse; Jessica Tallet, University of Toulouse

DCD11 Scientific Committee

Jean-Michel Albaret, University of Toulouse, France; Christine Assaiante, Aix-Marseille University, France; Anna L. Barnett, Oxford Brookes University, UK; Patrick Berquin, University of Amiens, France; Rainer Blank, University of Heidelberg, Germany; John C. Yves Chaix, Univ Groningen, The N University of Lond Lausanne, Switzerl C Magalhães, Fed Polatajko, Univer of Leeds, UK; Jess Waelvelde, Arteveld Israel; Peter Wils

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The development and evaluation of the Adolescents Motor Competence Questionnaire (AMCQ): A self-report questionnaire for 12-18 years olds

A. Timler[1], F. McIntyre[2], S. Crawford[3], M. Cantell[4] & B. Hands[1]
[1]*Institute for Health Research, University of Notre Dame Australia, 6160, Australia. Amanda.Timler1@my.nd.edu.au;* [2]*School of Health Sciences, University of Notre Dame Australia, 6160, Australia;*

[3]*Epidemiologist, Alberta Perinatal Health Program, Calgary, T2A 3N4 Canada;* [4]*Department of Special Educational Needs, University of Groningen, The Netherlands.*

Aim: At present there is no self-report tool to identify adolescents with DCD at the population level. In this paper the development and evaluation of a questionnaire for 12 – 18 year old Australian youth will be presented.

Methods and Results: The Adolescent Motor Competence Questionnaire (AMCQ) was developed over 4 phases using a sample of 37 adolescents (12-17yrs) with a range of motor competence. *Phase 1: Content Development.* This stage involved designing 29 test items focusing on aspects of motor competence. These were informed by the DSM-5 diagnostic criteria, an extensive literature search, and interviews with key informants with DCD. Eight leading experts in the field of DCD reviewed the terminology and content of each item which led to the development of a further 19 items expanding the questionnaire to 48 items. *Phase two: Content Validation.* Individual or small group interviews were completed with 10 adolescents with DCD discussing each item for its 'youthfulness' and ease of comprehension. The questionnaire was also sent to 10 experts to rate the relevance of each item (1-4). As a result 12 items were removed leaving a total of 36 items. Analysis of the internal consistency of the 36-item questionnaire identified 10 items to be removed resulting in a 26-item questionnaire ($\alpha = 0.922$). *Phase three: Concurrent validation and reliability.* Adolescents with a range of motor skills completed the AMCQ and the McCarron Assessment of Neuromuscular Development (MAND) in order to determine the concurrent validity. The test-retest reliability of the AMCQ over 7 days was $r = 0.96$. *Phase four: Establishment of cut score.* The cut scores to identify probable DCD were established using the decision of agreement proportions between the AMCQ and the MAND.

Discussion: The final 26-item questionnaire has evidence of validity and reliability. Preliminary evidence indicates that this questionnaire is suitable for use with a general population and is capable of identifying adolescents with probable DCD. In the next stage, the questionnaire will be administered to a population-based sample of 300 adolescents. There is also potential to validate this tool with populations from other countries.

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Tal-Saban, M. T., Ornoy, A., Grotto, I., & Parush, S. (2012). Adolescents and adults coordination questionnaire: Development and psychometric properties. *American Journal of Occupational Therapy, 66*(4), 406-413.

Keywords: Self-Report Questionnaire; Adolescence; Motor competence; Identification; Assessment.

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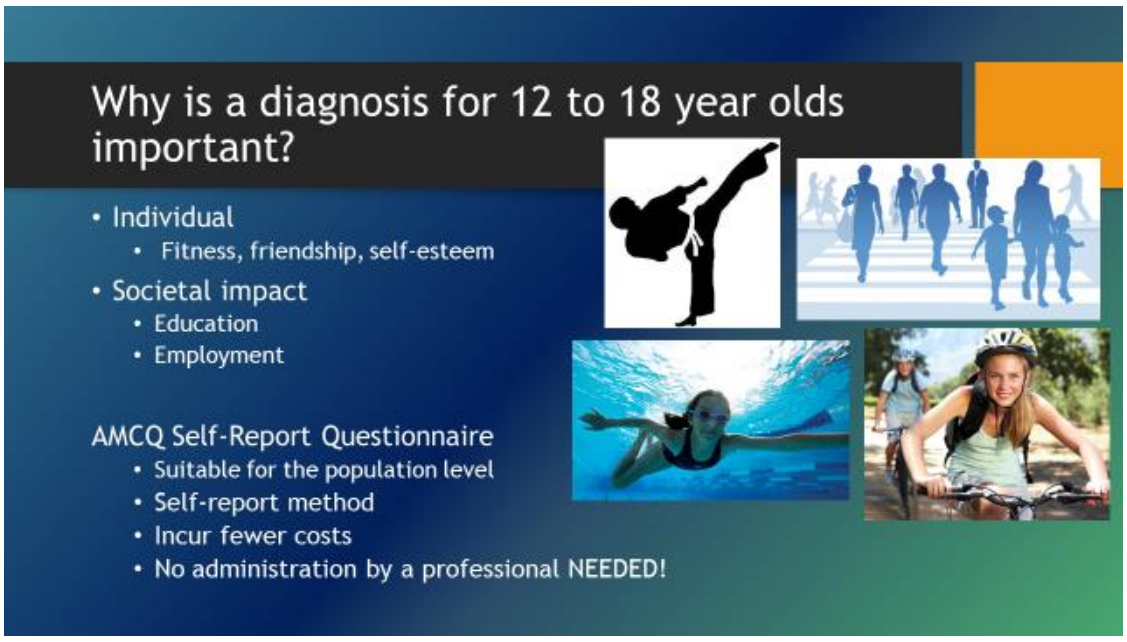
APPENDIX G: Scientific conference presentations and posters and industry presentations related to this thesis

Timler, A., McIntyre, F., Cantell, M., Crawford, S. & Hands, B (2015) *The development and evaluation of the Adolescent Motor Competence Questionnaire (AMCQ)* Presented at the Developmental Coordination Disorder Conference 11, Toulouse, France. July 2nd – 4th, 2015.



Available assessments

- Clinical assessments
  - Movement Assessment Battery for Children 2 (MABC-2
  - Bruininks-Oseretsky Test of Motor Proficiency 2 (BOT-
  - McCarron Assessment of Neuromuscular Development (M

Costly & time consuming to assess

- Questionnaires
  - Developmental Coordination Disorder Daily Questionnaire (DCDDaily-Q)
  - Developmental Coordination Disorder Questionniare'07
  - Adolescent and Adults Coordination-Questionnaire (AAC
  - Adult Co-ordination Disorder Checklist (ACD)

Do not accommodate 12 to 18 years

AMCQ development

Phase	Input	Items	Informant Group
1 AMCQ content development	Literature Review		Informed by Criteria A and B of the DSM-5
	Key informants	29	Adults and an adolescent previously diagnosed with DCD (n = 3)
	Expert review	35	Move.Grow.Engage, Western Australian DCD team (n = 8)
2 Content validation and item assessment	Expert Rating	48	International experts (Australia, the Netherlands, Canada) (n = 10)
	Adolescent discussion	36	AMPitup (n = 10)
	AMCQ and MAND completion		(N = 38) AMPitup (n = 15), Basketball club (n = 11), Staff Members (n = 12).
3 Reliability and validity of the AMCQ	Statistical analysis	26	Test-retest = t (16) = -1.22, p < .001 α = 0.902

Phase 1: AMCQ Content development

- Key informants:
  - Examples



- Language (Klutz- Clumsy- high degree of co-ordination- more uncoordinated- prefer not)

- Experts:
  - Examples



AMCQ development

Phase	Input	Items	Informant Group
1 AMCQ content development	Literature Review		Informed by Criteria A and B of the DSM-5
	Key informants	29	Adults and an adolescent previously diagnosed with DCD (n = 3)
	Expert review	35	Move.Grow.Engage, Western Australian DCD team (n = 8)
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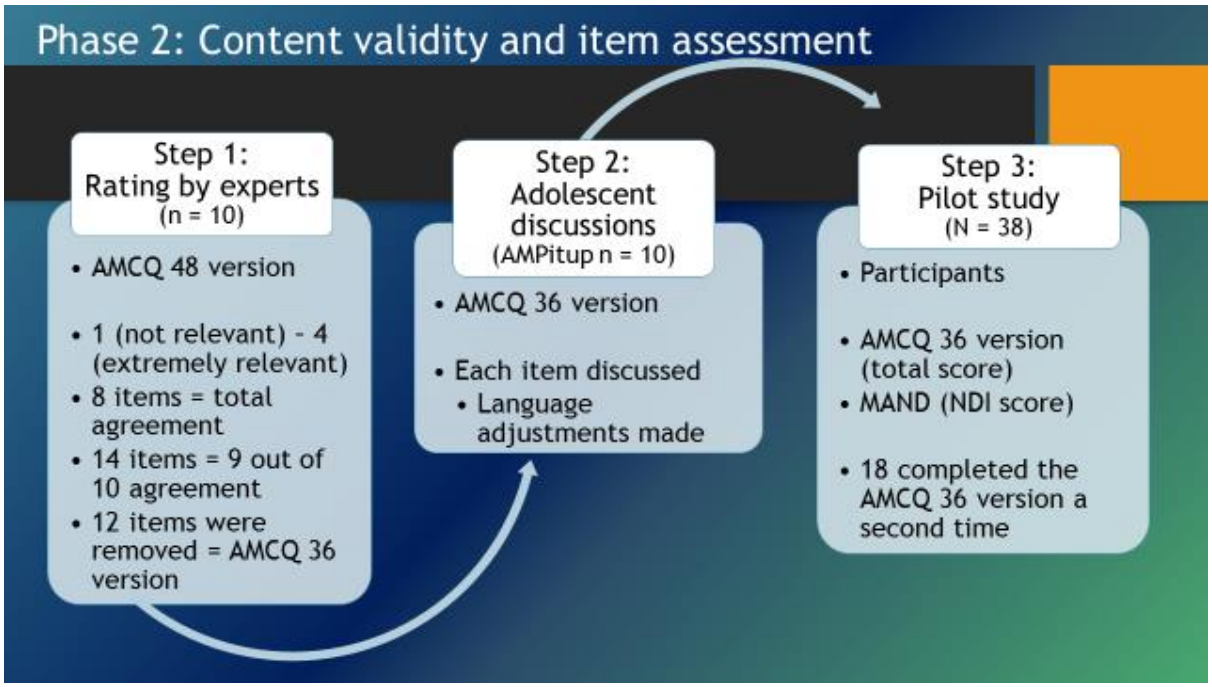
3 Reliability and validity of the AMCQ	Statistical analysis	26	Test-retest = t (16) = -1.22, p < .001 α = 0.902



