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THE RELATIONSHIP BETWEEN PRIOR GAME EXPERIENCE AND DIGITAL GAME-BASED LEARNING: AN INNOV8 CASE-STUDY

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Abstract:

The adoption of gaming within education on a global basis is receiving widespread attention as this trend is a relatively new and innovative method for teaching and learning on an institutional level. The nature of the research documented in this paper seeks to provide insight into the potential effectiveness of using IBM's Innov8 © to teach information systems at a higher education institution. The authors conducted the research during a career placement week which took place at their higher education institution. A number of grade 12 learners had the opportunity to play IBM's Innov8 in the institutions computer labs as a way of introducing them to broad information systems concepts as well as exposing them to a more enjoyable and entertaining way of learning. This paper will seek to explain correlations between the findings which point to the effectiveness of Innov8 as an innovative method of teaching information systems.

Keywords: Digital Game-Based Learning, Innov8 ©, The Net Generation, Information Systems Education, Business Process Management

I. INTRODUCTION

Whilst a multitude of corporate institutions are increasingly using gaming for a number of purposes, from team building to prototyping new business processes, the use of gaming for learning within educational institutions is experiencing a slower adoption rate. This may in part be due to the fact that the effectiveness of digital game-based learning as a method for teaching information systems is a contemporary research focus area and whilst a number of studies have been, and continue to be conducted, a substantial body of evidence will need to be gathered to prove its effectiveness unequivocally. Additionally, there appears to be a trend at education institutions that educators themselves are unsure of how to incorporate digital games into their curriculum and they are skeptical about the effectiveness of these digital games for learning. In order to assess the effectiveness of using IBM's Innov8 to teach information systems at a higher education level, the authors elected to have the game played by a number of school leavers who were interested in studying information systems. These school leavers represent a different type of learner to what educators were previously used to. Not only do they learn differently but they also have unique learning preferences which educators need to take cognizance of if they want to positively influence these learners' experiences at higher education institutions.

With regards to digital game-based learning, of particular interest to researchers and educators alike, is the degree to which a learner's previous game-playing experiences influence their subsequent game-playing experiences at a higher education institution. One school of thought pertaining to digital game-based learning is that the degree to which a person enjoys and learns while playing a digital game is influenced heavily by their previous game-playing experience. The authors wanted to test that hypothesis with respect to a digital game, Innov 8, that the authors are

considering using as part of the information systems curriculum at their higher education institution. This paper details the findings of that research.

II. LITERATURE REVIEW

Digital Game-Based Learning

Prensky [2007] defines digital game-based learning (DGBL) as "...any marriage of educational content and computer games" and further refines it to be "...any learning game on a computer or online". This definition assumes then that learning achieved through DGBL means can be equally, if not more, effective than traditional learning methods. The reason why DGBL learning is effective can be attributed to three primary reasons being added engagement, interactive learning process and the way in which the learning process and the added engagement factors are combined [Prensky, 2007].

Van Eck [2006] argues that whereas previously people mostly viewed games as serving only entertainment purposes, most people are now of the opinion that games can be used as an engaging form of learning. According to Van Eck [2006] this change in opinion can largely be attributed to three factors. Firstly, continuing research in DGBL has highlighted the potential and power of DGBL which have been widely published. Secondly, there have been advances in learner characteristics such as a preference for inductive reasoning, a desire for multiple streams of information, a need for increased and speedy interactions with content and improved visual literacy skills. These advances have resulted in learners becoming disenfranchised with traditional teaching methods. Thirdly, the increasing popularity of games has led to the creation of a massively commercially successful industry which was worth \$10 billion dollars in revenue in 2006, and continues to grow year-on-year [2006]. This means that an increasing percentage of the global population is familiar with digital games.

This change in both perception and understanding in relation to using digital gaming as a learning tool is resulting in the adoption and integration of DGBL within educational and corporate institutions [Roodt & Joubert, 2010]. According to Prensky [2007], introducing DGBL into the learning environment generates a number of advantages, being that the learning methodology is one of engagement, the learning process is interactive, the digital games can be adapted to the subject matter and the learning style is suited to modern learners.

Smith [2007] argues that digital games can be used to augment learning in almost any subject. In terms of the topic identified by the authors, DGBL in the context of Information Systems (IS) subjects will be explored as an augmentative learning tool.

Innov8

Innov8 is a serious game which was developed by IBM® as part of their Academic Initiative programme. Numerous corporate and educational institutions across the globe are enrolled in this programme and the University of Pretoria chose to enroll during quarter three of 2008 [Roodt & Joubert, 2009]. This institution registered for the programme specifically to gain access to Innov8 as the authors at the Department of Informatics wanted to explore the possibility of implementing relevant serious gaming across its curriculum. According to Gupta and Sharda [2008] by integrating such tools into the classroom, students will be able to relate better to the tool as it simulates real-life scenarios and is also a more engaging and entertaining way of interacting with ones' students. The authors became aware of Innov8 after it had been presented at a number of conferences of which the authors obtained the proceedings.

