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The Rules of the Game

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Abstract

This response to Rachel Muehrer, Jennifer Jenson, Jeremy Friedberg and Nicole Husain's paper, *Challenges and opportunities: Using a science-based video game in secondary school settings*, explores the issues encountered while a science-based video game is introduced in secondary school settings. It highlights the importance of the context, the availability of technologies, the skilfulness of the teachers and readiness of the students for a more successful use of games in schools. In addition, the definition of student engagement is also further discussed.

Keywords

digital games . education . student engagement .

Play is said to be a powerful and wide-spread method of learning, apart from schools' curriculum. Indeed, most psychologists would agree that play is a crucial process through which we test ideas, develop new skills, and participate in various social roles (Piaget 1962). At a young age, an enormous amount of spontaneous and motivated learning occurs in the relative absence of didactic instruction during play (Lepper and Chabay 1985). As play is generally accepted to be a beneficial learning process, it should be further enhanced to maximise its effectiveness in aiding the academic aspects of education.

Children today are very much exposed to, and familiar with, electronic forms of play, such as computer and video games. These popular forms of entertainment contain attractive graphics and smart interactions. Game designers also incorporate a number of strategies to further appeal to players. It may not be productive to view education and digital games as polar opposites or mutually exclusives. In fact, schools around the world have already recognised the importance of using technology in education. It is arguable that strategies and tactics used in these games might provide instructional designers with new methods of engaging learners-- creating entertaining games, with an educational purpose. "The prevalence of video games has shaped how younger adults and children – both males and females – think and learn" (Gee 2005). It is likely that such game designs can be effectively integrated into various types of learning environments and activities.

Marc Prensky (2005) also proposes that game play and learning can be combined with suitable digital game-based learning which includes both dimensions of game play and learning. He proposes that a balance between play and learn is crucial for high level engagement and learning quality. An overemphasis of one over the other would either make it too much of an entertainment or lead to computer-based training with low levels of engagement both of which would lose the impact and effect of this amalgamation.

In recent years, digital gaming has become an area of interest in the educational setting. The main attraction is that educators could adopt the concepts and ideas in game design to engage learners, especially school going students. Spending large amounts of time and effort understanding and exploring games may be effortless and even natural from a

gamer's point of view. Teachers would be more than happy if they could engage their students the same way games engage them. Such excitement and enthusiasm among students playing video games bear considerable potentials for education (Gee 2004).

However, Cher Ping Lim (2008) cautions that with the integration of digital games into schools, several technical and structural issues may arise. Technical issues, such as the lack of technical support and time hamper the introduction of digital games into the schools. Structural issues, such as inflexible timetable and the lack of professional learning opportunities, further compound to the problem. These issues have been identified and explained by Rachel Muehrer and her colleagues as they studied the relationship between student learning and experience with the collection of games and simulations in *Genomics DNA Lab*.

Considerations when introducing games into schools

The paper by Muehrer and her colleagues has outlined the extra effort required to use online science-based computer video games in secondary educational setting. Consistent with Cher Ping Lim's claims, the authors pointed out several salient issues that need further exploration and consideration when introducing educational video games into the school context. They reported the importance of the (1) context, (2) technological setup, (3) teachers and also (4) students' readiness when using video games in the school context. Two additional issues regarding students' engagement were also discussed: (1) whether engagement could be used as an indicator of students' measurable success (e.g., academic achievements) and (2) whether students learn the game or learn the intended content. Each of the points raised would be discussed in the following sections.

The Influence of the Contextual Factors

The contextual factors are less visible but very important mediators for successful implementation of such innovations in schools. Metaphorically speaking, these contextual factors are like web on the wind – highly structured but difficult to detect until one looks carefully (Nardi and Engeström 1999). Despite many decades of studies and experiences, technological efforts by schools still focus largely on technological tools while contextual and instructional supports that learners need have been neglected.

The importance of context in the introduction of digital games into the school is highlighted by Cher Ping Lim, Lee Yong Tay and John Hedberg (2011). They conclude that the real challenge is not bringing games into schools but rather the changes in terms of schools' organisation and culture needed to incorporate this new approach in education. Even if there is an ideal digital game for the teaching and learning of school related subjects, it is certain that such a game will not survive in the current educational environment because the existing systems may be unable to support such an endeavour. "In order to realise the potential of such gaming technologies in education, it will indeed be necessary for us to 'change the game' in more fundamental ways with regard to our current institutions of learning. That is, to design an educational system in which educational games can flourish" (Lim, Tay and Hedberg 2011 p. 341). The use of

technology or digital games in schools should not only focus on the tool itself; the context where the tool (i.e., the video game for learning) is situated is equally important, if not more important.

