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Improving Learning Experiences Through Gamification: A Case Study

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Abstract

Gamified learning systems are becoming increasingly common within educational institutions, however there is a lack of understanding on the elements of gamification that influence, either positively or negatively, the learning experiences of students using these systems. This study examines an existing gamified learning tool implemented within an Australian university, and explores the aspects of this system that impact upon the student experience. It was found that positive influences included a combination of motivational and game-based elements such as presentation of content, self-efficacy of learning experiences, and feedback that positively influence students. Additionally, aspects of the system that negatively influenced learning experiences included issues such as interaction flaws and compatibility issues.

Introduction

Student interest and motivation within traditional learning environments has been shown to be in decline, resulting in decreased student achievement, and increased student attrition in many instances (National Research Council & Institute of Medicine 2003; Battin-Pearson et al. 2000). According to Shernoff et al. (2003), the most notable causes of student disengagement with learning include boredom, alienation, and disconnection between learning activities and the real life application of knowledge. A recent study has found that students are 1.5 times more likely to fail when learning through lectures and other traditional learning methods, when compared with active learning methods (Freeman et al. 2014). It is important to recognise that these negative learning experiences are typically only prominent where the learning environment is not ideal, and by improving the conditions within the learning environment students can become enthusiastic, inspired, and highly engaged with learning activities (Shernoff et al. 2003; Freeman et al. 2014).

Studies have examined the concept of learner engagement, which can influence behaviour, emotion, and motivation, as a potential solution to increase student interest and motivation (Fredricks and Blumenfeld 2004). Explorations of engagement within classrooms have shown that learning outcomes are significantly improved when student engagement is high, as engagement results in the students actively and purposefully participating in their own learning experiences (Rabe-Hemp and Woollen 2009).

The past few decades has seen rapid development and advances in the area of computer game technologies, with an estimated 95% of households with children under the age of 18 owning at least one device for playing computer games (Brand 2011). Furthermore, it is estimated that 94% of children between 6 and 15 years of age play video games regularly (Brand 2011). Hoping to benefit from the rising popularity of video games, there has been an increase in educational games to improve student engagement, motivation, and enjoyment within learning environments (Garris et al. 2002; Barger and Byrd 2011).

Gamified learning systems typically allow a greater level of student control over the learning situation than traditional learning (Rabe-Hemp and Woollen 2009; Douglas et al. 2011). Increased student control over learning activities is a key requirement for autonomous learning, which facilitates increased intrinsic motivation and active participation in learning (Rabe-Hemp and Woollen 2009). Learning tasks that stimulate high levels of student engagement have been shown to be highly predictive of student motivation, commitment, and performance in higher education (Shernoff, and Hoogstra 2001).

Ongoing student interest and motivation in learning is dependent upon the historical learning experiences of each individual student. Student disengagement in past learning activities makes it more likely for students to disengage in future learning activities, while high levels of engagement in past learning activities make it more likely for students to engage in future learning activities (Martens et al. 1997). This supports the notion that game-based learning activities could be used as gateway devices, gently leading students to become more engaged and autonomous in their learning.

Whilst video games have been shown to be capable of enhancing student engagement (Raymond 2010; Cordova and Lepper 1996), there is still contention as to the benefit to learning outcomes that can be achieved through educational games (Huizenga et al. 2009; Wheeler 2006; Van Eck 2006). Additionally, there is evidence that the use of educational games can significantly increase the time taken for students to generate meaningful knowledge (Huizenga et al. 2009).

Our current understanding of educational gamification is, therefore, limited; as we do not adequately comprehend how gamified learning systems influence the experiences of learners, and what the impact of these experiences have on their engagement and motivation. There is a requirement for detailed examination of the individual

experiences of students who are using gamified learning systems, in order to provide insights into the elements of gamification that have a positive effect on improving student engagement, as well as an identification of those elements that might inhibit learning outcomes.

The following describes the implementation of an educational gamified system by an Australian university, the goals of which were to provide an effective learning tool that positively engaged students, and improved their ability to generate knowledge.

