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## The validity and reliability of the Basketball Jump Shooting Accuracy Test

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1       **The validity and reliability of the Basketball Jump Shooting Accuracy Test**

2

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4

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46 **Introduction**

47 Basketball requires athletes to execute a diverse range of physical and  
48 technical tasks during game-play (Abdelkrim, Chaouachi, Chamari, Chtara, &  
49 Castagna, 2010; Scanlan, Dascombe, Reaburn, & Dalbo, 2012). Athletes frequently  
50 perform passing, dribbling and shooting manoeuvres during repeated, high-intensity  
51 and low-intensity running bouts (Read et al., 2014). Shooting in particular is  
52 fundamental to offensive performance and strongly influences the outcome of  
53 basketball games. In this regard, winning probability increases when a team  
54 demonstrates superior accuracy from two- and three-point shooting distance  
55 compared to the opposing team (Ibáñez et al., 2008; Lorenzo, Gomez, Ortega,  
56 Ibanez, & Sampaio, 2010; Melnick, 2001; Özmen, 2016). There are a variety of shot  
57 types performed in basketball such as the lay-up, dunk and jump shot; however, the  
58 jump shot is recognised as the most common shot executed, accounting for 67% of  
59 all shot attempts in the 2014-15 National Basketball Association (NBA) regular  
60 season (Erculj and Strumbelj, 2015). Despite the importance of jump shooting  
61 performance to team success, there are few valid and reliable assessments to assess  
62 jump shooting accuracy in basketball athletes.

63

64 Existing assessments examine jump shooting accuracy however important  
65 testing considerations are lacking. When designing a skill test in sport, a key  
66 consideration is replicating the conditions in which the skill is commonly performed  
67 while also ensuring these conditions remain consistent for each athlete. For example,  
68 the Australian Football Kicking Test (AFK) assesses field kicking accuracy with  
69 temporal constraints placed on athletes from distances commonly disposed from  
70 during a game (Woods, Raynor, Bruce, & McDonald, 2015). Inter-subject variability

71 in test conditions has been observed in existing jump shooting tests due to  
72 underpinning methodological limitations. For instance, during the On the Move  
73 Shooting Test and 60-second dynamic two-point and three-point shooting tests,  
74 athletes receive a chest pass before each shot attempt, which introduces  
75 inconsistencies to the shooting conditions given each pass attempt cannot be  
76 precisely replicated across test trials (Pojskić, Šeparović, Muratović, & Užičanin,  
77 2014; Thakur and Mahesh, 2016). Furthermore, the AAHPERD basketball test  
78 instructs athletes to attempt a minimum of one shot from five different locations in  
79 addition to a maximum of four lay-ups in a 60-second time frame. Variability is  
80 introduced between subjects in this test as athletes can choose the remaining  
81 locations after satisfying these basic conditions (Vernadakis, Antoniou, Zetou, &  
82 Kioumourtzoglou, 2004). Another limitation of current jump shooting assessments in  
83 basketball is the ambiguous information detailing the testing protocols presented in  
84 the current literature, which weakens test reproducibility (Robertson, Burnett, &  
85 Cochrane, 2014; Thakur and Mahesh, 2016). For example, the Spot Up Shooting  
86 Test instructs players to attempt five jump shots from different locations; however it  
87 is unclear whether all five shot attempts should be performed at each location in  
88 succession and the exact location of each jump shot is not explicitly defined  
89 (Thakur and Mahesh, 2016). Meanwhile, the stationary two-point and three-point  
90 shooting tests assess accuracy from five different locations with each athlete  
91 attempting two shots from each location. However, it is unclear whether athletes  
92 attempt two shots in succession at each location or attempt a single shot at each  
93 location before returning to the beginning of the test and repeating the same protocol  
94 (Pojskić, et al., 2014). Moreover, while the majority of jump shooting assessments  
95 evaluate two- and three-point shots in isolation (Erculj and Supej, 2009; Pojskic,

96 Separovic, & Uzicanin, 2011; Slawinski et al., 2018), the existing tests that combine  
97 two- and three-point shots have not been validated (Kinc, 2008; Okazaki and  
98 Rodacki, 2012; Thakur and Mahesh, 2016).