AMCQ development

Phase	Input	Items	Informant Group
1 AMCQ content development	Literature Review		Informed by Criteria A and B of the DSM-5
	Key informants	29	Adults and an adolescent previously diagnosed with DCD (n = 3)
	Expert review	35	Move.Grow.Engage, Western Australian DCD team (n = 8)
2 Content validation and item assessment	Expert Rating	48	International experts (Australia, the Netherlands, Canada) (n = 10)
	Adolescent discussion	36	AMPitup (n = 10)
	AMCQ and MAND completion		(N = 38) AMPitup (n = 15), Basketball club (n = 11), Staff Members (n = 12).
3 Reliability and validity of the AMCQ	Statistical analysis	26	Test-retest = $t(16) = -1.22$, $p < .001$ $\alpha = 0.902$

Phase 3: Evidence of Reliability and Validity

	MAND (≥85) (criterion measure)		
AMCQ 26 version (cut score = 83)		Probable DCD	Non DCD (control)
	Probable DCD	12	7
	Non DCD (control)	3	16

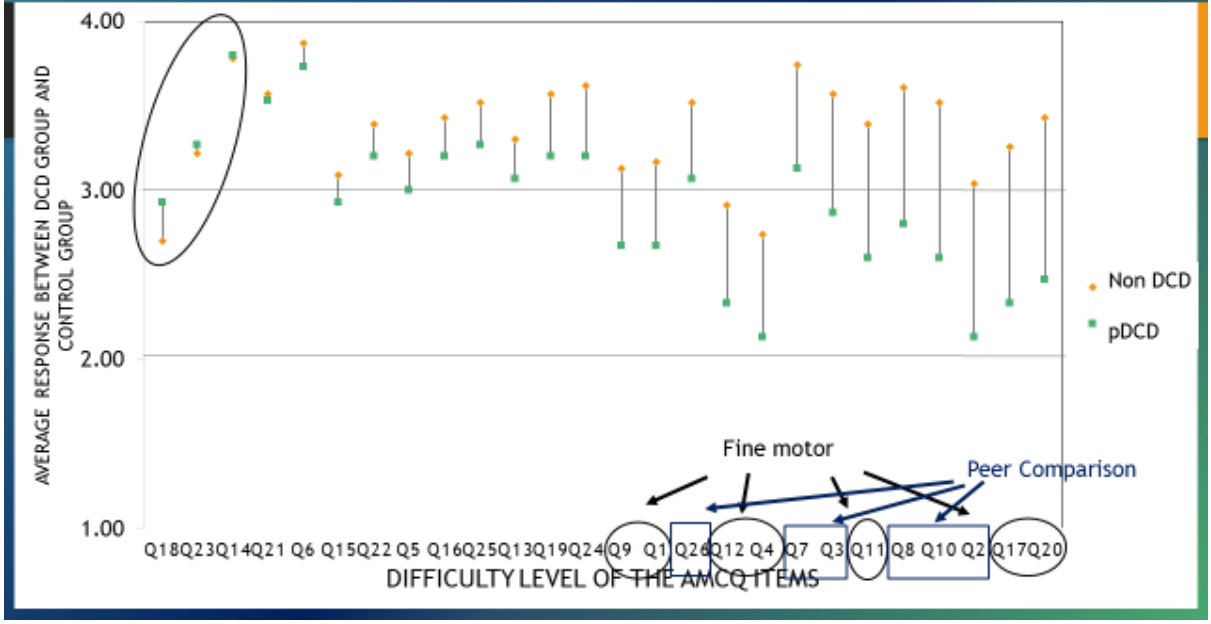
Total proportion of agreement: 74%

- Sensitivity: 80%
- Specificity: 70%

Sample Questions

Questions	NEVER	SOMETIMES	FREQUENTLY	ALWAYS
I PREFER TO PARTICIPATE IN INDIVIDUAL SPORTS (SUCH AS SWIMMING, MARTIAL ARTS, ATHLETICS) RATHER THAN TEAM SPORTS (SUCH AS FOOTBALL AND NETBALL)	☐	☐	☐	☐
I CAN RIDE A BICYCLE	☐	☐	☐	☐
I FIND IT HARD TO USE A FORK OR A KNIFE WHEN EATING A MEAL	☐	☐	☐	☐
MY HAND WRITING IS FAST ENOUGH TO KEEP UP WITH THE REST OF THE CLASS	☐	☐	☐	☐
I BREAK OBJECTS ACCIDENTLY MORE OFTEN THAN MY FRIENDS	☐	☐	☐	☐
I HAVE TROUBLE LEARNING NEW OUTDOOR GAMES	☐	☐	☐	☐

Mean AMCQ scores



Conclusions

- AMCQ shows:
- Reliability:
  - Cronbach's alpha: 0.902
  - test-retest reliability: t (16) = -1.22, p < .001
- Discrimination accuracy:
  - Total proportion of agreement: 74%
  - Sensitivity: 80%
  - Specificity: 70%
- Cut score = 83
- The AMCQ is currently being completed with a larger Australian sample

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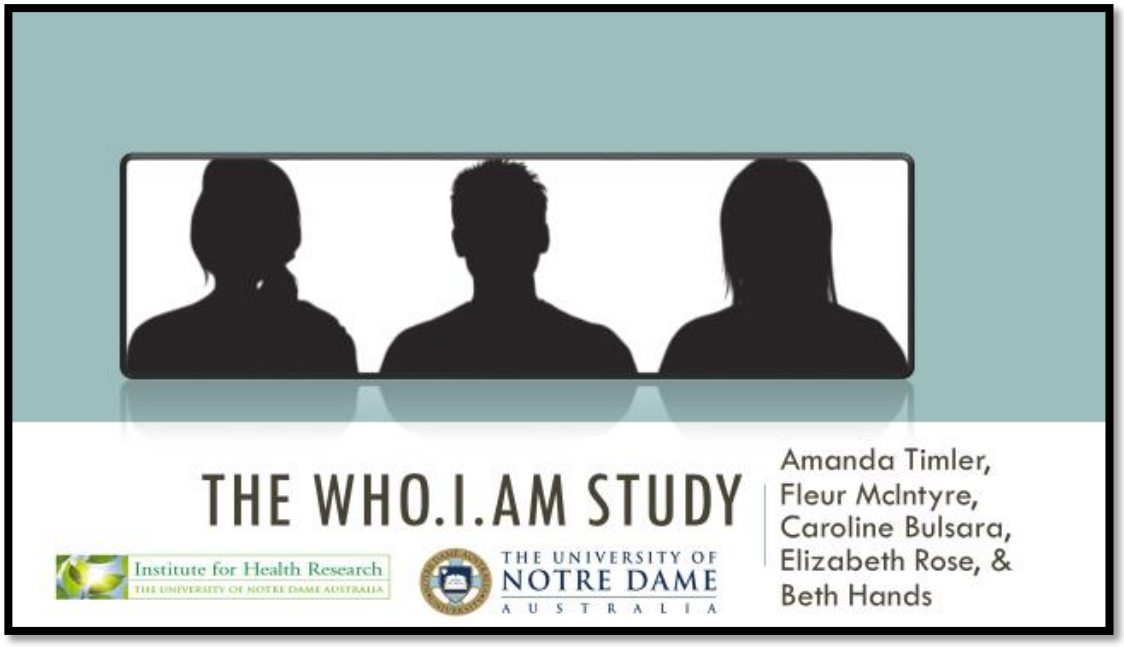
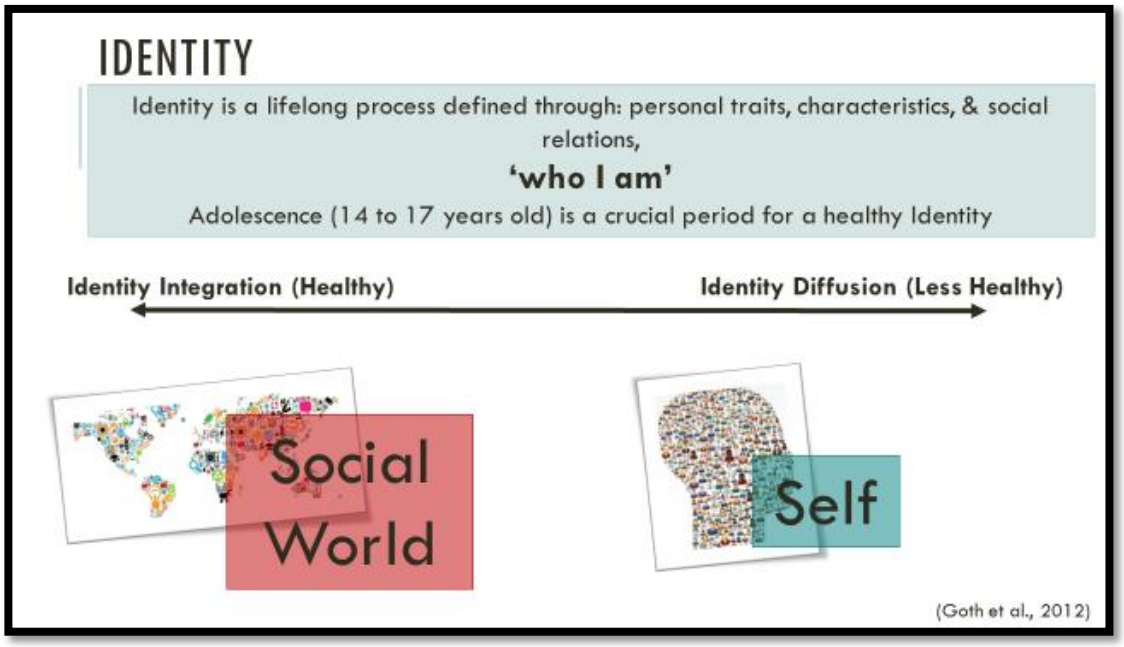
Timler, A., McIntyre, F., Bulsara. C., Rose. E., & Hands, B. (2017). *The development of a healthy identity is compromised in adolescents with LMC: The who.i.am study*. Presented at the Developmental Coordination Disorder Conference 12.