Body Central

Fundamentals of Bioscience is a first year undergraduate unit offered within the Bachelor of Nursing (BN) and Bachelor of Paramedic Practice (BPP) at the University of Tasmania. This unit is designed to prepare students for a broad spectrum of first level practice roles in community health nursing, acute care and mental health nursing, as well as paramedic practice. Students are required to demonstrate and apply knowledge of the structure and basic functions of body systems; demonstrate and apply knowledge of the interactions between microbes, the environment, and human structures and function; and integrate data from clinical scenarios and learning resources to differentiate between normal and abnormal anatomy and basic function. This unit has an annual enrolment of approximately 700 students and is delivered across four geographic locations.

Teaching staffs have consistently reported that students struggle to learn and retain the vast amount of complex subject matter within this unit and students are invariably anxious about the amount of content covered. Given the purpose of these early units in building a strong foundation of core knowledge for students to continue into more advanced units, the cognitive burden produced by these units was considered to be an issue.

Accelerated Nursing and Paramedicine degrees require students to learn a vast amount of Bioscience in a compressed time frame (6 semesters over 2 years, compared with 3 years for traditional degrees). First year students are invariably overwhelmed by the task of mastering content related to biochemistry, cell biology, microbiology, as well as the basic anatomy and physiology of all body systems. Furthermore, the vocabulary associated with this discipline is equivalent to simultaneously learning a foreign language (Wulff 2004; Sobel 2005).

In an attempt to engage students more actively in the unit content, a project was proposed to develop an interactive educational tool (Body Central) that provided fun, engaging and re-playable content related to the core needs of the unit. It was hoped that a more interactive learning tool would increase the productivity of study time for students, result in improved content retention, increase the frequency and immediacy of

feedback to students, and allow teaching staff to monitor real-time progress of the student cohort, enabling augmentation of unit materials to address learning deficits.

Body Central is presented as a series of events, or a progression. Events of this progression include: Dialogue; Model investigation; Minigames (including Quizzes, Identification, and naming activities); and Certificate presentation.

Body Central commences with a series of body system investigation environments. These investigation environments provide core text and pictorial content related to anatomy and allow students to learn about various body system elements at various levels of detail, for example surface anatomy, gross anatomy, histology, and cytology. This core content is supported by a number of 'tools' to facilitate investigation. The following are examples of available body system investigation environments and tools (also see Figure 1):

- Anatomy tutorial: provides the user with a visual representation of basic human anatomy. The user is presented with visual representations of human anatomy, the terms for categorising sections of the human body and other relevant labels and information.

- System review: provides the user with a visual representation of the selected body system. As the user hovers their curser over on each organ, a label is displayed providing the organ name.

- Surface Anatomy: provides the user with a visual representation of the body's exterior and a 'keyhole' tool to view the body system underneath the skin. When selected, the tool gives a visual indication of the 'keyhole area' around the mouse curser. As the body area comes into range of the tool, the keyhole area' shows an image of the body underneath.

- Gross Anatomy: provides the user with a visual representation of the selected body system, and two investigative tools — a magnifying glass and the keyhole tool. When selected the magnifying glass tool provides the user with a larger, more detailed and labelled view of a selected organ to investigate Organ Anatomy. When selected, the keyhole tool provides users with a visual indication of the keyhole areas around the mouse cursor. As the body comes into range of the tool, the keyhole area shows a cross-sectional image of the organs underneath (internal anatomy).

- Histology: provides the user with a visual representation of the tissues located within a selected body organ. The user is provided with a detailed and labelled cross-sectional view of the tissue layers of the selected component.

- Cytology: provides the user with a visual representation of the cells located within a selected tissue layer.

Figure 1: *Body Central software demonstrating the zone highlight and glossary label (left image) and the 'keyhole' function for investigating internal anatomy (right image).*

Figure 2: Body Central software demonstrating the question set mini-game (left image) and structure identification task (right image).

Body Central integrates a number of core gamification elements, designed to support the learning environments by encouraging play, providing immediate feedback, and allowing students to track their progress through the core content.