The importance of Technological Setups

Consistent with the findings of Muehrer and her colleagues, other studies have confirmed that there is still relatively little use of technologies for teaching and learning as accessibility still presents a major challenge to most schools. Muehrer and colleagues note that the most overwhelming obstacle to successful gaming sessions at every site is the unavailability of technology, be it due to slow Internet connection or faulty computers. Limited access leads to limited use, resulting in limited impact (Tay, Nair and Lim 2010). The availability of technological setups such as computers, computer laboratories, wireless Internet access infrastructure, technical support and serviceability of the technologies are essential to the successful introduction of digital games in the school setting. Easy access to technology is inevitably one of the necessary conditions before any meaningful integration of digital games or integration of technologies in schools could take place.

The Pivotal Role of the Teacher

Researchers have listed "teachers' beliefs and practices" as one of the key factors affecting successful integration of technology into the classrooms (Ertmer 2005). The roles that teachers play are of utmost importance in determining the effectiveness and success of digital games' integration into a learning environment. It is quite clear that in a learning environment, which utilises technologies to engage students, the teacher should also have the necessary technical competencies as well as good knowledge of computer software applications. While basic teaching skills and knowledge remain important, in the new gaming leaning environment appropriate pedagogy should also be ensured.

A popular, if erroneous belief is that students will automatically and naturally be attracted to technologies and will be enticed to perform academic related tasks or behaviours if technologies are used in the process of teaching and learning. This is a false impression as technologies are merely tools and are only able to achieve its intended benefits if used adequately. The students involved in the research reported by Meuhrer and colleagues were not naturally attracted to the educational gaming software applications introduced. Guidance and reminders from teachers were given before students started to take interest in the application. Student management skills are also essential in learning environments that use computers and technologies because structuring the work of students in such a learning environment is different from a conventional classroom.

Similar to a typical classroom, the teacher needs to manage the students and provide orienting activities. Students need to be equipped with skills to guide them when they encounter either technical or content related problems. Cher Ping Lim and Ching Sing Chai (2004) stress the importance of orienting activities in technology-based lesson. These orienting activities include introductory sessions to technological tools, advance organisers and instructional objectives, worksheet and checklist, and technological and

non-technological tools for post instructional reflections. The teachers also need to create a conducive learning climate for students involved in the program so that their social and emotional needs are well taken care of. Student management is important in a technologically enriched learning environment.

A good teacher is probably worth more than a computer with a lousy teacher. It is important to note that technologies are only tools; it is unlikely that technology in itself can improve ineffective teaching practices.

The Readiness Level of the Students in the Use of Technologies

Meuhrer and her colleagues also raised the highly relevant issue of the level of readiness of the students in a technologically enriched learning environment and in this case a digital gaming environment. Many readers might assume and expect that this new generation of digital natives would not have any issues using technologies for their work and leisure. According to a report on students' online digital technologies and performance by OECD (2009) nearly 17% of 15 year-olds who have grown up in this technological era do not have the skills to move easily through the digital environment. This means that these students could still encounter problems using technologies for their studies, applying for jobs, filling out online forms for various purposes in the future. The unexpected low level of students' readiness in studying in a technological enriched environment could also be a result of the schools' and teachers' unbalanced focus on the delivery of subject content without equipping students with the necessary technological skills. Hence, this gives us more compelling reasons to introduce these technologies (whether or not it is educational digital games) into the classrooms as early as possible, so that all of our students could be exposed to technologies.

Some Definition of Student Engagement

The issue of engagement is another topic that deserves more discussions and explorations. The term "engagement" needs to be first defined. Briefly, in a scenario of a given task, engaged student comply with minimal requirements and disengaged students go off-task easily (Bangert-Drowns and Pyke 2001).

Learner engagement is paramount to learning success but in order to understand engagement we also need to understand the role of emotions in learning. Jennifer Fredricks, Phyllis Blumenfeld and Alison Paris (2004) take a psychological approach and describe three aspects of engagement – behavioural, emotional, and cognitive, and recommend that engagement be studied as a multifaceted construct. According to the authors, behavioural engagement can be defined as positive conducts, such as participation in school related activities; following of rules and classroom norms; absence of unruly behaviour; contributing to class discussion and so on. Emotional engagement refers to affective aspects of students' reactions in the classroom, such as interest, boredom, happiness and anxiety. Cognitive engagement emphasises the psychological investment in learning with a desire to go beyond the requirements and a preference for

challenge. The concept of cognitive engagement is quite similar to constructs in the motivation literature.

They share the view that, in general, there is a consistent association between behavioural engagement and achievement across a variety of samples. However the strength of correlation varies across studies according to the abilities of students studied (ranging from “gifted” to “at-risk”). Although there are issues that make it difficult to draw firm conclusions, “there is evidence from a variety of studies to suggest that engagement positively influences achievement” (Fredricks, Blumenfeld and Paris 2004, p. 71). The authors also describe the antecedents of engagement: school-level factors, classroom context, and individual needs. School-level factors include consistency of goals, class size, student’s participation in school policies and management and opportunities for staff etc. Classroom context shows effect in terms of teacher and peer support, classroom structure, autonomy support, task characteristics. Individual needs may vary in terms of need for relatedness, autonomy, and competence. All variables mentioned above pose a diversity of impacts on students’ levels of engagement.