CURRENT RESEARCH QUESTION:

Does identity health differ between adolescents with high and low motor competence and does it differ between males and females ?

EXPLANATORY SEQUENTIAL MIXED METHODS

PHASE 1: QUANTITATIVE

Participants: N = 160 (64.4% males, M_{age} = 14.44 years, *SD* = 0.750)

DATA COLLECTION:

- Sporting club
- Local schools

MEASURES:

Adolescent Motor Competence Questionnaire (AMCQ)

26 items (four-point Likert: Never, Sometimes, Frequently, & Always)
Total score 104, cut score 83/below = low motor competence (LMC)
High score = high motor competence (HMC)

I PREFER TO PARTICIPATE IN INDIVIDUAL SPORTS (SUCH AS SWIMMING, MARTIAL ARTS, ATHLETICS) RATHER THAN TEAM SPORTS (SUCH AS FOOTBALL AND NETBALL)

Assessment of Identity Development in Adolescents (AIDA)

58 items (5-point Likert: no, more no, part/part, more yes, & yes)
Continuum scoring (Total scale = 232) includes subscales:
Self (27 items) & Social world (31 items)
Lower score = healthier identity

I have hobbies or interests that have become part of who I am.

RESULTS

GENDER:
- Males had higher motor competence & healthier identities ($F = 11.68$, $p = .001$)

MOTOR COMPETENCE:
- The LMC group had less healthy identities specifically for the Self ($F = 7.22$, $p = .008$)

MOTOR COMPETENCE & GENDER:
- LMC Females had less healthy identities ($p < .001$) especially for their Social World

PHASE 2: QUALITATIVE

Participants: 7 HMC (4 males), &10 LMC (6 males)

INTERVIEWS (Informed by responses from AMCQ & AIDA)

13 Semi-structured questions:
1. Social support mechanisms (family & peers)
2. Environmental stressors (community sports, school & home)

- Interviews lasted for 45 minutes to 1 hour

DATA ANAYLSIS:
- Qualitative themes were considered in relation to the identity subscales:

RESULTS

SOCIAL WORLD
PEER SUPPORT & ACTIVITIES

LMC reported lower levels of social support

- Males: smaller social networks, some still participated in sport
- Females: valued close friendships, assistance from school peers, although some experienced fragmented friendships, and did not like being judged on physical ability

'Well these days I do not have really close friends… that I talk with… last year the friend that I told you about was more so, we were able to talk about some things but I do not think I would ever be fully comfortable about talking.' (14 year-old LMC male).

'I just do not like the way [physical education] is set out in all schools not just my school and I do not like that they grade you on your physical abilities, but then I guess they do the same for mental...'
(15 year-old LMC female)

SOCIAL WORLD
SCHOOL EXPERIENCE & COMMUNICATION

LMC school experience was driven by:

- Academic performance such as extension programs and picking subjects
- Post-secondary education
- Teachers

Males: felt relaxed about their future, valued parents & teachers opinions

Females: felt stressed about school & their future, valued more mothers for advice

'Last year was a bit of a struggle for me, but I said over the holidays that this was going to be my year and it has been. I [am] enjoying school, so that's good… Yes, [picking classes], has made me want to be at school… because [school] make you do a lot of things that you do not really have interest in, so it is a lot better when you do get to do what you want to do'
(15-year-old LMC female).

SELF
PERSONAL CHANGES

Regardless of motor competence, many developed their identities by observing traits, personalities & characteristics of people they admired.

- LMC males & females - self-confidence came from their academic skills
  - Did not like change, 'creatures of comfort'
  - Responsibility
  - Stress and pressure
  - Only motivated to participate in physical activities if they saw the value, or from parent, peer support

'A lot of my self-worth comes from my intellect, I pride myself on the fact that other people see me as smart and intelligent, as someone that you could come and see if you needed some help. I am currently at the top of my year for economics, politics and law so I quite enjoy that prestige' (14-year-old LMC male).

SELF
FUTURE PLANNING

Adolescents felt planning three years (but not 5 or 10 years) down the track was important

- LMC Females valued organization, planning, thinking about their future
- LMC Males felt more relaxed, most knew their next step, or happy to 'go with the flow'

Some of the LMC females were scared of not achieving their goals, therefore felt greater stress and pressure towards their future

'I definitely think about my future a lot, I definitely try to place where I am in the future and see how I can get there… if it does not scare you then it does not make you stronger, but with the acting, in three years' time I am scared about what is going to happen and that actually strives me when I compare it to math [teaching]… I would not be as scared' (14-year-old LMC female).

SO WHAT?

- Those with LMC may be at risk of psychosocial issues & less healthy identity
- Overall - Males tend form healthier identities than females
- Level of motor competence may be a protective factor for males towards the health of their identity
- LMC females experience the greatest difficulties in forming a positive sense of self & identity.
- THEREFORE LMC females may be at a double disadvantage during adolescence especially surrounding their social interactions & school experiences.

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Timler, A., McIntyre, F. & Hands, B (2017). *Is self-report versus parent report similar for adolescent's motor competence?* Poster presented at the Developmental Coordination Disorder Conference 12.

Is self-report versus parent report similar for adolescent motor competence?

Amanda Timler, Fleur McIntyre, & Beth Hands

Introduction

An adolescent's motor competence influences their physical, social, and emotional development. Many parents may not be aware of their adolescents level of motor competence and the difficulties faced by those with a low level. Consequently, parent-report may differ from adolescent self-report.

Aim

To what extent parent assessment of their adolescent's motor competence matched that of the adolescent's self-report.

Method

Participants:

- 133 parent and adolescent (12 - 16 years, 66.2% males, M_{age}=14.48 years, SD= .79) dyads.

Measures:

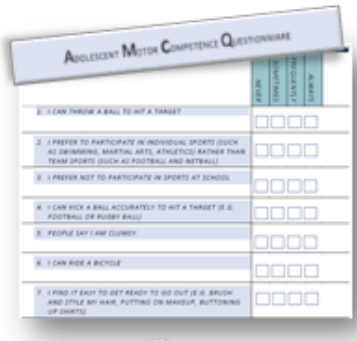
Parents completed:

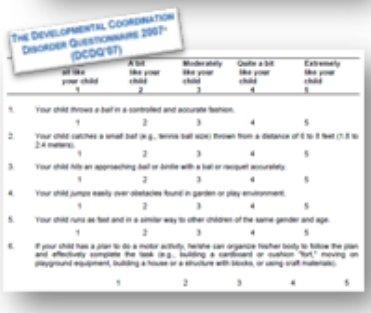
- Developmental Coordination Disorder Questionnaire, 2007 (DCDQ'07).

Adolescents completed:

- Adolescent Motor Competence Questionnaire (AMCQ).

The sample was separated into High (HMC) and Low (LMC; AMCQ; ≤ 83, DCDQ'07; ≤ 57) motor competence.

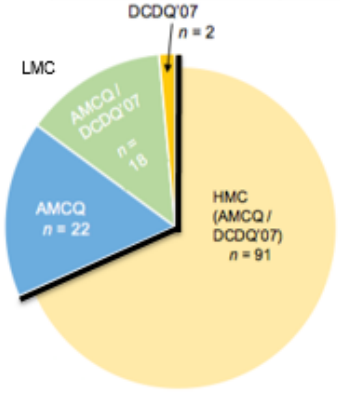




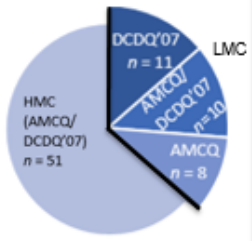
Results

Table 1. *Descriptive statistics [M(SD)] for age, AMCQ, and DCDQ'07 measures for total sample, males and females.*

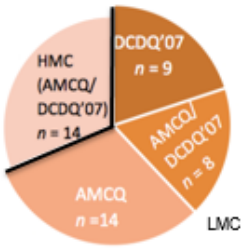
Measures	Total (N = 133) M (SD)	Males (n = 88) M (SD)	Females (n = 45) M (SD)	Gender p
AMCQ	87.15 (11.33)	89.88 (11.08)	82.20 (10.24)	.001
DCDQ'07	65.50 (11.46)	66.24 (10.95)	64.07 (12.36)	.303



N = 133, Proportion of agreement = 0.82



Males, *n* = 88



Females, *n* = 45

Figure 1. Motor competence levels identified by AMCQ, DCDQ'07 or both

- Parents identified more boys than girls with LMC.
- Proportionately more girls self-reported LMC than boys

Conclusion

- Self-report motor assessments may be more realistic for adolescents, especially for females.
- Self-report may help identify previously undiagnosed adolescents with LMC.
- Parents were less likely to identify LMC among adolescents, especially females.

Contact details: Amanda .Timler1@my.nd.edu.au

Zwiers, K., Cantell, M., **Timler, A.,** McIntyre, F., Crawford, S. & Hands, B. (2017). *Cross-Cultural Dutch Adaptation of the Adolescent Motor Competence (AMCQ-NL) and Exploration of its Psychometric Properties.* Poster presented at the Developmental Coordination Disorder Conference 12.

university of groningen / faculty of behavioural and social sciences — THE UNIVERSITY OF NOTRE DAME AUSTRALIA — Nassau College

Cross-Cultural Dutch Adaptation of the Adolescent Motor Competence Questionnaire and Exploration of its Psychometric Properties

Karin Zwiers[1,2], Marja Cantell[2], Amanda Timler[3], Fleur McIntyre[3], Susan Crawford[4], & Beth Hands[3]

[1]*Dr. Nassau College, Industrieweg 3, 9402 NP Assen, the Netherlands*

[2]*University of Groningen, Special Needs Education and Youth Care Unit, the Netherlands*

[3]*University of Notre Dame, Institute for Health Research, Fremantle, Australia*

[4]*Alberta Perinatal Health Program, Calgary, Canada*

Background and Aim

- The Adolescent Motor Competence Questionnaire (AMCQ; Timler, McIntyre, Crawford, Cantell, & Hands, 2016) is a self-report tool developed at the University of Notre Dame, Australia to identify suspected motor difficulties in adolescents between the ages of 12 to 18 years.
- The purpose of this study was to adapt the AMCQ for Dutch adolescents (AMCQ-NL) and to explore its psychometric properties.