Within each investigation environment, students are prompted to engage in small activities and games based on materials they have just been exposed to. For example, once a student has worked through a particular investigation, the system will challenge the user to a mini-game. The user is required to successfully complete mini-games to progress. Examples of mini-game elements include simple question sets, or identification tasks to complete (see Figure 2).

Mini-games may also consist of more complex identification tasks such as organ identification or spelling the names of structures correctly. Spelling games were supplemented by an additional ‘hangman’ game for spellings that were close to the

correct answer. The 'hangman' game was adapted for a medical audience, displaying an ECG (electrocardiogram) trace that would 'flat line' after 3 attempts.

The second gamification element included in Body Central is the provision of immediate feedback. Feedback is one of the strongest elements of games that promote engagement and enhance motivation (Oblinger 2004; Dickey 2005), and so was included within this system to allow students to receive more active and immediate indications of their progress. Feedback within the Body Central application was provided in the following manners (see Figure 3):

- Feedback on each quiz answer: notification of the correctness of each answer given;
- Feedback on overall performance: notification of number of correct answers given in each mini-game;
- Progression graphics within each section: thermometer filling graphics allow students to track their progress within the section (the thermometer was chosen to keep with the medical theme of the course and subject);
- Progression graphics within system: star graphics allow students to track their progress through each section of the system; and
- Certificate: awarded at the successful completion of each section.

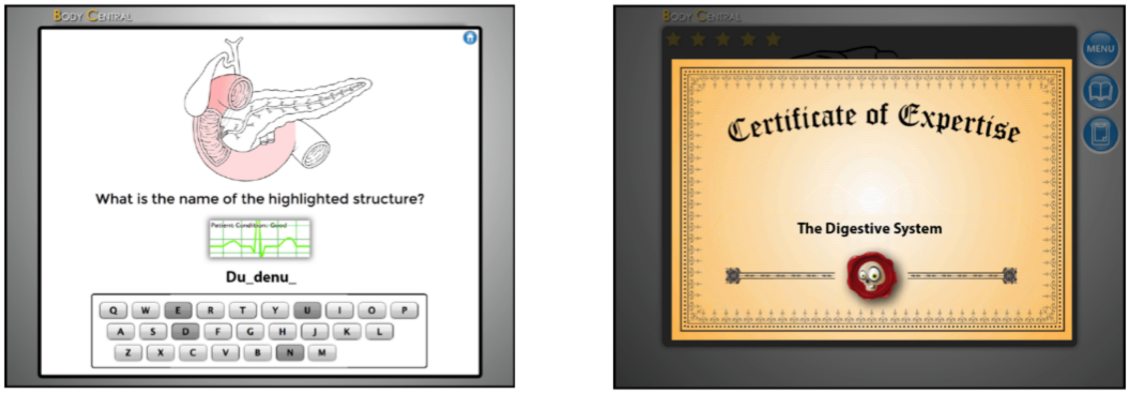

Figure 3: *Body Central software demonstrating the 'hangman' spelling game (left image) and expertise certificate awarded upon successful completion of each module (right image).*

Methodology

In order to examine the aspects of Body Central that both positively and negatively impacted the student experience, a semi-structured forum, within a qualitative case study design, was undertaken with users. The purpose of this forum was to identify, from the perspective of those learning through the game, those aspects that facilitated or augmented the learning process, and those that limited the efficacy of the learning process.

During 2012, fifty first year Nursing and Paramedicine students volunteered to participate in the Body Central software trial. The trial examined the students' knowledge of digestive system anatomy but was undertaken prior to any formal teaching of digestive system anatomy to ensure a common baseline understanding. Participants were aged between 18 and 55 years and included 34 females and 16 males (typical gender ratios for the student cohort). The 50 participants were randomly assigned to 'Software' or 'Workbook' groups (25 in each). In the software group, which included 7 males and 18 females, participants completed the 'Digestive System' progression of Body Central.

At the completion of the trial, these participants were invited to participate in a qualitative evaluation. Of the original 25 trial participants, 10 volunteered to participate in the evaluation forum which was conducted by an independent researcher, who had not been previously involved with the design or delivery of the Body Central trial or related Fundamentals of Bioscience unit.