99         A valid and reliable jump shooting assessment can have wide-ranging  
100 applications in basketball. Skill accuracy assessments can be utilised either on their  
101 own or as part of a multi-dimensional assessment included in the talent identification  
102 process (Robertson, et al., 2014) and to assist with skill development in basketball  
103 athletes. Individual limitations in jump shooting technique can be identified for each  
104 athlete which can help in the development of specific skill-enhancing strategies  
105 (Robertson, et al., 2014). A simple, repeatable skill assessment can also allow for  
106 progress in skill performance to be monitored which helps to assess the effectiveness  
107 of implemented training interventions (Sunderland, Cooke, Milne, & Nevill, 2006).

108         Before utilisation in the field, skill assessments should first be examined for  
109 validity and reliability. Validity refers to the degree in which a test measures the skill  
110 in question. Specifically, content validity refers to the ability of a test to mimic  
111 particular actions of a sport, such as comparing test outcomes between shots of varying  
112 difficulty (Aandstad and Simon, 2013). Furthermore, construct validity can be  
113 assessed by comparing skill outcomes of athletes competing at varying playing levels  
114 with superior shooting accuracy expected to be possessed by athletes competing at the  
115 higher level (Sampaio, Godoy, & Feu, 2004; Scanlan, Dascombe, & Reaburn, 2012).  
116 Meanwhile, determination of reliability across multiple trials indicates the consistency  
117 of an assessment to measure the outcome of interest (Robertson, et al., 2014). Relative  
118 reliability refers to the consistency of the position of individual scores relative to others  
119 in a group whereas absolute reliability simply concerns the consistency of scores by  
120 each individual (Weir, 2005). A common challenge when developing a skill test is

121 balancing the trade-off between validity and reliability where consistent testing  
122 conditions are present for each athlete while also ensuring the assessment possesses  
123 valid characteristics similar to those seen during game-play. Maintaining a balance  
124 between both test features can be difficult but important to achieve.

125         The current limitations in shooting tests developed for application in  
126 basketball such as inter-subject variability in testing conditions, ambiguous  
127 information regarding testing protocols and assessing two- and three-point shooting  
128 accuracy in isolation has led to the development of the Basketball Jump Shooting  
129 Accuracy Test (BJSAT). The BJSAT is designed to evaluate jump shooting accuracy  
130 across game-specific court locations in a replicable manner. Therefore, the aim of  
131 this study is to determine the content validity, construct validity and reliability of the  
132 BJSAT.

133

## 134 **Methods**

### 135 *Participants*

136         Male (n = 18) and female (n = 23) basketball athletes were recruited from  
137 two separate semi-professional State Basketball League (SBL) clubs. Athletes were  
138 either classified as SBL (n = 30, age:  $22.7 \pm 6.1$  yr, playing experience:  $14.2 \pm 7.4$   
139 yr) or SBL Division I (n = 11, age:  $20.6 \pm 2.1$  yr, playing experience:  $11.4 \pm 4.3$  yr)  
140 based on the predominant competition played during the 2018 regular season. The  
141 SBL is the pre-eminent state basketball competition in Western Australia comprising  
142 of men's and women's competitions, while the SBL Division I is the competition  
143 directly below the SBL. Athletes competing in both competitions train together  
144 before being selected to play in either the SBL or SBL Division I each week. All  
145 playing positions were represented among the cohort, including guards (males = 6,



146 females = 13), forwards (males = 11, females = 7) and centres (males = 1, females =  
147 3). All athletes provided informed consent, with athletes under the age of 18  
148 providing written consent from their guardian. Athletes free from any injury or  
149 illness that limited participation with those unable to participate verbally instructed  
150 to notify the assessor. The study protocol was approved by an Institutional Human  
151 Research Ethics Committee.