Method

- In the adaptation process, words were adjusted and items transformed, to make them more appropriate for Dutch culture, and back-translations were reviewed for equivalency (Figure 1).
- The first version of the AMCQ-NL was field-tested with three adolescents diagnosed with DCD.
- The psychometric properties of the AMCQ-NL were evaluated in a school sample of 147 adolescents:
  - 72 males, 75 females (*M*age: 15.7 years)
  - Pre-vocational secondary education: 26.5%
  - Senior general secondary education: 36.7%
  - Pre-university education: 36.7%
- The internal consistency of the 26 items of the AMCQ-NL was determined by Cronbach's alpha to measure reliability.
- Construct validity was investigated using factor analyses.
- Comparison of scores between the AMCQ-NL and Self Concept of Ability in PE class (SCA5-PE; Vilholainen, Aro, Purtsi, Tolvanen, & Cantell, 2014).
- Gender differences were examined with a t-test.

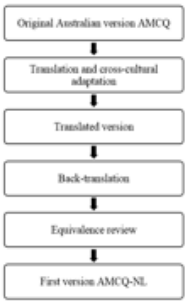


Figure 1 Flow chart of the translation and cross-cultural adaptation process

Results

- The Australian research team was satisfied with the equivalence of the back-translations to the original.
- Based on remarks of the participants in the field study, the AMCQ-NL was further improved by altering wording and adding examples (*e.g., #1: "I can throw a ball to a target->"... to a lamp post"*).
- Internal consistency of the AMCQ-NL was very good (α=.803) and test-retest reliability very high (ICC=.934).
- A high correlation (r=.672, p < .01) was found between the total score on the AMCQ-NL and SCA5-PE.
- The factor analysis revealed three factors explaining 35.2% of the variance:
  - Factor 1. *"Participation in physical activity and sports"*
  - Factor 2. *"Clumsiness"*
  - Factor 3. *"Activities of Daily Living (ADL)"*.
- The AMCQ-NL total scores differed (p<.01) between boys (M=89.14) and girls (M=83.4).

Conclusion

- The Dutch version of the AMCQ is an age and culture appropriate tool.
- The use of a standardized instrument of motor competence could strengthen the preliminary findings of validity of the AMCQ-NL.
- The use of this easy-to-administer self-report tool to identify Dutch adolescents with suspected motor difficulties may be the first step in developing strategies to minimize the effects of motor difficulties that affect the daily life of the adolescent and their families.
- The AMCQ-NL can assist in increasing our understanding about male and female perceptions of motor competence in adolescence.
- Future research is needed to compare results for the AMCQ in different cultures.

Contact information:

AMCQ: Amanda Timler: amanda.timler1@my.nd.edu.au

AMCQ-NL: Marja Cantell: m.h.cantell@rug.nl

References

Timler, A., McIntyre, F., Cantell, M., Crawford, S., & Hands, B. (2016). Development and evaluation of the psychometric properties of the Adolescent Motor Competence Questionnaire (AMCQ) for Adolescents. *Research in Developmental Disabilities, 59*, 127-137.

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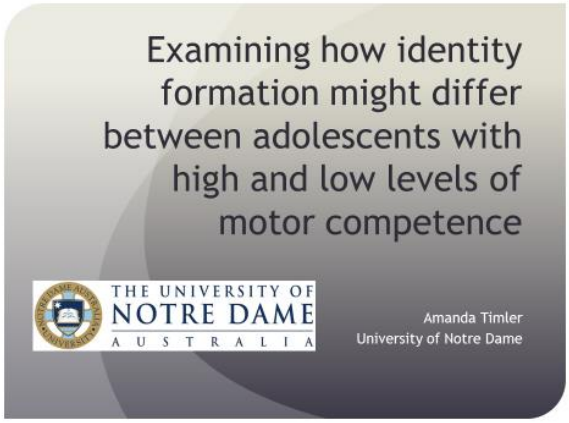

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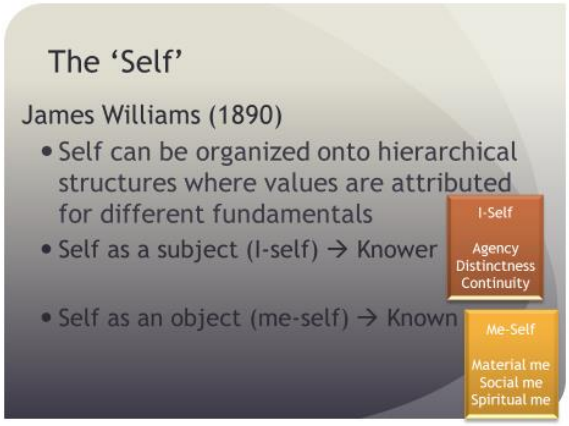

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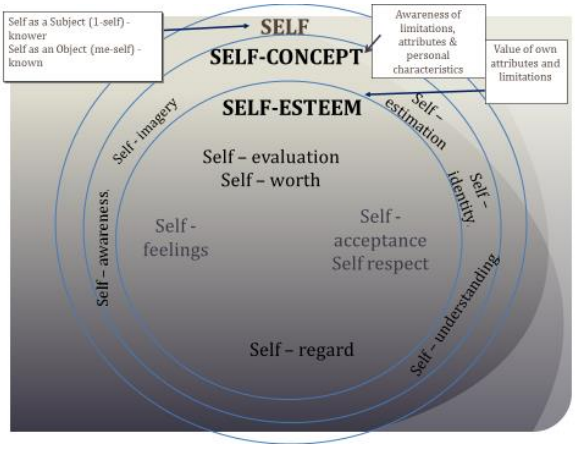

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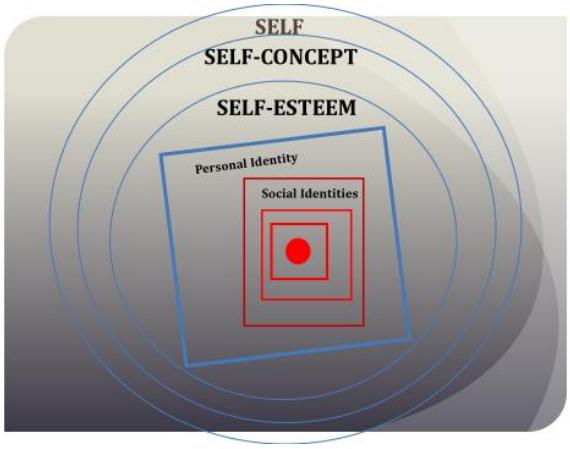

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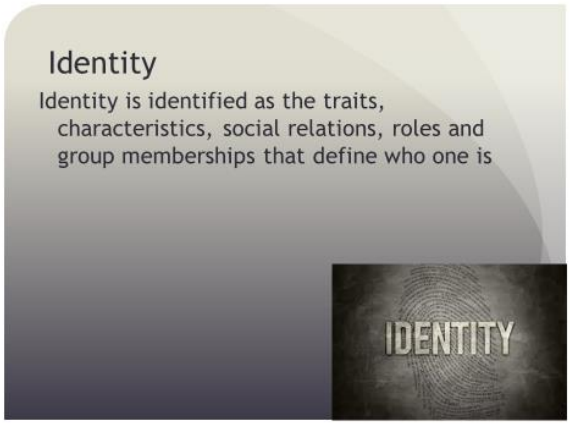

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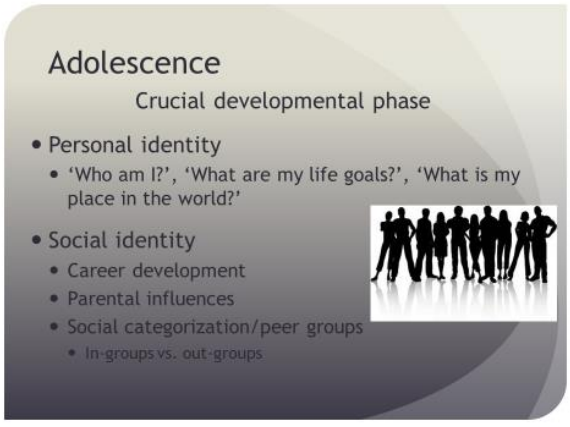

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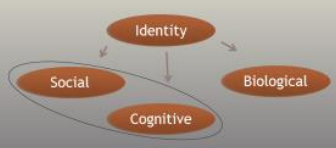
Identity formation during adolescence

- Identity formation is affected by:



- Informational, Normative and Diffuse-avoidant orientation styles (Berzonsky, 1992)
- Identity integration vs. Identity diffusion (Goth, 2012)

7

Developmental Coordination Disorder

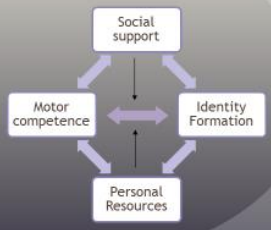
- Lower participation in physical activities
- Lower social support (peer-victimization)
- Higher levels of depression

- Identity formation
  - We don't actually know!

8

Hypothesis and Conceptual Framework

- Adolescents with low motor competence will be more likely to fall into the diffusion spectrum



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MOTOR COMPETENCE

- DCDQ- Teens (Wilson, Crawford, Cantell and ME!)

IDENTITY

- Assessment of Identity Development in Adolescence (Goth, 2012)

PERSONAL RESOURCES

- Self-Perception Profile for Adolescents (Harter, 2012)
- Focus groups with adolescents with high and low levels of motor competence

SOCIAL RESOURCES

- Interviews with parents of adolescents with DCD
- Focus groups with adolescents with high and low levels of motor competence

10

Watch this space

11

Timler, A., McIntyre, F & Hands, B (2014) *Tool development and validation: Adolescent Motor Competence Questionnaire*. Presented at the University of Notre Dame School of Health Sciences Higher Degree Research Presentation Series, Perth, Western Australia. (November 7th, 2014).