The evaluation study group was composed of 6 females and 4 males, aged between 19 and 35, with a mean age of 23.24.

The qualitative semi-structured forum covered a range of topics related to the participants' experiences during the trial of Body Central, for example:

- The students' positive experience with learning via the Body Central game.
- The students' negative experience with learning via the Body Central game.
- The students' perception of the differences between learning via the Body Central game and more traditional text-books.
- The improvements that would enhance the learning experience offered through Body Central.

Once collected, the forum data was analysed using the qualitative three-phase coding technique (Yin 1998; Urquhart et al. 2010) in which the data is decomposed from rich contextual statements into smaller sub-components, with the intent of revealing underlying characteristics and structures that may not be evident were the data to be

considered as a whole. This qualitative analysis approach allowed the researcher to uncover factors that may affect the ability of Body Central to influence learning experiences of participants.

Results

Positive Features of Body Central

In reviewing the game from the perspective of students, a series of elements were identified that heightened their engagement, motivation, and enjoyment, encouraging them to continue their use of the game.

Focuses Students on Content

Body Central attempted to directly support learning outcomes, using interactive elements to focus the attention of the student towards highly relevant information contained within the system. The content was created with a 'fit-for-purpose' focus, in that everything within the learning activities was directly relevant to what they were learning, for example one student reported: *"Everything that you do on there is learning focused, there's no padding at all… and that makes it harder to get distracted*."

In many educational games there appears to be a propensity for players to become distracted from the educational content by the various extraneous activities within the game (Rieber and Noah 2008). These extraneous game elements are often added in order to make the game more fun and engaging for students (Squire et al. 2004), however they may distract students from the learning content (Rieber and Noah 2008), and discourage reflection upon the learning content (Paras and Bizzocchi 2005). Essentially, it appears that time spent distracted by extraneous game elements detracts from the potential benefits that might otherwise be gained through use of educational games.

In contrast to these educational games, Body Central was designed to include no extraneous game elements that could distract students from the content they were to learn. It seems evident that this design was successful, as participants appeared to spend their entire time with the system engaged directly with the learning content.

Content was Highly Relevant

While the system was able to focus the attention of participants entirely upon the learning content during their interactions with the gamified system, students reported that it was the relevance of this content to their studies that made the system much more useful. This resulted in a high level of engagement with the system, and consequently positively influenced learning outcomes. For example, a participant reported that: *"We've just finished a lecture then basically on the area we were examined on… and I*

felt that my memory recall was quite good as opposed to normally prior to a lecture I will just flick through our textbook."

By providing content that students recognise as being directly relevant to what they are learning in their course, students appear to have become more intrinsically motivated to engage with the system. The perceived value which a person has of the relationship between their own inherent interests and an activity they are undertaking has been found to be significantly indicative of their intrinsic motivation to continue engaging with that activity (Deci and Ryan 2008).

Additionally, it appears that students were readily able to generate meaningful knowledge from these directly relevant learning experiences. Participants reported that by engaging with Body Central, they were able to improve their knowledge on complex topics that confused them in class, and cement their existing knowledge to the point where their recall was improved. This contrasts with many typical educational games, where it has been found that students have difficulties in generating appropriate knowledge from the educational content (Crookall and Thorngate 2008), often due to extraneous content confusing or overwhelming students, or even due to the abstract way in which the content is presented within these types of games.

By facilitating the generation of appropriate knowledge, the student's perception of value is strengthened, which further improved the motivation of students to continue engaging with the gamified system. Therefore, the direct relevance and perceived value of the content within Body Central appears to have supported improved learning experiences for students. These improvements include reinforced engagement, motivation, and content recall, all of which appear to have encouraged students to continue engaging with the system over an extended period of time.

