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"Stickiness": Gauging students' attention to online learning activities

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"Stickiness": assessing students' attention to online learning activities

Online content developers use the term “stickiness” to refer to the ability of their online service or game to attract and hold the attention of users and create a compelling and magnetic reason for them to return repeatedly (examples include virtual pets and social media). In business circles the same term connotes the level of consumer loyalty to a particular brand. In this paper, the authors extend the concept of “stickiness” not only to describe repeat return and commitment to the learning “product”, but also as a measure of the extent to which students are engaged in online learning opportunities. The paper explores the efficacy of several approaches to the monitoring and measuring of online learning environments and proposes a framework for assessing the extent to which these environments are compelling, engaging, and “sticky”. In particular, the exploration so far has highlighted the difference between how lecturers have monitored the engagement of students in a face-to-face setting versus the online teaching environment. In the higher education environment where increasingly students are being asked to access learning in the online space, it is vital for teachers to be in a position to monitor and guide students in their engagement with online materials. The mere presence of learning materials online is not sufficient evidence of engagement. This paper offers options for testing specific attention to online materials allowing greater assurance around engagement with relevant and effective online learning activities.

Keywords: Stickiness, student engagement, learning analytics

Participation versus engagement metrics

In order for a student to gain a measurable benefit from a learning experience they need to be present within the learning environment. In the classroom, their attendance may be recorded, they may be required to prepare readings or other activities in advance of the class, they may be called upon or volunteer to offer their ideas, or they may through their physical interactions with the lesson show their interest in the proceedings. While presence in the learning environment is a vital factor in the learning experience, scholarship has shown that impressionistic grading around class attendance tells an incomplete story (Bean and Peterson, 1998). Bean and Peterson (1998) cite concerns that academics use participation marking as a “fudge factor in computing final course grades” and contend that “this phenomenon helps explain why assessment and measurement scholars almost universally advise *against* grading class participation”. They conclude that participation grades, especially if impressionistic, are “hard to justify if challenged” (Bean and Peterson, 1998). They do however concede that students can be led to understand the values espoused by engaged participation (in particular oral and collaboration skills) and acknowledge that students will often value elements more if a grade is given (Bean and Peterson, 1998). In this sense, creating a meaningful grade that measures holistic performance in specified desired participation elements would seem preferable to doing away with participation analytics altogether. In the online learning environment, participation is more difficult to observe as a student may log in and log out yet fail to engage with the materials. Just as in a physical classroom where a student may be physically present yet academically disengaged, the online learning environment may fail to maintain students’ attention. Thus first level learning analytics such as those advanced by

Blackboard LMS, which tend to rely on baseline data including entry, exit and length of time in the environment as indicators of "student engagement", may prove as limited as impressionistic participation grades.

Blackboard's "Performance and Retention Dashboard" tracks engagement as a product of a student's course activity, and also monitors login activity, content reviews by a student and their Discussion Board postings (Blackboard, 2015). Moodle's "Engagement Analytics" functionality tracks three indicators: Assessment Activity, Forum Activity and Login Activity, and assigns weightings to each in order to calculate an engagement score for each student that ranks their relative engagement with course content ('Engagement Analytics Plugin - MoodleDocs', n.d.).

While such analytics are valid to a degree and certainly presence within the learning environment is a precursor to any engagement, these analytics provide a very limited and superficial commentary on student engagement and supply almost no detail as to the level of "stickiness" provided by the unit content; the attention paid to the learning experience by the student, or any action or reaction that followed their engagement with the material. Metrics may also show when an assessment was completed, but not speak to the quality of the activity nor to its "stickiness". Similarly, such indicators are poor predictors of repeat engagement (student motivation). Like the disengaged student in a physical classroom, logging in and logging out does not prove much beyond the fact that a student entered and exited the learning environment. Student presence online is therefore at best only the first among many signals of "stickiness" in the online environment.

While passive presence is not necessarily a positive indicator of engagement, the number of active "clicks" likewise may not prove to be a reliable or worthy measure of the effectiveness of the learning materials. In fact, if students equate excessive clicks with overcomplicated or confusing information, they may lose interest. As evidenced by the *Sesame Street* "stickiness" experiments discussed later in this paper, when a programme becomes confusing, the viewer stops paying attention. The authors here argue that the concept of "stickiness" as it has been applied to the digital space more broadly, can be directly applied to monitoring online learning activity of students in a way that will ultimately benefit learning design. To this end, the authors here suggest how a set of important indicators contribute to the "stickiness" of an online unit, and that each indicator must be measured and compared to determine the likely success of the learning experience for the participants. These indicators in turn affect the ongoing design of the unit of study, but the focus of the remainder of this exploration will centre on the analytics associated with "stickiness", veering away from the resultant impact on course design though its significance is duly acknowledged.