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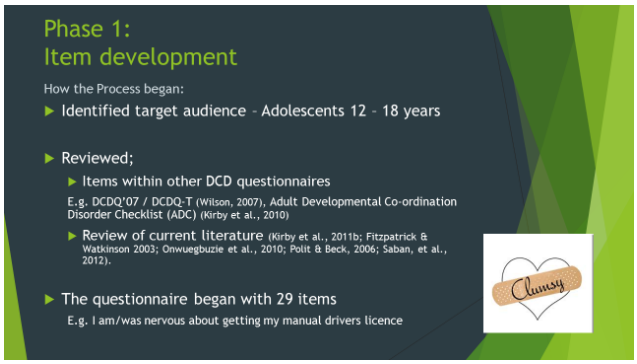

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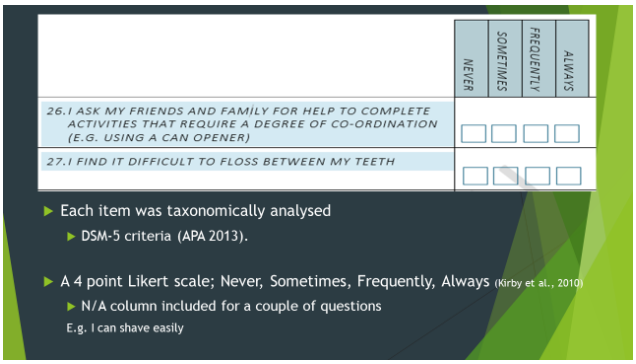

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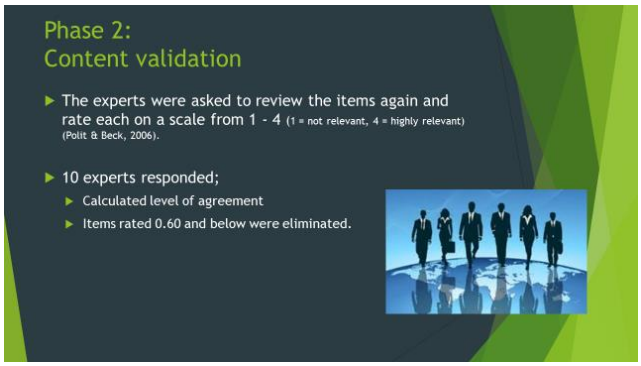

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Results:

- 8 questions = total agreement
  E.g. *I can throw a ball to hit a target*
- 14 questions = 9/10 in total agreement
  E.g. *My hand writing is fast enough to keep up with the rest of the class*
- 12 items removed
  E.g. *When I run my limbs feel uncomfortable (E.g. arms and legs)*
  E.g. *I can name my right and left sides*
- A total of 36 items remained.

7

Phase 3: Concurrent validation

Current stage of the project:

- Scheduled for completion in mid November
- A sample of participants with a range of motor skills (AMPitup (N = 12) (completed), and a local basketball sporting club) will complete:
  - AMCQ - (Adolescent Motor Competence Questionnaire)
  - MAND - (McCarron Assessment of Neuromuscular Development) (McCarron, 1997).
    - Clinical assessment of motor competence
- Assess time taken to complete the AMCQ to review respondent fatigue (Onwuegbuzie et al., 2010).

8

Concurrent validity

- Level of agreement between the MAND and AMCQ
  - Bland-Altman

Construct validity

- Exploratory Factor Analysis (SPSS)
  - Examine the number of factors loading onto;
  - 4 DMS-5 Criteria (independent t-test)

Reliability

- Test-retest reliability (7 days) - Pearson's correlation coefficient
- Internal consistency - Cronbach's alpha

9

Phase 4: Establish cut-off scores for DCD

- To establish the cut point for the AMCQ we will use;
  Decision Agreement Proportions between the AMCQ and the MAND

Paper 1 of my PhD!

10

Acknowledgements

I would like to thank:

- Supervisors; Professor Beth Hands and Dr Fleur McIntyre
- The Perth DCD collaboration team: Move.Grow.Engage.
- The adults and adolescents who participated in one or many of the various phases of the validation process.
- In addition, the international collaboration of Marja Cantell (Netherlands) and Susan Crawford (Canada).
- Collaboration Research Network (CRN)

11

Questions?

12

Carey-Hill, W. & **Timler, A.** (2014) *Knowledge Translation*. Presented at the University of Notre Dame School of Health Sciences Higher Degree Research Presentation Series, Perth, Western Australia. (November 7th, 2014).

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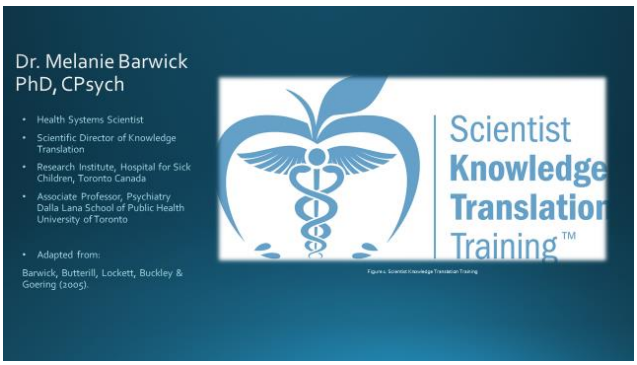

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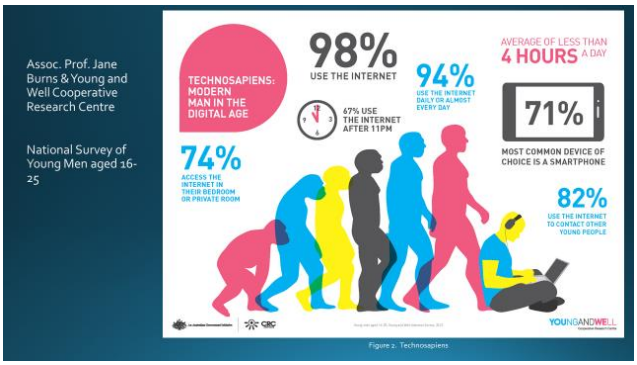

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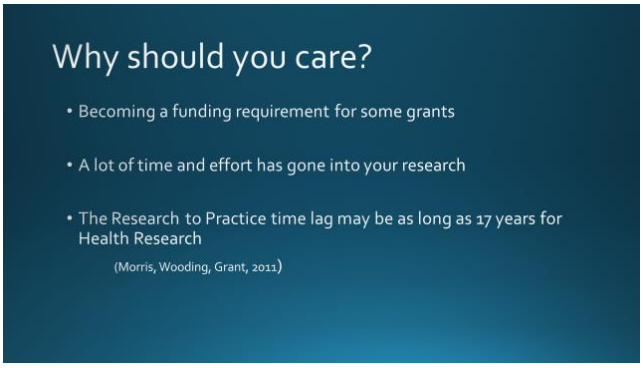

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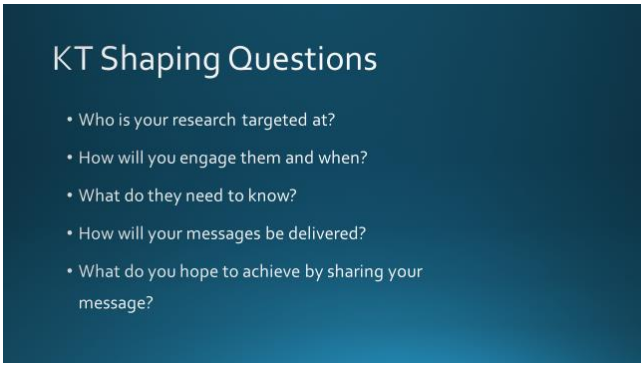

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Intended Knowledge Users

1. General Public (recreational athletes, older adults, carers)
2. Scientist Practitioners (clinicians, physiotherapists, S&C, sport)
3. Researchers
4. Research Funding Bodies

- Decision/Policy Makers
- Private Sector/Industry
- NGOs

7

KT Goals

1. Impart Knowledge…to all of the intended users
2. Generate awareness, Interest
   - Role/importance of the ankle joint complex
3. Behaviour change
   - Reduce Chronic/Acute Injury Risk
   - Inform Practice change – exercise prescription
4. Future Research
   - Patent/product
   - Implementation of Practice change
   - Policy Change
   - Disseminate Tools

8

KT Strategies

E.g. Collaboration – also think outside of your field (E.g. graphic designers)
- Networking
- Conferences/ publications – inform scientific community
- Educational materials
- Behaviour change
- Communication of practice
  - social media
- Communication for practitioners

KT Process

9

KT Impact

1. Well-being outcomes

E.g. Research builds knowledge
- Change of practice
  - Injury patrol –reporting pain levels of chemotherapy treatment

2. Distribution
- Apps
- Access online – open access
- Partnerships / Industry – may not read publications
- Policy
- Knowledge and attitude change

3. Evaluation
- Survey …..
- Focus on how one has processed the information

10

Resources

E.g. Web – multiple social media
- Blogs / Twitter / Facebook
- Website development
- Art installation / Dance your thesis
- Graphics / imagery / infographics
- Open access journals / publications
- Travel – conferences, meetings, educational purposes……

Leads to **Implication**
- Branding / copyright
- Story boards
- Short video's
- Collaborating research

11

Our KT Goals for UNDA

- Information is there in publications – how do you integrate that into KT?
- Begin KT activities in your own School, group, office, area
- Avoid Duplication of effort
  - Share resources

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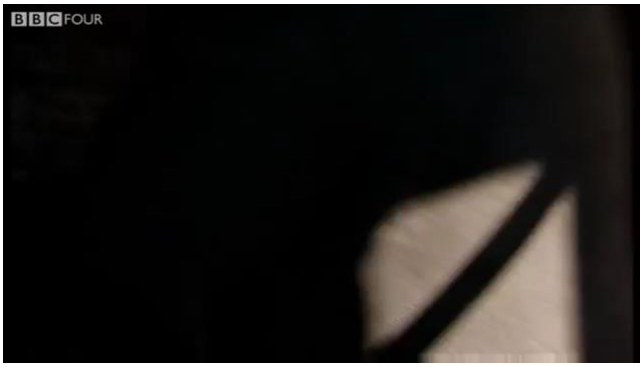