152

### 153 *Basketball Jump Shooting Accuracy Test Development*

154         The BJSAT was developed using shot location data derived from the 2013-14  
155 NBA regular season which revealed the court locations where athletes attempted the  
156 highest frequency of shots (Beshai, 2014). Though this data does not state the type of  
157 shots attempted at these locations, due to the distance of the locations chosen for  
158 inclusion in the BJSAT, it was expected that these were jump shots. Detailed  
159 shooting location data such as this was only accessible from the NBA, renowned as  
160 the premier basketball competition in the world. From these data, 4 x two-point and  
161 4 x three-point shot locations were included in the BJSAT with an equal number of  
162 shot attempts from the right and left sides of the court. In total, the test consisted of 8  
163 x jump shot attempts at pre-determined locations on the court. One jump shot was  
164 attempted from each of the eight shot locations in a predefined order (Figure 1). The  
165 shot order of the BJSAT ensured athletes were alternating between two- and three-  
166 point shooting distance and not performing consecutive jump shots from either  
167 distance throughout the test. This feature of the BJSAT more closely replicates in-  
168 game shooting patterns (Gomez, Gasperi, & Lupo, 2017) compared to jump shooting  
169 assessments previously undertaken in basketball that involve successive shot

170 attempts from the same shooting distance (Erculj and Supej, 2009; Pojskic, et al.,  
171 2011; Pojskic, Sisic, Separovic, & Sekulic, 2017).

172

173 \*\*\*INSERT FIGURE 1 AROUND HERE\*\*\*

174

### 175 *Testing Procedures*

176 Testing sessions were conducted on indoor, hardwood basketball courts prior  
177 to scheduled training sessions. Testing was undertaken during the final week of a 4-  
178 month pre-season phase before the opening regular season game. During this phase,  
179 athletes were undertaking two training sessions per week each two hours in duration.  
180 Training was predominantly skill-based and focussed on match-play. Prior to testing,  
181 all athletes were given a demonstration of the BJSAT and performed a 2-min  
182 shooting warm-up from the shot locations included in the BJSAT. Athletes were  
183 instructed to attempt four shots with an even spread from the left and right sides of  
184 the court and from two- and three-point distance. A standardised 10-min warm-up  
185 consisting of light shuttle runs, bilateral countermovement jumps and dynamic  
186 stretching was also undertaken by all athletes. Each athlete completed four trials of  
187 the BJSAT with 2 min of passive rest between trials where athletes could walk  
188 around the other half of the court and recover before the next trial. If a jump shot was  
189 performed in the incorrect order, athletes were advised to continue the assessment  
190 with verbal instruction ensuring the correct order was followed for the remainder of  
191 the trial. Athletes began each trial at the midpoint between the half-court line and  
192 three-point line (Figure 1). At each shot location, a holding apparatus standing at a  
193 height of 1 m was positioned to deliver basketballs to the athletes. The male athletes  
194 used standard size 7 basketballs (Wilson Solution; Wilson; NSW, Australia) and the

195 female athletes used standard size 6 basketballs (TF-1000 Legacy; Spalding; KY,  
196 United States of America) to align with game regulations. All shots were attempted  
197 with athletes placing both feet within a marked area at each shot location (60 cm x  
198 60 cm). If an athlete attempted a jump shot with one or both feet outside of the  
199 marked area, the athlete continued the trial; however verbal instruction was given  
200 immediately to ensure both feet were placed within the marked area for the  
201 remaining shot attempts. These approaches permitted standardised shooting  
202 conditions for all athletes.

203 Athletes were instructed to complete each trial of the BJSAT as fast as  
204 possible to replicate the intensity of jump shot attempts in games in that the athlete  
205 shooting the basketball often has little time when attempting the shot due to  
206 defensive pressure. Athletes were instructed to not wait and observe the outcome of  
207 each shot attempt and instead sprint to the next shot location after attempting each  
208 shot. A time limit for each trial was not placed on the athletes; however consistent  
209 verbal encouragement was given during each rotation to ensure athletes were moving  
210 as fast as possible between each shot location. Athletes took  $28.1 \pm 2.7$  s to complete  
211 the BJSAT.