Timely Informative Feedback

Participants identified that the visible feedback provided by the system was very informative and allowed them to monitor their own progress: for example, one participant reported that: *"I spelt duodenum incorrectly and it gave me a hangman option which said you were so close."*

Participants indicated that the provision of timely and informative feedback, both positive and negative, assisted them to improve their knowledge, and assisted in the resolution of incorrect knowledge. *"In terms of normal assessments, like a quiz where we name body parts… we don't normally get feedback from what we've done for weeks. But with this we know what we've done right or wrong right away, and that's good."*

Previous studies have found that the inclusion of this type of feedback can have a significant impact upon the feeling of competence that individuals gain through engagement with a challenging task (Deci and Ryan 2000). The feeling of competence

is a core tenet of intrinsic motivation (Ryan et al. 1983), and the ability of individuals to autonomously satisfy their desire for task competence has been found to be a major factor that contributes towards sustained motivation and engagement (Durik and Harackiewicz 2003).

It appears that participants found the provision of timely and informative feedback helpful in supporting their engagement and motivation within Body Central. Additionally, this feedback allowed participants to improve the effectiveness and accuracy of the knowledge they generated through the learning activities, as the system provided them with immediate feedback that assisted them to reinforce their existing knowledge, and recognise their misconceptions and work to rectify them.

Visually Represents and Stratifies Content

Participants reported that the simplistic visual representations of the learning content made it easier for them to learn otherwise difficult and abstract content. This appears to have supported an improvement in the efficiency and effectiveness with which students processed the content, resulting in enhanced motivation, engagement, and recall. For example, a participant reported that: *"I learn better that way than reading paragraphs of text that tell you what you're supposed to draw out of it or whatever."*

People are able to absorb information more rapidly, and to a higher degree of accuracy, when they are provided with a visual source of information rather than a textual or verbal source (Ainsworth and Loizou 2003; Coltheart 1999). This effect appears to be stronger still when people are able to interactively manipulate the visual source of information, in order to explore more aspects of the information (Garris et al. 2002). Educational video games are a ready source of interactive, visually represented information, and they have been used in many contexts to allow students to manipulate and explore difficult concepts and environments, enabling them to test their knowledge experientially (Garris et al. 2002). This same concept appears to also be applicable to Body Central investigated, with participants reporting that the ability to interact with the visual representations helped them improve their understandings.

Furthermore, it appears that the use of clear colouration within learning diagrams, models, and system feedback supported and enhanced the learning processes of students. The visual stratification of different information appears to have improved the ability of students to differentiate between different structures and information within the visual representations, which further improved their ability to comprehend and generate appropriate knowledge on the topic areas. For example, as one participant reported: *"When it asked me that question later I thought about the colour of that structure. It helped me to identify them."*

Studies have found that the use of colours has numerous positive influences upon cognition, which significantly influence learning processes, including increasing

attention, mental arousal, and retention of information (Dzulkifli and Mustafar 2013). This suggests that the use of clear colours to differentiate information within Body Central helped to simplify the learning process for students, assisting them to maintaining engagement with the learning content, and help improve learning outcomes through enhanced retention of information.

It appears that the use of simplistic visual representations, and colour differentiations, improved the ability of participant students to concentrate on the learning activities, thereby improving their engagement, motivation, and retention of learned information. This therefore appears to improve the efficiency and effectiveness of learning processes, as well as improving learning outcomes.

Variable Activities with Progressive Difficulty

The system included the ability to cater to a wide range of different student skills and abilities through the provision of varied challenges, which progressively become more difficult as each student expands their individual knowledge within the topic areas. The system was designed to include different types of activities, each with their own unique challenges that aim to challenge students in a variety of ways.

In order to maximize the engagement and motivation of students, the content being taught needs to appropriately match the existing knowledge and abilities of each individual student (Barger and Byrd 2011). If the content being taught is too simple for a student, that student risks becoming bored, and may disengage from the learning activity (Csikzentmihalyi 1990). By contrast, if the content being taught is too complex for a student, that student risks becoming frustrated, which may also cause them to disengage from the learning activity (Csikzentmihalyi 1990). A common issue with traditional teacher-led learning is that the teacher typically must cater to the general abilities of the student cohort, which often makes it difficult or even impossible for them to cater to the individual needs of each student (Gauci et al. 2009).