"Stickiness" defined in the online learning environment

The concept of "stickiness" holds currency in the technological space. "Sticky" content refers to content published on a website, which has the purpose of getting a user to return to that particular website or hold their attention and get them to spend longer periods of time at that site (Netlingo, n.d.). Website traffic has been traditionally measured in terms of the number of different computers accessing a website in a given timeframe (e.g. Monthly Active Users or MAU) or in terms of page views or "clicks" (e.g. Unique Canvas Page Views). The development of web browser capabilities have allowed developers to gather measurements that track the number of visits by a single user (repeat usage) and their time spent per visit (session stickiness) (MartketingTerms.com, n.d.). Further developments, discussed later,

leverage technologies such as client-side activity monitoring (mouse movements) and eye-tracking technologies. The relatedness of "stickiness" to eyes lingering on or returning to a site is connoted by the term "eyeballs", which refers specifically to the number of visitors to a particular site and competition for the same (Zott, Amit, & Donlevy, 2000).

In common parlance, "Stickiness" connotes the ability for one substance to adhere to another. In some cases (like Sellotape – a UK brand of pressure-sensitive tape used for joining) only one side need be adhesive in order to stick. In other cases (like Velcro - a brand name for a hook and loop fastener) both sides work in equal measure to adhere, with one side not at all being able to serve the purpose of sticking without the benefit of the other. Ideally in a learning environment one wants the "Velcro" sort of relationship, where both the student and the activity each provide the relevant surface to which to adhere; for the student to stick to the learning and the learning to "stick" to the student.

"Stickiness" in itself is not a novel concept in terms of information "binding itself" to a viewer (Gladwell, 2002). Indeed as indicated thus far, "stickiness" is represented by a host of definitions ranging from product loyalty to education. In fact, the latter provides one of the most useful, for our purposes, definitions of "stickiness" in the educational context:

> …the messenger matters: messengers are what make something spread. But the content of the message matters too. And *the specific quality that a message needs to be successful is the quality of "stickiness"* [emphasis mine]. Is the message…memorable? Is it so memorable, in fact, that it can create change; that it can spur someone to action? (Gladwell, 2002)

According to Malcolm Gladwell (2002), "the information age has created a stickiness problem. But…examples suggest that there may be simple ways to enhance stickiness and systematically engineer stickiness into a message". Such "systematic engineering" of "stickiness" is vital for the success of online courses as if students' attention is not captured by both the message and the mode, such learning is doomed to failure (as proven by Undergraduate MOOCs such as those produced by Udacity) (Lodge, 2013). The question is, how do we know as providers of online content that students are in fact engaged with the "message" to a degree that "spurs action"? In short, how can we measure the extent of our online materials' "stickiness" where "stickiness" is seen to denote engagement with the content, attention to the meaning, understanding of the import, and the ability to apply or otherwise act on the information learned? Furthermore, which available analytics can assist the measurement process with a view to improving design and also to promoting the effective as well as affective delivery of course materials?

"Stickiness" lessons from television metrics

Children's television promoting literacy in the 1960s (like *Sesame Street*) spent incredible effort in developing and testing episodes for "stickiness". In these experiments, the alternative to the *Sesame Street* session was a series of slides shown in rapid succession on a "distractor machine" alongside the television. The percentage distraction was a measure of the relative time the children spent attending to one or the other devices. An episode of *Sesame Street* would air only if the percentage attention shown by the child previewers was upwards of ninety percent. Such attentiveness measures may assist in the measurement of online engagement today given the multiple "distractor machine" equivalents competing for students' attention. Hence the amount of uninterrupted attention given to online content (as

opposed to attention given to other "distractors") may be one indication of the "stickiness" of online course content. Valuable metrics in this space may include registering when students log out or simply "click" out of the online course materials or as posited further on in this paper, the actual time students spend reading or viewing the learning products provided without disengaging. The key outcome for the researchers of the *Sesame Street* programme, and one from which online course designers can learn today, is that if the children were interested they would pay attention to the educational information and if the information were confusing, they lost interest (Gladwell, 2002). In addition, they discovered that the type of attention paid by children to the programming was quite different to that which the adult producers and their advisors had predicted would engage children. What they managed to achieve from these extensive studies was the ultimate in "stickiness"; a programming formula that has arguably improved the pre-school literacy of generations of children globally. What higher education, and in particular online learning, can learn from these experiments (especially given the direct application of a technological environment by which the learning is transmitted) is that clear, direct and interesting messages hold the attention of the viewer, while confusing information or narrative repels interest (Gladwell, 2002).