212

### 213 *Basketball Jump Shooting Accuracy Test Scoring System*

214 Four different scores could be awarded for each jump shot attempt in the  
215 BJSAT adapted from similar skill assessments in Australian football and basketball  
216 (Strand and Wilson, 1993; Woods, et al., 2015). For the BJSAT, scoring options  
217 ranged from 0-3 (Table 1). Two assessors scored the BJSAT with one assessor  
218 present for the testing session undertaken at each respective club. Both assessors  
219 were made aware of the testing and scoring protocols before administering the test.

220 Overall test performance for each trial was determined as the total score for each of  
221 the eight shots attempted. For example, if an athlete received a score of 2 points for  
222 each shot attempt in a particular trial an overall score of 16 was recorded. Each  
223 athlete received a mean BJSAT score for each trial and for the four trials combined.  
224 Jump shooting accuracy could therefore be monitored for trends such as a trial order  
225 effect.

226

227 \*\*\*INSERT TABLE 1 AROUND HERE\*\*\*

228

### 229 *Statistical Analysis*

230 Means and standard deviations were calculated for all BJSAT scores across  
231 each of the four trials separately. To evaluate content validity, a dependent t-test was  
232 performed to compare scores between two- and three-point shot attempts across all  
233 trials (Kinc, 2008). Construct validity of the BJSAT was assessed using an  
234 independent t-test to compare performance between athletes of different playing  
235 levels (SBL vs. SBL Division I) across all trials. Effect sizes (*d*) were calculated for  
236 each pairwise comparison based on the following classifications: *trivial* = 0-0.19,  
237 *small* = 0.20-0.49, *medium* = 0.50-0.79 and *large* = >0.80 (Cohen, 1992). The mean  
238 typical error (TE) and smallest worthwhile change (SWC) were calculated for the  
239 four trials combined. Four trials were conducted to examine the reliability of the  
240 BJSAT. Between-trial reliability of the BJSAT was assessed by determining relative  
241 reliability indicated by intra class correlation coefficient (ICC) and absolute  
242 reliability indicated by coefficient of variation (CV) measures with 95% confidence  
243 intervals (CI). For all ICC calculations, a two-way mixed model was undertaken  
244 because of the suitability this model provides to research involving repeated

245 measures. The following criteria were used to classify ICC outcomes: *poor* = <0.50;  
246 *moderate* = 0.51-0.75; *good* = 0.76-0.90; and *excellent* = >0.90 (Koo and Li, 2016).  
247 A CV <10% was taken as an acceptable benchmark (Atkinson and Nevill, 1998).  
248 Parametric assumptions of normality and homogeneity of variance were assessed and  
249 confirmed prior to running inferential statistics. Statistical analyses were performed  
250 using Statistical Package for Social Sciences (SPSS) software (v 25.0; IBM Corp.,  
251 Armonk, NY, USA). Statistical significance was set at  $p \leq 0.05$ .

252

## 253 **Results**

254 Mean  $\pm$  standard deviation scores during the BJSAT according to shot  
255 distance (two-point vs. three-point) and playing level (SBL vs. SBL Division I) for  
256 all trials combined are shown in Figures 2 and 3. There was a significant, *large* ( $d =$   
257  $0.99$ ,  $p = < 0.01$ ) difference in BJSAT score between two-point and three-point  
258 shots. There was a non-significant, *trivial* ( $d = 0.17$ ,  $p = 0.57$ ) difference in BJSAT  
259 score between gender. There was also a non-significant, *trivial* ( $d = 0.15$ ,  $p = 0.70$ )  
260 difference in BJSAT score between playing levels. The mean TE of the BJSAT  
261 across all trials was 2.2 while the SWC was 1.6 (0.2) and 4.0 (0.5) respectively.