The flow theory of optimal experiences suggests that by providing students with challenges that match their abilities, students will experience significantly improved engagement with the learning content (Paras and Bizzocchi 2005), which further improves their intrinsic motivation within and enjoyment of the learning activities. For example, a participant stated that: *"It seemed to flow quite well from the basic to the more complex topics that we were studying and examined on. This helped a bit, because it meant that what we were doing always helped with the new harder concepts."*

Additionally, it appears that Body Central afforded students greater levels of control over their own learning activities, with participants reporting that being able to selectively interact with the varying learning activities within the system allowed them to target specific knowledge areas where they felt that they needed improvement. This appears to have facilitated improved learning processes for students, allowing them to

develop self-efficacy and learn the content required within their course in an autonomous manner *"I find the interactive parts extremely helpful. They make learning all the terms a breeze! I wish there were more sections like this, as they clarify the information for my poor, rusty and befuddled brain!" and "I liked how you had your own time to be able to go around all the areas… and go back to it as many times as you like before you start the questions".*

It was found that the progression of users through the content of the system was highly visible, enabling users to readily identify their progress. A number of interface elements contributed to this, including a "star" mechanic that awarded the user with a gold star for every section of the system they complete. *"You've got a progress bar when you are doing quizzes which is like a thermometer which fills up when you're winning. So when you've got a question right a star pops up and spins, and fills into the thermometer".*

Self-efficacy and autonomy are core tenets of intrinsic motivation (Deci and Ryan 2008), and contribute towards the feelings of competency and control that allow individuals to feel an innate desire to continue engaging with an activity for its own sake, rather than because they feel that there may be some external consequence if they do or do not engage with the activity (Deci and Ryan 2008).

It therefore appears that by providing variable activities with progressive levels of difficulty, Body Central was able to provide positive learning experiences for participants, including improved student engagement with learning activities, and improved intrinsic motivation through feelings of competency and autonomy.

Supports Multiple Styles of Learning

The system was designed to support the learning requirements of students that have a preference for experiential and visual learning processes. Traditional learning environments often do not favour visual and experiential learners, and so the system activities were designed to be sufficiently flexible to improve support for students of a wide range of learning style preferences.

Students often demonstrate a preference for different learning styles, and it can be difficult for traditional learning environments to support the diversity of approaches. This is another area where gamified learning systems are able to provide improved learning experiences, as game-based education is able to provide students with control over their learning, scaffolding of abilities, cognitive challenges, periods of reflection, and allow students to learn in the way that best suits them (Pivec and Kearney 2007).

Traditional learning environments are typically oriented towards students with what has been referred to by Kolb as 'Reflective Observation' and 'Abstract Conceptualization' learning style preferences (Sfard 1998; Kolb 1984). However students with 'Concrete

Experience' and particularly 'Active Experimentation' preferences can suffer significantly, with many educational institutions emphasizing the collection of information and thinking about phenomena rather than allowing students to apply their knowledge experientially (Paras and Bizzocchi 2005). By contrast, Body Central appears to have facilitated students with all learning style preferences, as the system provided students with textual information, visual diagrams for observation, time for reflection, and the ability to experimentally experience the content within an interactive setting.

Sfard (Sfard 1998) suggests that providing students with flexible learning options, including supporting varying styles of learning, positively influences the learning experiences. These positive experiences can manifest through improved satisfaction, motivation, and engagement with the learning activities. Within Body Central, this indeed appears to be the case, as one participant reported that: *"I'd much prefer something interactive rather than a text book. So I think that technology is the way to go."*

Therefore, it appears that by supporting the varying learning style preferences, participant students were afforded improved learning experiences. By allowing students to follow the learning process in the way that suited them best, students were consequently able to improve their respective learning outcomes.

Negative Features of Body Central

While the above section suggest the game was perceived as generally successful in terms of meeting its objectives, a review of the system also revealed elements that were found to inhibit the achievement of learning outcomes. These elements affected the experiences of individuals in such a way that their engagement, motivation, and enjoyment were negatively impacted when using Body Central.