Beyond this discovery, the makers of *Sesame Street* also explored another question: were the child viewers taking in the lesson or just enjoying the Muppets? In one experiment, Harvard University School of Education in 1975 used an infrared Eye View Monitor to track eye movements in a large number of pre-schoolers sitting close to the screen. In the first experiment, a simple range of blended letters appeared in sequence across the middle of the screen and the Muppet character moved along the line dealing with each letter in turn to sound the word. This method proved successful with the children all tracking the letters from left to right and holding on each letter where the Muppet paused. They were attentive, engaged and performing the eye tracking associated with the process of reading. In a second experiment, the letters were lower on the screen and the letters moved closer in towards the centre of the screen as the Muppet characters created the word. This second activity was a dismal failure simply because the Muppet demonstrating the lesson (Oscar) was too distracting. Oscar was effectively hyperactive and held a number of objects. The children missed the message entirely (Gladwell, 2002). The lesson to be learned here in online learning is that the background to an activity needs to promote the outcome not distract from it or the participant will overlook the significance of the information. In addition, active interaction proved engaging, and when participants were asked to become physically involved, attention soared. Writes Gladwell (2002); "…the more [people] are engaged in…something — intellectually and physically — the more memorable and meaningful" (Gladwell, 2002). Repetition was another key feature; though perhaps one to be used advisedly with adult learners who require the presentation of information in "similar but not duplicative environments" (Kenner & Weinerman, 2011). The overarching message from the children's television research is nevertheless clear: structure and format of the material can enhance "stickiness" (Gladwell, 2002) and the extent of this "stickiness" can be reliably measured (and thereafter predicted). Furthermore, measuring and monitoring "stickiness" within the target audience is crucial to long-term success:

> We all want to believe that the key to making an impact on someone lies with the inherent quality of the ideas we present. But in none of these cases [presented by Gladwell] did anyone substantially alter the content of what they were saying. Instead, they tipped the message by tinkering, on the margin, with the presentation of their ideas…The line between hostility and acceptance…is sometimes a lot narrower than it seems…The lesson of stickiness is [that]…there

is a simple way to package information that, under the right circumstances, can make it irresistible. All you have to do is find it (Gladwell, 2002).

"Stickiness" lessons from Cycling

Most would be familiar with speed races in cycling where speed earns the frontrunner the coloured jersey and the goal is to win against a competitive field. By contrast, online learning is less like a sprint and more like the cycling equivalent of the *randonnée*, which is a journey characterised by flexible start times, multiple options for diversions, pit-stops and "personal bests". The central focus of the *randonnée* is strategic participation; achieving a set goal (usually a destination or set distance) is important, but the greater achievement is the enjoyment of the journey according to one's personal mapping as to how the journey will be completed. Strategy plays a vital part in achieving the overall aim, as does having the right equipment, understanding the conditions and organising a support crew. However, one cannot "win" simply by speeding through and arriving at the destination; in fact, if one arrives too early the "penalty" may be waiting around while the rest of the riders take the suggested time to become fully immersed in the experience. Its objectives are not race checkpoints, but the experience of the space between them.

In online learning, as in the *randonnée* event, the experience is somewhat marred (or at least does not present its full potential to the participant) when speed defines the experience. Likewise dashing through an evaluation without strategic preparation seldom benefits the participant. Flexibility as equated to speed in an online course is therefore not a very useful measure of student engagement. An important and central recommendation is that reviewers should avoid inferring that faster (or slower) than average readers are less engaged with content, and rather consider the 'time-to-read' metric as only one of several indicators of student engagement. Participation measured against performance goals on the other hand may prove to be a much better starting point for illuminating the "stickiness" of an online programme.

"Stickiness" lessons from web-based training

Designers and developers of web-based training share a common goal with media organisations: both seek to retain attention and encourage action from their participants. The greater lessons for online learning come not from the traditional web-based analytics measuring "visits", but from the more modern metrics used by cutting-edge web training that seek to quantify what viewers *do* while in the information environment, and their resultant action.