262

263 \*\*\* INSERT FIGURE 2 AROUND HERE\*\*\*

264

265 \*\*\* INSERT FIGURE 3 AROUND HERE\*\*\*

266

267 Mean  $\pm$  standard deviation, ICC, and CV with 95% CI for BJSAT score are  
268 presented in Table 2. Analysis of all athletes across the four trials demonstrated  
269 *moderate* relative reliability ( $n = 41$ ,  $ICC = 0.71$ ,  $p < 0.01$ ), which strengthened when

270 only the SBL athletes were analysed ( $n = 30$ ,  $ICC = 0.78$ ,  $p < 0.01$ ) and weakened  
271 when only the SBL Division I athletes were assessed ( $n = 11$ ,  $ICC = 0.31$ ,  $p = 0.20$ ).  
272 Absolute reliability was above the accepted benchmark for all athletes ( $CV =$   
273  $16.2\%$ ), the SBL athletes ( $CV = 17.5\%$ ) and the SBL Division I athletes ( $CV =$   
274  $12.1\%$ ). Males ( $n = 18$ ,  $ICC = 0.72$ ,  $p < 0.01$ ) and females ( $n = 23$ ,  $ICC = 0.73$ ,  $p <$   
275  $0.01$ ) both demonstrated *moderate* relative reliability while absolute reliability was  
276 above the accepted benchmark for both males ( $CV = 16.9\%$ ) and females ( $CV =$   
277  $15.8\%$ ). Two-point shooting accuracy demonstrated greater reliability ( $ICC = 0.68$ ,  $p <$   
278  $< 0.01$ ,  $CV = 19.8\%$ ) compared to three-point shooting accuracy ( $ICC = 0.58$ ,  $p <$   
279  $0.01$ ,  $CV = 20.0\%$ ).

280

281 \*\*\*INSERT TABLE 2 AROUND HERE\*\*\*

282

## 283 **Discussion**

284 This study presents the development of a jump shooting accuracy assessment,  
285 which was deemed to possess adequate content validity. When evaluating the content  
286 validity of the BJSAT, athletes scored significantly better in two-point shot attempts  
287 compared to three-point shot attempts. The BJSAT was sensitive to the distance  
288 accuracy trade-off demonstrated in previous shooting tests with accuracy greater in  
289 two-point shots compared to three-point shot attempts, mimicking a pattern observed  
290 during game-play where two-point shooting accuracy is often superior to three-point  
291 accuracy (Kinc, 2008; Özmen, 2016). Previous evidence demonstrates basketball  
292 athletes tend to be less accurate from greater shooting distances due to an increase in  
293 release angle and velocity on the basketball and decline in release height (Okazaki and  
294 Rodacki, 2012). Athletes adopt these movement strategies when shooting from longer

295 distances leading to greater instability on the basketball and consequently detrimental  
296 shooting performance outcomes (Okazaki and Rodacki, 2012). Our findings confirm  
297 a *large* difference exists between the shooting accuracy of athletes from two-point  
298 distances compared to three-point distances during the BJSAT highlighting the  
299 assessment's ability to detect differences in shooting accuracy between shots of  
300 varying difficulty while replicating in-game shooting demands. The BJSAT replicates  
301 these demands because jump shot attempts throughout the test alternate between  
302 shooting location and distance. During basketball game-play, jump shots are sparsely  
303 attempted from the same location or distance repeatedly with shots attempted from a  
304 range of locations and distances (Gomez, et al., 2017). The BJSAT is one of the few  
305 current assessments that combine shot attempts from two- and three-point distance  
306 (Kinc, 2008; Okazaki and Rodacki, 2012; Thakur and Mahesh, 2016), however unlike  
307 these existing assessments, shooting performance from two- and three-point distance  
308 in the BJSAT have been validated. While the holding apparatus utilised in the BJSAT  
309 were not game specific and delivered the basketballs at different heights to each  
310 athlete, this equipment ensured testing conditions remained as consistent as possible  
311 for all athletes in a practical, time efficient manner while keeping the focus of the test  
312 on the skill of jump shooting.