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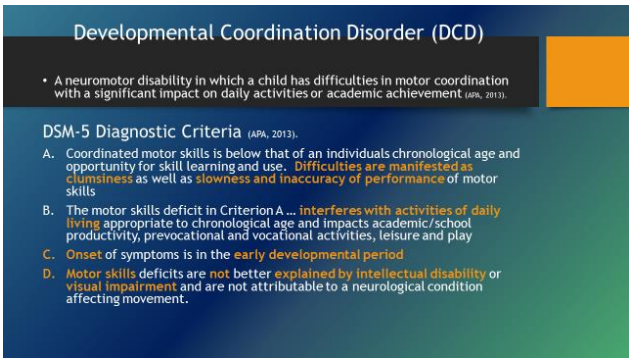

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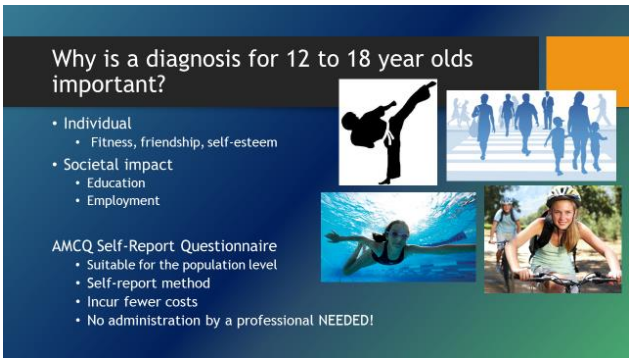

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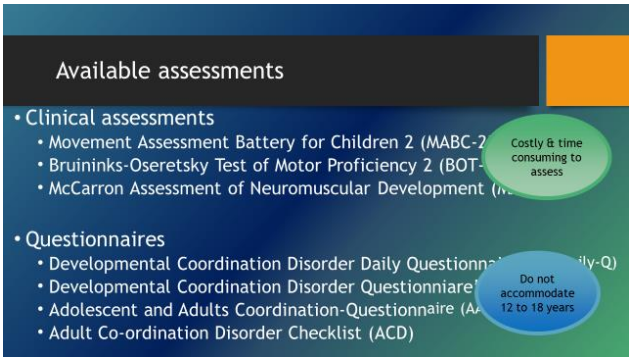

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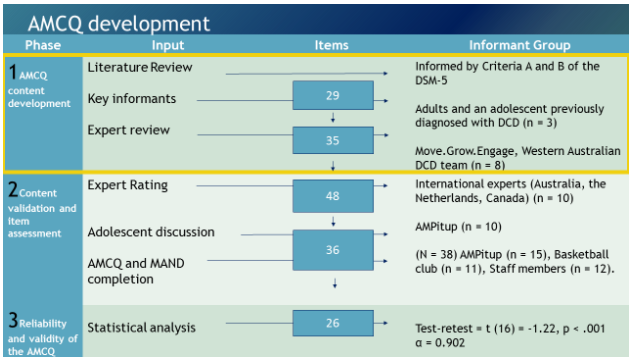

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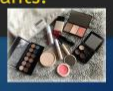
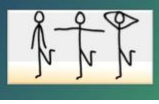
Phase 1: AMCQ Content development

- Key informants:
  - Examples



- Language (Klutz- Clumsy- high degree of co-ordination- more uncoordinated- I prefer not to)
- Experts:
  - Examples





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AMCQ development

Phase	Input	Items	Informant Group
1 AMCQ content development	Literature Review		Informed by Criteria A and B of the DSM-5
	Key informants	29	Adults and an adolescent previously diagnosed with DCD (n = 3)
	Expert review	35	Move.Grow.Engage, Western Australian DCD team (n = 8)
2 Content validation and item assessment	Expert Rating	48	International experts (Australia, the Netherlands, Canada) (n = 10)
	Adolescent discussion	36	AMPitup (n = 10)
	AMCQ and MAND completion		(N = 38) AMPitup (n = 15), Basketball club (n = 11), Staff members (n = 12).
3 Reliability and validity of the AMCQ	Statistical analysis	26	Test-retest = t (16) = -1.22, p < .001 α = 0.902

8

Phase 2: Content validity and item assessment

Step 1: Rating by experts (n = 10)
- AMCQ 48 version
- 1 (not relevant) - 4 (extremely relevant)
- 8 items = total agreement
- 14 items = 9 out of 10 agreement
- 12 items were removed = AMCQ 36 version

Step 2: Adolescent discussions (AMPitup n = 10)
- AMCQ 36 version
- Each item discussed
  - Language adjustments made

Step 3: Pilot study (N = 38)
- Participants (n= 28 males, n = 10 females)
- AMCQ 36 version (total score)
- MAND (NDI score)
- 18 completed the AMCQ 36 version a second time

9

AMCQ development

Phase	Input	Items	Informant Group
1 AMCQ content development	Literature Review		Informed by Criteria A and B of the DSM-5
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3 Reliability and validity of the AMCQ	Statistical analysis	26	Test-retest = t (16) = -1.22, p < .001 α = 0.902

10

Phase 3: Evidence of Reliability and Validity

	MAND (≥85) (criterion measure)		
AMCQ 26 version (cut score = 83)		Probable DCD	Non DCD (control)
	Probable DCD	12	7
	Non DCD (control)	3	16

Reliability:
Cronbach's alpha: 0.902
test-retest reliability: t (16) = -1.22, p < .001

Discrimination accuracy:
- Total proportion of agreement: 74%
- Sensitivity: 80%
- Specificity: 70%

Final cut score = 83

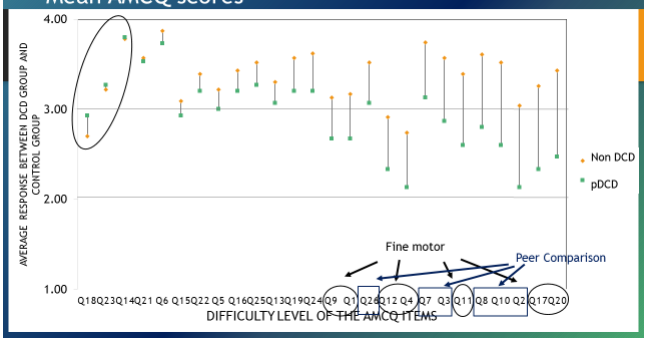
11

Sample Questions

Questions	NEVER	SOMETIMES	FREQUENTLY	ALWAYS
I PREFER TO PARTICIPATE IN INDIVIDUAL SPORTS (SUCH AS SWIMMING, MARTIAL ARTS, ATHLETICS) RATHER THAN TEAM SPORTS (SUCH AS FOOTBALL AND NETBALL)				
I CAN RIDE A BICYCLE				
I FIND IT HARD TO USE A FORK OR A KNIFE WHEN EATING A MEAL				
MY HAND WRITING IS FAST ENOUGH TO KEEP UP WITH THE REST OF THE CLASS				
I BREAK OBJECTS ACCIDENTLY MORE OFTEN THAN MY FRIENDS				
I HAVE TROUBLE LEARNING NEW OUTDOOR GAMES				

12

Mean AMCQ scores



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AMCQ-NL cross-cultural adaption (the Netherlands)

1. Original items were translated into Dutch and adjusted for the Dutch Culture
2. Two back-translations were reviewed for equivalency
3. First version of the AMCQ-NL was field tested (n = 3 adolescents with DCD)
4. Psychometric properties of the AMCQ-NL were evaluated (N = 140)

Item number	Australian AMCQ	AMCQ-NL
Item 2	Individual rather than team sports (football and netball)	Individual rather than team sports (soccer and volleyball)
Item 6	I can ride a bicycle	I can do tricks on a bike
Item 7	Doing up make up, clasps on necklaces, watches or bracelets	buttoning up shirts
Item 26	Trouble learning new outdoor games	Difficult to learn new games in PE class

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AMCQ-NL - Basic Psychometric Properties

- Sample: N = 140 (n = 65 males, n= 75 females)
- Cut score of 83:
- the AMCQ-NL identified 52% of girls and 26.2% of boys scored 83 or lower.
- Internal consistency: Cronbach's alpha = 0.799
- Test-retest (n = 7) intra-class correlation coefficient (ICC) 0.934
- Construct validity – AMCQ-NL vs. Self-Concept of Ability Scale (SCAS-PE) r = 0.672.

15

Factor	Item	Component 1	2	3
1 Participation in physical activity and sports	4 kick ball to hit something	,767	,156	-,042
	1 throw ball to hit something	,750	,136	-,017
	10 rather be spectator at sports game than participate	,718	,036	,117
	8 catch a ball consistently	,625	,104	,062
	9 hit ball with bat	,612	,267	,077
	3 not participate sports at school	,560	,062	,215
	2 individual rather than team sports	,535	-,158	-,304
	18 nervous about coming last in race	,500	,152	,121
	26 difficult to learn new games in PE	,401	-,237	,395
	6 do tricks on bike	,350	,330	,146
	19 ask for help when co-ordination is required	,267	,178	,245
	24 balance on one foot	,264	,249	,179
	16 confusing left and right	,249	,117	-,017
2 Clumsiness	15 do not think I'm clumsy	,290	,777	-,056
	5 people say I'm clumsy	,330	,739	,030
	13 more unco-ordinated than friends	,246	,713	,059
	11 use scissors	-,089	,418	,158
	21 stumble on stairs	,048	,346	,127
3 Activities of Daily Living (ADL)	20 easy to floss teeth	,122	,089	,609
	17 fast handwriting to keep up with class	-,034	,034	,571
	22 slow to change clothes	,220	,001	,569
	25 hard to walk along a straight line	,226	,108	,435
	23 break objects more often than friends	-,111	,352	,421
	12 easy to read handwriting	-,305	,032	,371
	14 difficult to use knife and fork	-,089	,241	,307
	7 easy to get ready to go out	,052	,211	,211

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Comparisons

	AMCQ (N = 38)	AMCQ-NL (N = 140)
Internal consistency	Cronbach's alpha: 0.902	Cronbach's alpha: 0.799
Test-retest reliability	t (16) = -1.22, p < .001	Test-retest (n = 7) ICC = 0.934
Concurrent validity	AMCQ (total score) vs. MAND (NDI) R = 0.491 (p < .002)	
Construct validity		AMCQ-NL vs. SCAS-PE r = 0.672 (p<.01)
Factor Analysis		Three factors identified 1.Participation in P.A. and sport 2. Clumsiness 3. ADL

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The AMCQ is a part of my larger PhD study

Timeline	
2014	Proposal presentation
	HDHS Ethics approval
	Tool Validation → AIDA
	Tool Development → AMCQ
2015	Presentation
	Data Collection (N = 300) Current Phase
2016	Write up Quantitative findings
	Qualitative Data collection → Adolescent focus group
	→ Parent interviews
	Write up Qualitative findings
	Write up thesis

Thesis Submission aimed for December 2016.