Popular online content providers *Medium.com* and *Upworthy* measure success differently to traditional online metrics. To assess whether visitors are truly engaging with their site's content, they express the core activity of their consumers not as "viewing" or "visiting", but as "reading" and "watching". To do so, they gather a "primary metric" concerning the "Time To Read" (TTR) or "Attention" to their content (Davies, 2013; Upworthy Insider, 2014; Williams, 2015). Rather than "monthly active users" and "page views", content success is measured in "minutes", and whether readers scroll to the end of an article. By reviewing and adapting their content to their analyses, they seek to optimise the time that people spend reading, expressed as a TTR score, rather than simply encouraging more views. These publishers also set a target for the "Expected Reading Time" of an article to differentiate between readers who might quickly skim an article, compared to those who absorb the

content at a more leisurely pace. *Medium.com* seeks to understand how long it takes the eye to register a message, and the optimal length of a post in order to maximise its TTR metric. By monitoring how a reader uses the browser it collects statistics about when a reader starts, pauses and eventually stops reading its content.

Upworthy builds upon a basic "Time On Page" metric to gather additional signals from the user's mouse movements, video player controls and browser environment to confirm whether the user is truly engaged with the content, or has been distracted and is no longer interacting with the materials. It further assesses whether an article is shared, liked or commented upon as a sign that the content was "satisfying and rewarding" or "boring". The *Upworthy* approach supports a definition of engagement, which moves beyond attention and coverts interest into action and reaction. Merely measuring the amount of interest shown toward a particular piece of content does not measure whether it is engaging and "sticky". It is only when viewing this metric in association with other action and reaction indicators that one can surmise that a message has "stuck".

"Stickiness" lessons from attention tracking studies

If conversion of information into participant action is acknowledged as a desirable even optimal outcome of engaging with learning materials, and therefore a true indicator of "stickiness", then attention tracking may provide a useful analytic for evaluating student engagement with online courses. The aim is to attract the viewer's eye to hover longest over the most important information, or information that is a call to action, given that conversion of information (or in educational terms, the application of knowledge and skills) is paramount.

Developers of online content seek to understand where a user's attention lingers by gathering data about the location of the user's gaze or mouse pointer on a page. This data is often communicated in the form of a heat map. Heat maps in web pages show up as blocks of colour (like auras) based on the eye or mouse movements of the viewer and can be measured both for time and intensity of viewing. Heat maps easily communicate, for example, that embedded information (such as a video) was more likely to attract the participant to click on it than a hyperlink to the same content. The lesson in this case is that analytics can assist in understanding how to guide participation of the user by designing the materials to signpost where they next need to direct their attention. For example, analysis of eye-tracking reveals a dominant 'F-shaped' reading pattern for web pages, which helps content designers better understand the tendency for English-reading users to scan the left side of the page, and the first few words of each line, before deciding if the page is worth their attention (Nielsen, 2006). Significantly for universal designers, users of right-to-left reading languages display the reverse behaviour, singling out the right of screen for special attention (Ciotti, 2013).

Figure 1 - F-Pattern Heat Map (Nielsen, 2006)

Heat maps have assisted in demonstrating that participants are not necessarily dissuaded by the length of the materials presented so long as they remain informative and engaging. Thus the common web page design principle that readers avoid scrolling "beyond the fold" is not applicable; it is better that the viewer has all the information they require before being asked to participate in interactive or assessment activities even if it means scrolling the page. Finally, heat maps show that while participants are willing to give considered attention to an online article or otherwise lengthy piece of information, instructions and announcements should be brief and concise so the message is attended to and received (Ciotti, 2013)

It is more difficult, though not impossible, to gather these next-level attention tracking metrics, but it does behove academics to employ the lessons of web-based training given the similarity of the product and the necessity to convey a clear and engaging message to students. Attention tracking facilities may be as simple as adding additional browser tracking capabilities into an existing LMS, or as advanced as lab-based eye-tracking systems. The lessons explained above can clearly have a positive impact on online design and the metrics used also have import for online delivery in higher education. Adoption and adaptation of such metrics to the educational environment will net improvement in curriculum design, delivery and overall engagement of students.

Drawing the lessons together into a new metric for measuring online engagement

By measuring and combining these observations, it is possible to quantify the extent to which a student is engaged with content, and to infer the "stickiness" of that content. "Stickiness" may be measured by observable Attention, Action and Reaction metrics, for instance:

- Attention: Clicks, Logins, Time To Read.
- Action: Discussion Board Posts, Chat Room Messages.
- Reaction: Grades, Satisfaction Surveys, Grading.

While each metric in isolation informs a different perspective, taken together, the metrics may help to assemble a three-dimensional picture of student behaviour, similar to that which an experienced educator might gather in a classroom setting. Such an amalgamated metric can begin to answer the questions: to what extent is the student firstly paying attention to the content, secondly engaging in actions that demonstrate understanding, and finally achieving a positive attitude and improved grades?