313

314           Construct validity provides insight into the ability of an assessment to  
315 discriminate between athletes competing at different playing levels. A non-  
316 significant, *trivial* difference was observed between gender ( $d = 0.17$ ,  $p = 0.57$ ).  
317 Little difference in jump shooting accuracy was forecasted between male and female  
318 athletes because both genders were recruited from a state-level competition, testing  
319 was undertaken at the same point in the season and similar training programs were

320 being undertaken at the time of testing. Interestingly, only a non-significant, *trivial*  
321 difference ( $d = 0.15$ ,  $p = 0.70$ ) was also evident in BJSAT score between SBL and  
322 SBL Division I athletes. The low sensitivity of the BJSAT to differentiate between  
323 athletes of higher and lower playing levels may have been due to methodological  
324 limitations in athlete recruitment rather than an inability to discriminate between  
325 athletes possessing higher and lower shooting accuracy. The largest limitation in  
326 athlete recruitment was the similarity between playing levels in that both groups of  
327 athletes undertook similar training programs, with many athletes competing at both  
328 levels throughout the season. A pre-determined number of athletes was not sought  
329 for each playing level and position, rather that each was represented by both genders.  
330 As all athletes participating in this study were recruited from two SBL teams, it is  
331 possible the poor sensitivity in differentiating between the SBL and SBL Division I  
332 athletes may have been due to the samples demonstrating homogenous skill  
333 outcomes. Rather it is plausible other attributes differentiate playing level in these  
334 athletes given higher-level basketball competition often necessitates superior  
335 physical (e.g. jump power) (Abdelkrim, Chaouachi, et al., 2010) technical (e.g.  
336 dribbling speed) (Torres-Unda et al., 2013) and tactical (e.g. number of positioning  
337 movements) (Abdelkrim, Castagna, El Fazaa, & El Ati, 2010) attributes. Future  
338 research should further explore the discriminatory capacity of the BJSAT to  
339 differentiate shooting accuracy between athletes from playing levels who possess  
340 notable differences in shooting ability such as national and state competitions.

341 Skill tests should possess acceptable validity as well as adequate reliability  
342 before being adopted in practice. The BJSAT was shown to possess *moderate* relative  
343 reliability, comparable to previously reported shooting tests such as the two- (ICC =  
344 0.82) and three-point (ICC = 0.85) tests developed by Pojskic et al. (2011). While the



345 BJSAT possesses weaker ICC than the tests developed by Pojskic et al. (2011), tests  
346 developed previously exclusively examined only two- or three-point shots, whereas  
347 the BJSAT requires athletes to execute shots from both distances in combination. The  
348 variability in shooting distance and location in the BJSAT conceivably would reduce  
349 the relative reliability observed. However it is this variability in shooting distance and  
350 location that makes the BJSAT more representative of in-game shooting demands  
351 because shots are attempted from a range of distances and locations during games  
352 (Gomez, et al., 2017). Research has also examined novel skill assessments in other  
353 sports, reporting either similar or lower relative reliability than observed in our study.  
354 For instance, the Nine-Ball Skills Test is used in golf and assesses the ability to land  
355 nine different shot types at a certain location, demonstrating an ICC of 0.67  
356 (Robertson, Burnett, Newton, & Knight, 2012). Meanwhile soccer passing, shooting  
357 and dribbling tests assessing skill precision across two separate trials revealed ICC  
358 ranging from 0.38-0.77 for different skills (Russell, Benton, & Kingsley, 2010).  
359 Relative reliability of the BJSAT were shown to be comparable with tests in other  
360 sports and slightly below those reported in basketball due to the modest variability  
361 across the repeated trials when all athletes were evaluated. There was evidence of a  
362 trial order effect with accuracy scores improving and stabilising across the first three  
363 trials of the BJSAT (Table 2). Practitioners therefore are encouraged to administer up  
364 to three trials of the BJSAT to habituate athletes with the shooting locations and order  
365 of the test. Undertaking a longer familiarisation of the BJSAT or shooting warm-up  
366 may also help habituate athletes sooner with the BJSAT. Novel assessment conditions  
367 and pre-planned shooting locations may have influenced the shooting accuracy of  
368 athletes during the initial trial, thereby allowing a familiarisation exposure.