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Planned Publications

Planned Publications	Status
Development and validation of the Adolescent Motor Competence Questionnaire (AMCQ) for Teens with an Australian sample	Under Review
Psychometric properties of a culture-adapted English version of Assessment of Identity Development in Adolescence (AIDA) in Australia	Second Draft
Identity formation with high and low motor competence adolescents: Are there differences?	First Draft
Is there congruency between a parent's perspective and their adolescent's perspective of identity formation?	First Draft
Do adolescent self-perceptions mediate the relationship between motor competence and identity formation in adolescents?	Yet to begin

This is dependent on sample recruitment

19

Acknowledgements

Supervisors: Professor Beth Hands & Dr Fleur McIntyre

The Perth DCD collaboration team: Move.Grow.Engage.

The participants

Co-Authors: Marja Cantell (the Netherlands) & Susan Crawford (Canada)

Collaboration Research Network (CRN)

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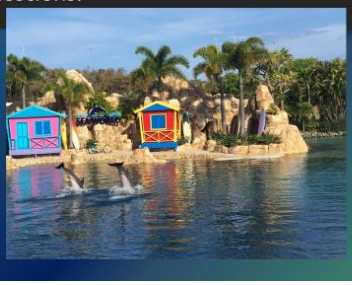
Any Questions?



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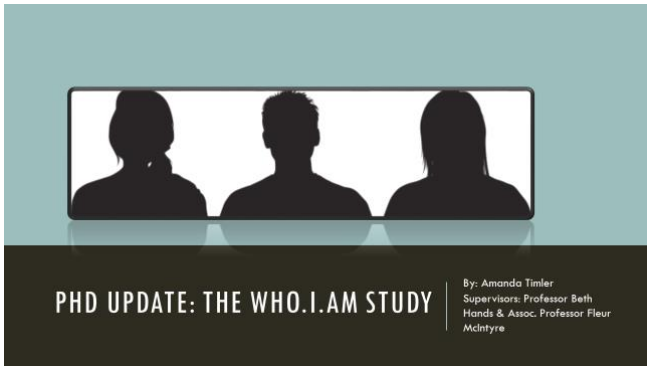

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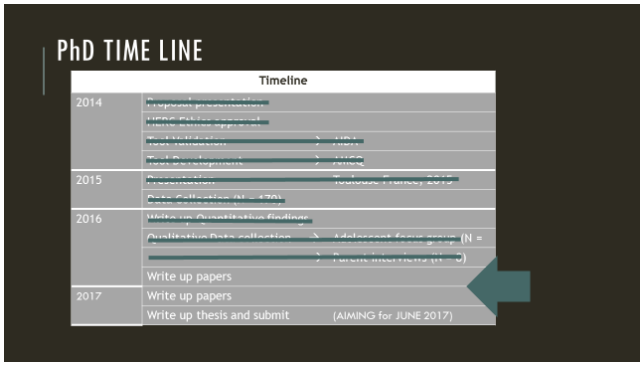

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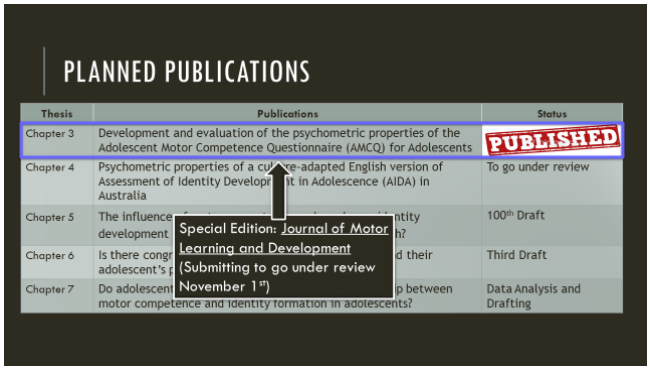

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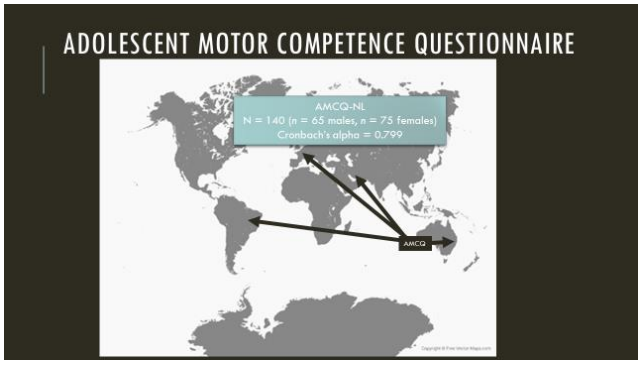

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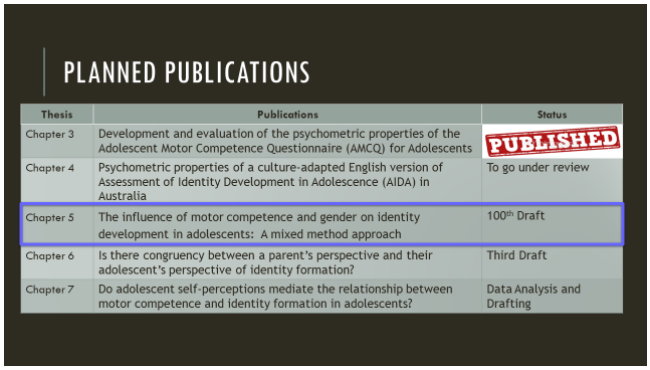

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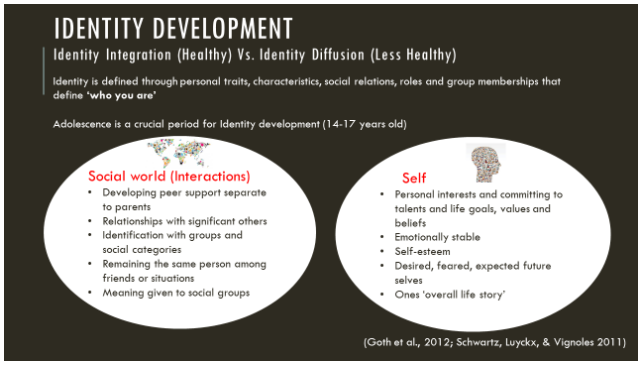

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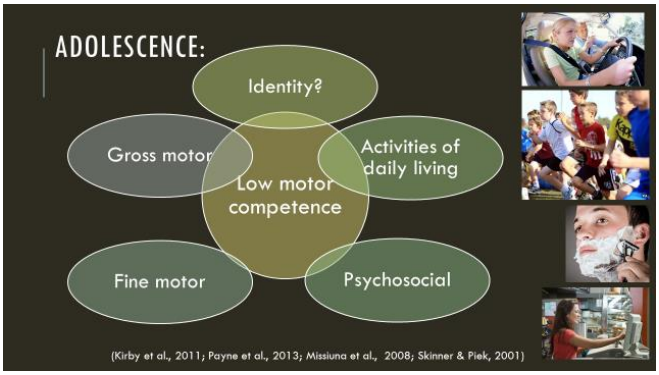
ADOLESCENCE:



(Kirby et al., 2011; Payne et al., 2013; Missiuna et al., 2008; Skinner & Piek, 2001)

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GAP

Currently, only one qualitative study has explored identity development with this risk group.

Lingam et al., (2013) looked at identity and empowerment in teenagers with DCD

- Central theme 'we are all different'
- Attitudes of day to day lives & school
- Self-worth came from forming social network

- Further quantitative research is needed in this area!

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RESEARCH QUESTION

Does identity formation differ between adolescents with high and low motor competence and does it differ between males and females ?

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SEQUENTIAL MIXED METHODS DESIGN

PHASE 1: QUANTITATIVE

- Participants: N = 160 (64.4% males, M_{age} = 14.44 years, *SD*= 0.750)

MEASURES

Adolescent Motor Competence Questionnaire (AMCQ)

26 items [four point Likert scale 1) Never, 2) Sometimes, 3)Frequently, 4) Always]

Cut score ≤83 (out of 104) = motor difficulties may be present (higher score = higher motor competence)

Assessment of Identity Development in Adolescents (AIDA)

58 items (5 point format 0 = no, 1 = more no, 2 = part/part, 3 = more yes, 4 = yes)

Continuum scoring (Total scale = 200)

[1)Self (27 items) and 2) social world (31 items)] (lower score = healthier identity)

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PROCEDURES

- Data collection – 2 years
- Community sporting clubs (Footy, Netball & Basketball clubs)
  - School (Independent, Catholic & Government)
    - Consent obtained before completion of the surveys
    - Took adolescent's 35 minutes to complete

DATA ANALYSIS -SPSS

1. Two-way ANOVAs
2. One-way ANOVAs

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RESULTS

GENDER:

- Males had higher motor competence (AMCQ, M = 89.29) and healthier overall identity (M = 62.79), self subscale (M = 25.46), and social interactions (M = 37.33).
- Female had lower motor competence (M = 81.60) and less healthy overall identity (M = 86.81; F = 11.68 p = .001), Self subscale (M = 36.40; F = 11.48, p .001) and Social interactions (M = 50.50, F = 9.56, p = .002)

MOTOR COMPETENCE:

- LMC had less healthy overall identity (F = 5.35 p = .022), and Self subscale (F = 7.22, p = .008)

MOTOR COMPETENCE AND GENDER:

- HMC and LMC Females had less healthy overall identity (HMC females M = 80.75, p .025, LMC females 92.64, p <.001), and Self subscale (HMC females M = 33.57 p = .014, LMC females M = 39.25, p <.001) compared to the HMC males
- LMC Females had less healthy Social interactions (LMC females M = 53.39, p .001) compared to the HMC males

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PHASE 2: QUALITATIVE

Participants: Interviews N = 17 (M_{age} 14.65 years)
- [7 High motor competence (4 males), 10 Low motor competence (6 males)]

- Only those who nominated to be contacted a second time (17/79 response rate 4.7%)
- Participants grouped in the high and low motor competence
  - Interviews lasted for about 45 minutes to 1 hour

Interview Questions (13)

- Social support mechanisms (family and peers) and Environmental stressors (sporting, school and home) – based on responses from AIDA

DATA ANALYSIS

- NVivo
- Thematic Content analysis

NVIVO

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QUALITATIVE RESULTS

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OVERALL IDENTITY
PEER SUPPORT AND ACTIVITIES

HMC reported higher levels of social support

- HMC Males reported large groups of friends, participated in a range of activities including sports (Karate, Soccer…) computers, movies and parties.
- HMC Females valued close friendships, one on one friendships

- LMC males and females had smaller friendship groups, only hang out with friends on occasions, preferred activities such as 'hang out and chat', or outdoor activities

'Well these days I do not really have really close close friends umm… that I talk with, so I would say not really, last year the friend that I told you about was more so, we were able to talk about some things but I do not think I would ever be fully comfortable about talking.' (14 year-old LMC male).