Any implementation of such a measurement will need to be customised to the capability of the tracking and reporting systems available to the educator as sophisticated devices such as eye tracking functionality are not widely available. However, a simple "stickiness" score may be assembled from commonly-available metrics namely, a combination of a time to read (TTR) score, action metrics and reaction metrics.

By comparing actual TTR with "Expected Time To Read" (ETTR), educators may measure a student's overall Attention. Then by relating the TTR score to the frequency and volume of discussion board posts (both in posts and words), a student's "Action" may be measured. Further, by referencing that student's grades and disposition, a "Reaction" measure may be built.

In the classroom, a teacher is able to increase student engagement by increasing student activity. In designing an online course, there is usually a requirement that an assessment (quiz) is undertaken to verify knowledge, but unless there are active student initiated discussions, and a way of gauging the affective impact of a course (whether students are 'smiling or 'frowning' at their computer or tablet screens) then an engagement assessment is incomplete and uninformative. Analytics that monitor both effective and affective engagement can assist academics to build online courses that not only command attention, but prompt action and improve a student's ability to retain the learning. (Johnson, 2012).

Engagement measures should take into consideration the extent to which they encourage action amidst community; "engagement is more than the actions of a single actor; it is about social groups and reciprocal action and responsibility" (Churchill, 2010). In the educational context, it is important that students receive feedback and ongoing support not only from classmates, but also from teaching staff. Greater student participation in discussion forums generally increases their pass rates and grades, and active involvement by teaching staff in these fora increase the amount of time students invest in online activities. Further, by fostering a sense of community within the cohort, as well as encouraging contact between students and faculty, universities can increase student engagement (Beer, Clark, & Jones, 2010).

For example, Student A may spend 15 minutes reading an article expected by course designers to take 15 minutes to read. As a result, they may be assessed to be engaging with the content item entirely as expected, and be scored as 'fully engaged' - 100%. Subsequently, they post 3 separate questions on the class discussion board and respond twice to other students, averaging 30 words per post (where the typical activity is 2 posts of 15 words). They further register an A grade in the course and post an overall "satisfied" self-score with their learning.

Student A's interactions illustrate the two-sidedness of "sticky" content. Through the measurement and codification of engagement, educators may diagnose the extent to which a successful learning outcome is attributed to engaging content, or a student's responsiveness to

it, or the Velcro-like interplay of both. In this best-case example, the student's observed learning behaviour was in line with the expectations embedded in the course design, and, critically, moved beyond attention into action that displayed deep, and rewarding, engagement.

A second Student, B, may similarly thoroughly engage with the content, but fail to act - a one-sided example of "stickiness". Their subsequent satisfaction and grade (reaction measures), aggregated with other students in the same course, would provide a useful diagnostic tool to determine if it is the quality of the content or the cohort that is driving the learning outcomes - which side of the Sellotape is being sticky?

Student C's experience exhibits poor "stickiness": measured as spending 7 and a half minutes reading the same article (50% engagement) and uploading a single post of 5 words to the discussion board (below average action) resulting in a C grade and an "indifferent" self-satisfaction score (reaction). It is clear in this case that the learning has not "stuck" - and suggests limited adhesion on both sides of the interaction.

Worthy of note is the fact that individual student scores in isolation are less valuable than they are together. Using groups of students' data to build a cohesive picture of engagement and moreover, to approximate the perceived "stickiness" of the online activity, is what is at stake in this particular approach.

These metrics may be gathered with minimal LMS customisation, and adjusted in response to student behaviour and educators' observations. They can also have the embedded benefit of measuring students' self-efficacy if the Reaction metric goes beyond a simple score pertaining to satisfaction that asks students to rank overall *confidence* in applying the new knowledge or skills presented in the learning module.

Conclusion

Developers of online learning can learn much from the measurement of "sticky" indicators of their online content. Like game developers or social media sites, online educators should be concerned with the ability of their courses not only to educate, but also to encourage and motivate students to "stick with it" to the end. A "sticky" course will encourage students to revisit and complete their learning using similar audience-building techniques to those used by popular websites. Educators can assess the stickiness of their content by monitoring both the attention their content generates, and the extent to which it provokes action by the student producing desirable actions and reactions (effective and affective outcomes). During both the design and execution stages of online learning, educators who consider the "stickiness" of their content can expect more engaged, motivated and successful students who succeed because of, rather than in spite of, their online engagement.

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