369           Compared to previous two- (CV = 28.3%) and three-point (CV = 42.8%)  
370 assessments in basketball, the BJSAT displayed superior absolute reliability (CV =  
371 16.2%); however these remained above the accepted benchmark due to greater than  
372 normal variation from the mean accuracy scores across each of the four trials  
373 (Atkinson and Nevill, 1998). The BJSAT displayed comparable absolute reliability to  
374 skill assessments developed in other sports including golf (CV = 27.5%) (Robertson,  
375 et al., 2012) and soccer (CV = 4.6-23.5%) (Russell, et al., 2010). It is natural for skill  
376 assessments to demonstrate larger CV as this reflects technical performance within  
377 sport as superior athletes often demonstrate inconsistencies with skill accuracy  
378 throughout competition, such as inconsistencies in jump shooting accuracy between  
379 basketball games (Zhang et al., 2017).

380           The findings support the use of the BJSAT in practice, however our study  
381 was subject to some limitations. First, each athlete on a basketball team does not  
382 attempt the same amount of jump shots each game with shot attempts influenced by  
383 factors such as playing position (Zhang, et al., 2017). Additionally, the shots were  
384 attempted across a short duration, which is not commonly experienced during  
385 basketball game-play; however was necessary due to the practical requirements for  
386 efficient testing procedures. Second, the shot locations included in the BJSAT were  
387 derived from NBA data which may not be reflective of common shot locations in  
388 other competitions such as the SBL. Shooting location data used for the BJSAT was  
389 taken from the NBA given these data were not accessible from other competitions,  
390 including the SBL. Third, the assessment is pre-planned whereas shots are attempted  
391 in response to various stimuli during game-play. Therefore, performance in the  
392 BJSAT may not be reflective of all in-game scenarios encountered by athletes, such  
393 as shooting with the presence of a defender or in response to a particular game

394 situation. The BJSAT is pre-planned with a determined shot order to ensure  
395 consistent testing protocols for all athletes. Fourth, shooting performance in the  
396 BJSAT was not correlated with 2018 field goal percentage due to a lack of reliable  
397 match performance statistics. As a result, it is encouraged that future research  
398 examines the correlation between BJSAT and within competition shooting  
399 performance. Finally, our findings are indicative of male and female state-level  
400 basketball athletes and therefore may not be representative of other populations.  
401 Consequently, further research is encouraged confirming the validity and reliability  
402 of the BJSAT in athletes from teams competing at different playing levels and age  
403 groups. Further research is also recommended examining the effects of gender on  
404 shooting performance in the BJSAT in different playing levels.

405         The BJSAT may be used by basketball coaches, strength and conditioning  
406 staff, sport scientists, and athletes as a tool to quantify and track intra-individual  
407 jump shooting accuracy. The BJSAT was unable to discriminate between playing  
408 level however was shown to be sensitive to shooting distance and reliable from the  
409 court locations and distances contained in the assessment, as shown by the *moderate*  
410 relative reliability outcomes. Absolute reliability of the BJSAT however was above  
411 the accepted benchmark while the mean TE was 2.2 across all four trials and the  
412 SWC was 1.6 (0.2) and 4.0 (0.5), therefore practitioners are encouraged to monitor  
413 the position of each athlete's score relative to other members of the team.  
414 Practitioners are also encouraged to utilise the BJSAT to evaluate jump shooting  
415 accuracy in playing levels who possesses more pronounced differences in shooting  
416 ability to observe whether the assessment can discriminate in this manner. These  
417 findings illustrate the BJSAT may be utilised in monitoring shooting accuracy from  
418 various game specific shooting locations and distances. Furthermore, the BJSAT can

419 assist practitioners in reliably assessing shooting accuracy across different points in  
420 time such as for monitoring rehabilitation progress, assessing skill technique  
421 interventions and assisting in team selection.