However, the authors caution that there are still lingering issues regarding the measurement of each type of engagement as there are measurement problems that span across all three. One of the issues raised is that the current measures do not tap qualitative differences in the level of engagement, making it difficult to distinguish the degree of behavioural, emotional, or cognitive investment or commitment. In their review of psychological and sociological research on engagement, Stacy Olitsky and Catherine Milne (2012) argued that these continua as a model for engagement beg "the question of the complex relationship *between* cognition, emotion and behavior" (p. 21).

However, the research of Fredricks, Blumenfeld, and Paris (2004) suggests the importance of teachers’ support (both academic and interpersonal aspects) in influencing students’ behavioural, emotional, and cognitive engagement. For classroom structure, it refers to the clarity of teacher expectations for academic and social behaviour and the consequences of failing to meet these expectations. Besides, student interactions with peers could also have varying effect on engagement, depending with the social interactions that take place. Olitsky and Milne (2012) argue that engagement can also emerge from "collectively generated emotions" that have implications for how students in a collective environment, such as a classroom, respond to the introduction of a new resource like a digital game. Their analysis also suggests a role for other students in the fostering of engagement. Leslie Herrenkhol and Maria Guerra (1998) in their study of fourth grade students found that both audience and activity were necessary for engagement. Autonomy and supportive classroom contexts that offer choices, shared decision making, and absence of external limitations have the potential to enhance engagement. Tasks that afford opportunities for ownership, collaboration, fun, diverse forms of talents and are authentic, also enhance engagement. Unfortunately, the current common instructional approach in classrooms that focuses on recall or repetition of procedures based on superficial learning strategies is not likely to require intensive effort and learning that promote deep understanding.

The Issues of Engagement and Measurable Academic Achievements

Meuhrer and her colleagues make the claim that student engagement is not necessarily an indicator of measureable success suggesting a dichotomy between behavior and cognition. They reported that the class with the most score improvement was one of the classes with the least engagement (a class in a noisy computer lab talking amongst their peers about topics not related to the game). They also implied that although the students were observed to be sufficiently engaged the games were less successful in creating a general understanding of the concepts being simulated. Hence, it would be misleading to assume that students' engagement in the playing of the online computer video games would directly result in an improvement in the academic achievements and the understanding of concepts. Such findings seem to provide evidence for the structure of engagement proposed by Fredricks et al. (2004) but we are more aware that teachers need to work with students to optimize engagement, both individual and collective, if the goal is to maximise understanding of the intended content.

Engagement with the Game or Engagement with Content to be Learned

The results of the study presented by Meuhrer and her colleagues indicated that students were more interested in game-playing and progressing through the levels than in developing an in-depth understanding of the science concepts embedded in the games. These findings are congruent to an earlier study where students were attracted to the playing of games and not the academic content to be learned (*see* Tay and Lim 2008). We speculate that the attractive design elements found within the digital games may act as distractions to the players', and in this case, the students' focus on the academic content. Mark Lepper and Ruth Chabay (1985) in a classic study on the use of games for teaching and learning, pointed out that the extra game-like elements could be seen as likely to be distracting and to impair learning or make learning less optimal. However, games do allow for greater levels of student agency in having in a game the opportunity to select the elements that appeals to them which might be more likely to enhance students' focus and engagement to the resources presented. Perhaps, a balance between these perspectives is necessary to be more effective when video games are used in the schools.

Conclusion

Both our reflections on the implications of game implementation and student learning and our reading of the paper by Muehrer, Jenson, Friedberg, and Husain suggest that the introduction of digital games into schools and the evaluation of these games for student learning is more complicated than one might initially imagine. The cultural context or the ecology where such an educational innovation is situated needs to be able to provide the necessary conditions for it to flourish or at least to sustain its existence. The technological, teacher and student readiness are also critical factors that require serious and careful consideration. Furthermore, the issue on the different facets of engagement – game elements or intended academic content – also needs to be well-balanced and carefully assessed. It is hoped that through our continuous explorations and experimentations that we could gain an even better and more in-depth understanding of

the context and the rules of the game for the implementation of such an educational innovation in the school setting.

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Cher Ping LIM is a Professor of Education and the Head of the Outcome-based Learning Unit at the Hong Kong Institute of Education. He has published internationally in different areas of education technologies, namely online learning and other ICT-based learning environments in schools, teacher education and corporations. He has also provided technical consultancy services to UNESCO, Inter-American Development Bank, Asian Development Bank, World Bank, World Links, Microsoft, universities, schools and the Government of Barbados, Indonesia and Oman.