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OVERALL IDENTITY
SCHOOL EXPERIENCE AND TEACHERS

- LMC males and females school experience was driven by their academic ability.
  - Academic extension programs
  - Post-secondary education
  - Preferred to pick subjects
  - Teachers were sometimes difficult to understand BUT were valued if teachers recognized their difficulties

'Last year was a bit of a struggle for me, but I said over the holidays that this was going to be my year and it has been. I have been really enjoying school, so that's good… Yes, definitely [picking classes], has made me want to be at school… Yes, it does because they [school] make you do a lot of things that you do not really have interest in, so it is a lot better when you do get to do what you want to do' (15-year-old LMC female).

- HMC males were more relaxed about assignments, test and exams
  - Participated in mentoring programs
  - Sought teachers out for advice and additional support

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SELF
PERSONAL CHANGES

Regardless of motor competence, many developed their identities by observing traits, personalities and characteristics of people they admired.

- LMC males and females - self-confidence came from their academic skills
  - Did not like change
  - Responsibility
  - Stress and pressure (also reported by some HMC females)
  - Motivated to participate in physical activities if they saw the value

'A lot of my self-worth comes from my intellect, I pride myself on the fact that other people see me as smart and intelligent, as someone that you could come and see if you needed some help. I am currently at the top of my year for economics, politics and law so I quite enjoy that prestige' (14-year-old LMC male).

- HMC males and females felt like they were:
  - Maturing
  - Motivated to participate in a range of activities

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SELF
FUTURE PLANNING

Adolescents thought three years (but not 5 or 10 years) planning down the track was important

HMC and LMC Females valued organization, planning, greater thought into their future

HMC and LMC Males felt more relaxed, most knew their next step, 'go with the flow'

Some of the LMC females were scared of not achieving their goals, therefore greater stress and pressure towards their future

'I definitely think about my future a lot, I definitely try to place where I am in the future and see how I can get there and how I can get there… well you know if it does not scare you then it does not make you stronger, but with the acting, in three years' time I am scared about what is going to happen and that actually strives me when I compare it to math [teaching]… I would not be as scared' (14-year-old LMC female).

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SOCIAL WORLD (INTERACT)
PEER SUPPORT AND COMPARISON

- HMC and LMC females valued close friendships
- HMC males had large mixed groups (10 – 40 friends)
- LMC males had small social groups
- LMC females did not like being judged on physical ability:

'I just do not like the way it [physical education] is set out in all schools not just my school, yeah and I do not like that they grade you on your physical abilities, but then I guess they do the same for mental but…' (15 year-old LMC female)

  - Acted differently among certain friends
  - Experienced fragmented friendship groups
  - Valued school peers to assist them with classroom assessments

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SOCIAL WORLD (INTERACT)
COMMUNICATION

- HMC males and females would seek advice:
  - from other adult figures
  - Parents
  - Siblings
- LMC males valued parents and teachers options
- LMC females felt parents (specifically mothers) were important for advice and felt nervous about their future based on their siblings:

*'Well it is not so long and my older brother is finishing this year and he is really calm about it, but you have to do a lot of stuff once you finish school because that is when you apply for universities and that is where you mainly go because you have done well to get into those universities. **I know you can try it again but it is just like what, I hope I get into it please let me get into it… he is not going into stress he is really relaxed about it, but that freaks me out a bit more, because he is calm** because honestly this year was the year where it came out what he wanted to do when he was older so he wants to do something with banking and so he has just came up with that this year and I find it really difficult to understand…* (14 year-old LMC female).

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SO WHAT?

- Adolescents is a crucial time for identity development and those with LMC may be at risk of psychosocial issues and unhealthy identity development
- Overall - Males tend form healthier identities than females
- Level of motor competence may be a protective factor for males in the development of a healthy identity
- Females with LMC experience the greatest difficulties in forming a positive sense of self and their identity.
- THEREFORE LMC females may be at a double disadvantage during adolescence especially surrounding their social interactions and school experiences.

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LIMITATIONS

- Recruitment of quantitative and qualitative sample
- Misclassification of motor competence level
- Maintaining participant's interest over 2 years
- Conflicting schedules for allocated interview times (Skype/Virtual interviews)

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ACKNOWLEDGEMENTS

- Supervisors: Professor Beth Hands & Dr Fleur McIntyre
- Co-Authors: Caroline Bulsara & Elizabeth Rose

- All of the participants, school and sporting clubs
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WATCH THIS SPACE

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Timler, A., McIntyre, F. & Hands, B (2016) *Who am I? Five minute presentation*. Presented at the University of Notre Dame Health Research Symposium (December 8th, 2016).

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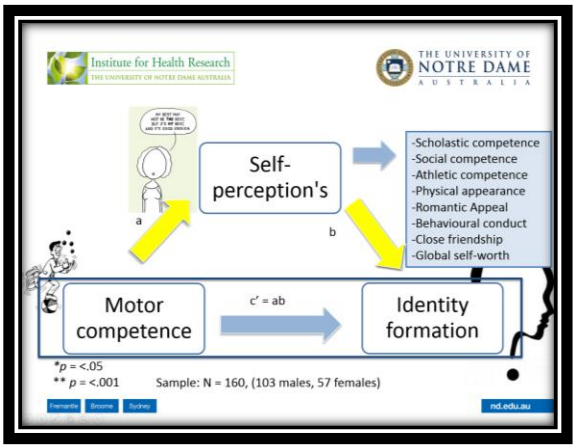

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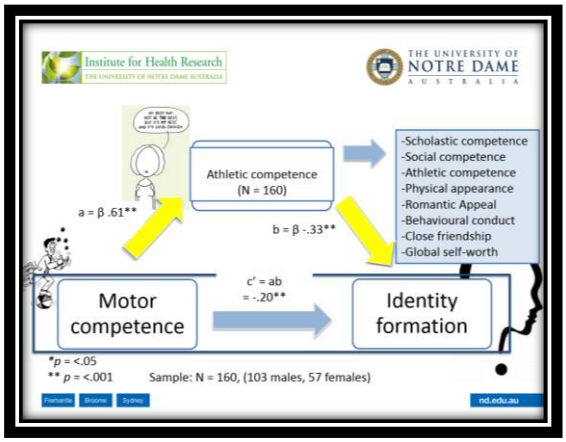

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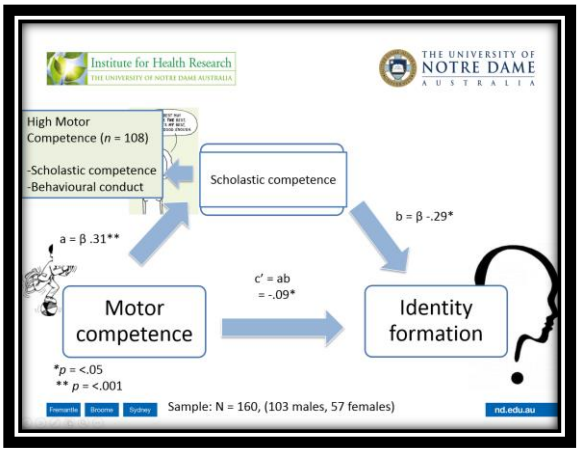

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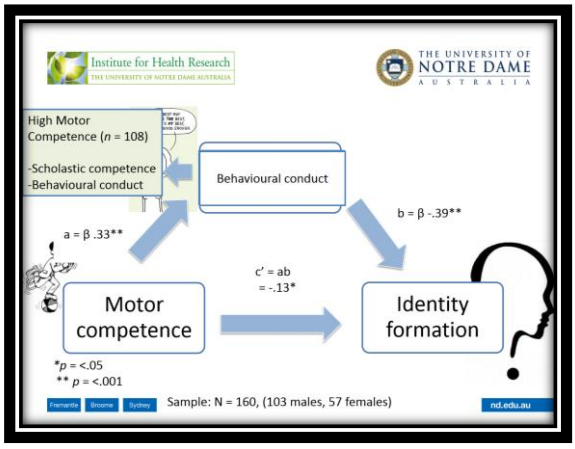

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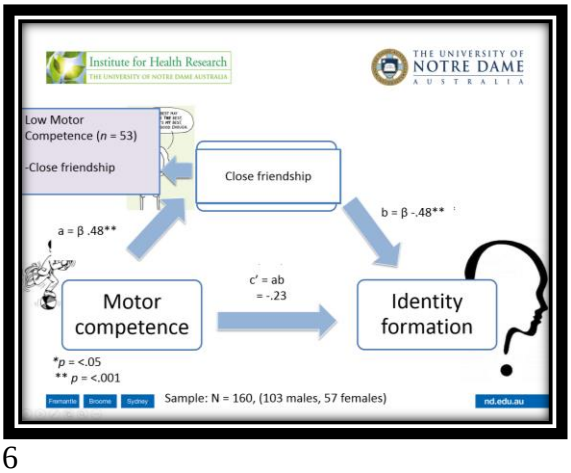

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