Developed by Final-Year IT Students

Despite the importance and potential benefits to be achieved from such game-based learning environments, there was an initial lack of available organisational support and funding provided for the development of teaching tools, thus necessitating the use of final-year IT students for the initial development of the system. The student developers were required to first learn the development language of the system, which had the potential to result in design, development, and implementation limitations. For example, the subsequent Body Central developer noted to the researchers that: *"I think they did a good job, but perhaps there were some issues there that might have been avoided if we didn't."*

The experience and competence of system designers and programmers have been found to be instrumental in ensuring that systems are of sufficiently high quality, and

appropriately address the problem that they are attempting to solve (Linberg 1999). Linberg (1999) suggests that where this experience or competence is not ensured, the system may fail to provide its supposed benefits. In the case of the gamified system examined, this suggests that poorly designed and developed educational software had the potential to be detrimental to the learning experiences and outcomes of students.

Browser Incompatibility

There were indeed a number of design, development, and implementation issues within the system when it was examined, and the relative inexperience of the developer appears to have contributed significantly to these issues. For example, participants reported that the system suffered from incompatibility issues, where certain web browsers including Internet Explorer were unable to access the system at all. Due to the institutional requirements of some students, and lack of technical ability of other students, there were quite a number of participants who were unable to access Body Central at all. For example: *"One problem that we have with it is that it doesn't work on Internet Explorer, they can use Chrome or Firefox, but it doesn't work on Internet Explorer. And there are a lot of industries, especially care industries, where their technical staff enforce Microsoft products to be used and nothing else, so we've got people who are excluded from using the system."*

This is potentially problematic in that while the learning opportunities and experiences of those who can use the system appear to have been improved in general, those who miss out are not able to gain these advantages, which may place them behind other students in terms of academic performance, as well as engagement and motivation to continue engaging with their education (Darling-Hammond 2010).

Interaction Issues

In addition, it was reported that there were a number of faults with Body Central that were found to negatively impact upon the learning experiences of participant students. These included erratic and sometimes erroneous interaction with diagrammatic structures, providing students with incorrect feedback to activities, and certain system functionalities were not operational For example, *"When you were moving over certain sections sometimes it was difficult to highlight or to get an idea of it." and "Sometimes the answer came up red even if it was right, it came up as incorrect. Which is quite confusing."*

These interaction issues were found to both frustrate participants when they were trying to learn, and also distracted participants away from the learning content. Distractions and frustrations have been found to break the flow of engagement that people form when they are undertaking interesting activities, and can thereby decrease the ability of students to generate meaningful knowledge from the system, and inhibit the motivation of students to continue engagement (Chen 2007).

Trust is a crucial element in learning environments, as students need to be able to trust that what they are being taught is accurate, true, and of a high quality (Hsua et al. 2007). Where students do not trust what they are being taught, they may disengage from the learning activity. In the case of a game-based learning system, if a student cannot trust that the content within the system is accurate and true then they may be unwilling to use the system.

Interface Issues

It was reported that there are numerous user interface design issues that could potentially confuse or frustrate users, potentially inhibiting the extent to which the system provides an engaging learning experience. For example: *"Another thing I noticed too was you were looking at a diagram and trying to learn it, and the questions popped up and it blocked out the diagram. If you could see through it you could still learn stuff, you want to be able to move the box that's asking the question so you can see the pictures"*. The user interface directly facilitates the interaction between users and the system, so problematic interface designs could inhibit the achievement of system objectives due to breaking engagement, and potentially decreased perceived system value or quality.

Furthermore, it was reported that the system was perceived as overly simplistic in its approach to learning, and may have thus been less engaging due to its perception as being less valuable to higher education users than it really is. For example, one participant commented that "It was quite simple, nothing too fancy about it, and it felt like it might be a program for children".

However, another student stated, *"At first it seemed quite basic but as you get into it you realise that it's very helpful"*.

In summary, issues that inhibited the learning experience of the trial students were centred on the interface design and technical development of the game, rather than the content and delivery structure of the game. This finding indicates that much attention is required by game developers to ensure that their game design does not counter the efforts of curriculum designers and subject matter experts, and lessen the opportunities for learning.