422

### 423 **Conclusion**

424         The BJSAT is a valid jump shooting accuracy test that is sensitive to  
425 shooting distance with athletes demonstrating superior accuracy from two-point  
426 compared to three-point attempts. Meanwhile, the BJSAT detected *trivial* differences  
427 in jump shooting accuracy of athletes competing at different, but relatively  
428 homogeneous, playing levels describing the construct validity of the assessment. The  
429 BJSAT demonstrated acceptable relative reliability across multiple trials in  
430 basketball athletes of varying playing levels. As a result, practitioners can utilise the  
431 BJSAT in monitoring jump shooting accuracy at progressive stages of a season for  
432 various purposes such as evaluating skill technique or rehabilitation interventions.  
433 Absolute reliability of the BJSAT however was above the accepted benchmark  
434 therefore practitioners are encouraged to monitor shooting accuracy performance of  
435 each athlete relative to other team members across a period of time.

436

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440

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- 550

**Table 1.** Scoring criteria for the Basketball Jump Shooting Accuracy Test.

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<b>Score</b>	<b>Description</b>
<b>3</b>	Basketball travels through the basket without touching the rim or backboard.
<b>2</b>	Basketball makes contact with the rim or backboard before travelling through the basket.
<b>1</b>	Basketball makes contact with the rim or backboard but does not travel through the basket.
<b>0</b>	Basketball does not make contact with the rim or backboard and does not travel through the basket.

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551

**Table 2.** The mean  $\pm$  standard deviation score and reliability statistics across four trials of the Basketball Jump Shooting Accuracy Test (BJSAT), according to playing level and shooting distance.

Group	n	BJSAT score					Reliability statistics		
		Trial 1	Trial 2	Trial 3	Trial 4	Total	ICC (95% CI)	p	CV%
<i>Athlete group</i>									
All Athletes	41	10.9 $\pm$ 2.6	12.7 $\pm$ 3.0	12.7 $\pm$ 2.5	12.5 $\pm$ 2.7	48.8 $\pm$ 7.9	0.71 (0.53-0.83)	<0.01*	16.2
SBL	30	10.9 $\pm$ 2.7	13.0 $\pm$ 3.1	12.6 $\pm$ 2.7	12.6 $\pm$ 2.6	49.1 $\pm$ 8.6	0.78 (0.61-0.88)	<0.01*	17.5
SBL Division I	11	11.0 $\pm$ 2.1	11.8 $\pm$ 2.7	12.8 $\pm$ 2.0	12.4 $\pm$ 3.1	48.0 $\pm$ 5.8	0.31 (-0.72-0.79)	0.20	12.1
<i>Shot distance</i>									
Two-point	41	6.0 $\pm$ 1.6	6.9 $\pm$ 2.0	6.9 $\pm$ 2.1	7.0 $\pm$ 1.7	26.8 $\pm$ 5.3	0.68 (0.48-0.81)	<0.01*	19.8
Three-point	41	4.9 $\pm$ 1.7	5.8 $\pm$ 1.7	5.8 $\pm$ 1.4	5.7 $\pm$ 1.8	22.0 $\pm$ 4.4	0.58 (0.33-0.76)	<0.01*	20.0

*Note:* SBL = State Basketball League; ICC = intraclass correlation coefficient; CI = confidence intervals; CV = coefficient of variation; \* indicates statistical significance.

553 **Figure Captions**

554 **Figure 1.** Layout of the Basketball Jump Shooting Accuracy Test.

555 **Figure 2.** The mean  $\pm$  standard deviation Basketball Jump Shooting Accuracy Test  
556 (BJSAT) score at different shot distances.

557 **Figure 3.** The mean  $\pm$  standard deviation Basketball Jump Shooting Accuracy Test  
558 (BJSAT) score for athletes competing at State Basketball League (SBL) and SBL  
559 Division I levels.