Conclusion

The qualitative evaluation of the Body Central game trial has provided insight into the need for, and the positive aspects of, games design that can enhance the learning experiences of students in very stressful and accelerated nursing and paramedic degrees. It as has identified a number of positive influences on the engagement, and enjoyment

of participants, which in turn are influences of the motivation and learning outcomes of students using Body Central at the university.

In reviewing this system, it appears that it is not just the novelty of the game itself that positively influences student engagement, but rather a combination of motivation and game based elements such as presentation of content, self-efficacy of learning experiences, and feedback. Further, it can be seen that learning style preferences of individual students also plays a positive role in maintaining continued engagement.

The analysis also indicated that issues such as interaction flaws, inoperable functionality, and compatibility issues can negatively influence a student's motivation to continually engage with the system over sustained periods of time, and could be factors that contribute towards student disengagement and attrition.

Whilst Body Central was designed to include a number of game elements and mechanics, and attempts to create a somewhat game-like interactive experience for students, it was designed in such a way so as to avoid providing students with 'gameplay' engagement. This separates the examined gamified system from more typical educational game systems, as most educational games include 'gameplay' elements, and the gamified system examined was attempting to mitigate the likelihood that students would engage in 'playing the game' rather than in 'learning through the game'. The goal of this specific design was therefore to focus the attention of students towards the educational content, using a fun, novel, and interesting style of game-like presentation, without distracting students with fun and engaging 'gameplay' elements.

However, this approach is inherently problematic, as engaging in the 'gameplay' aspects of games are typically the primary drivers of enjoyment and motivation (Prensky 2002), although other non-gameplay elements are capable of providing fun, engagement, and continuation desire. This means that the system was designed to provide game-like experiences, whilst avoiding the inclusion of the most powerful fun and motivating 'gameplay' aspects of video games.

The extent to which the system was successful in doing so is difficult to determine within the context of this study. Student participants reported that they found the system to be fun and interesting, and it was both reported and observed that learning outcomes were significantly improved through use of Body Central. However, given the available data from this study there is no way of knowing whether the specific avoidance of 'gameplay' elements was either beneficial or detrimental to these results.

This presents a valuable opportunity for future research to be conducted, as the examination of specific 'gameplay' game aspects and the respective influences that these could have upon both learning experiences and learning outcomes within game-based learning tools could provide significant and important insights into the design and implementation of more effective learning systems in the future.

Furthermore, the influence that the subjective preference of individual students has upon the effectiveness of learning within game-based learning tools warrants further investigation. The specific traits and preferences of individuals appears to have an influence upon the ability of game-based learning tools to provide positive learning experiences and learning outcomes. However we do not have sufficient understanding of exactly how significant these influences are for different learning styles, nor whether these effects are stronger or weaker than those of different learning styles in traditional learning environments.

This presents another valuable area of opportunity for future research to be conducted, the results of which would contribute towards improving our understanding of learning style preferences and how game-based learning systems could be designed to leverage these preferences to maximize educational benefits.

In conclusion, student engagement with learning activities is an important aspect of the educational experience, and contributes significantly towards learning outcomes. The lack of student engagement within educational environments has resulted in the creation of a large number of game-based learning activities, including gamified learning systems, which typically attempt to use game mechanics to make learning activities more enjoyable.

This study has reviewed a current gamified learning system implementation, and has indicated a number of positive and negative elements that influence the engagement, motivation, and enjoyment derived from the system by students. Valuable opportunities for further research, including the exploration of gameplay elements and the influence that these have upon learning outcomes, have also been presented.

This case has identified that while gamification, and game-based learning in particular, can be shown to positively influence an individual's engagement with learning, it is not only the presence of, or even features of, the system that influences positive experiences and therefore engagement. Specifically, we can see that a combination of good game design supported by motivational and educational theory is a core element of success. However, so too are the levels of organisational support, the preferences of students, the general perception of games, and the ability to continuously improve and add to the game in order to maintain novelty, and extend the positive experiences.

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