The game employs a first-person role-playing approach where the player assumes the role of a consultant within a company that is experiencing challenges. The player is given a goal which he/she must achieve in order to successfully complete the game. The goal is to re-engineer a call centre process for the company in order to make it more efficient and effective. In order to achieve this goal, the player has to complete certain tasks which evolve as the game progresses. The two primary aims of the game is to teach players who come from a more technical

background about business processes and more specifically about Business Process Management/Modeling (BPM) and vice-versa in terms of roles, while at the same time immersing them in a three-dimensional world which is closely aligned to real-life scenarios [Roodt & Joubert, 2009].

The Net Generation

The Net Generation, also referred to as 'The Millennials' [Carlson, 2000], is the term used to describe people who were born between 1980 and 1994, coinciding with the introduction of the personal computer and the internet. These young adults exhibit a number of characteristics that make them unique, largely attributable to their fascination and familiarity with new technologies [Oblinger & Oblinger, 2005]. One of these characteristics is described by Howe and Strauss [2000], who argue that these people, many of whom are now university students, mentally process information differently because they were raised with the personal computer. Oblinger and Oblinger [2005:16] refer to this mental processing as "...the ability to process or piece information together from multiple sources." The other defining characteristics are [Oblinger & Oblinger, 2005:17]:

- Ability to read visual images—they are intuitive visual communicators.
- Visual-spatial skills—perhaps because of their expertise with games they can integrate the virtual and physical.
- Inductive discovery—they learn better through discovery than by being told.
- Attentional deployment—they are able to shift their attention rapidly from one task to another, and may choose not to pay attention to things that don't interest them.
- Fast response time—they are able to respond quickly and expect rapid responses.

For the academic community, these students present a paramount challenge, not only because they learn differently from traditional learning methods but also because they want to learn differently [Roodt et al, 2009].

The Net Generation (a.k.a 'The Millennials') present a material challenge to the academic community, not only because they learn differently from traditional learning methods but also because they want to learn differently [Roodt et al., 2009]. In terms of the defining characteristics mentioned above, there are ten features that have a potential impact on higher education [Oblinger & Oblinger, 2005:16]:

- Digitally Literate – They can operate a variety of technological devices and are familiar with the internet, for example: laptops, cellphones and/or iPods ®.
- Connected – They are almost always connected to a technological network of some sort, for example: cellular networks and/or the internet.
- Immediate – They have fast response time and multi-task, for example: playing a game and instant messaging at the same time.
- Experiential – They have an exploratory style of learning and have a preference for 'learning by doing' which results in better memory retention of the subject matter, for example: creating an animation to teach peers about green IT instead of writing a document.
- Social - They seek to interact with others, whether in their personal lives, their online presence, or in class, for example: blogging and having social network profiles on a network such as Facebook ®.

- Teams – They prefer to learn and work in teams, for example: a peer-to-peer approach where students help each other.
- Structure – They like to know what it will take to achieve a goal, for example: rules, priorities and/or procedures for doing a task.
- Engagement and Experience – They like interactivity, for example: watching a YouTube ® video on a topic instead of reading slides.
- Visual and Kinesthetic – They are more comfortable in image-rich environments than text, for example: looking at pictures showing the impact of global warming instead of reading text.
- Things that Matter – They readily take part in community activities and want to learn about things that matter, for example: environmental concerns.

The consequences of this is that educators have to adapt not only their teaching methods, learning tools, content and assessment criteria, but also themselves in order to effectively help educate these students [Roodt et al., 2009].

III. RESEARCH METHODOLOGY

Research Approach

The research for this paper was conducted using a convenience sample of 41 Grade 12 (17-18 year old) students that participated at an IT week at the University of Pretoria. The purpose of the IT week is to engage school leavers and to introduce them to the possibility of studying an IT degree at the University of Pretoria. As it is also a marketing exercise of the different departments within the School of IT within the University of Pretoria, the authors' department decided to demonstrate some of the innovate teaching techniques the department is using to the scholars. In this case it was decided to let the scholars play through to Innov8 game created by IBM.

Furthermore the author's decided to survey the experiences of the scholars with the Innov8 game to attempt to answer a number of questions pertaining to the use of Digital Game-based Learning (DGBL) in the department. The main areas of interest for the author's were:

1. The ability for students to learn complex new concepts using DGBL.
2. The correlation between previous gaming experience and learning.
3. The correlation between previous educational gaming experience and learning.

Seeing as the use of DGBL in higher education is on the increase not only in the authors' institution but worldwide, it is important to attempt to quantify what effect the early introduction to games and games for learning at a pre-tertiary level will have on the students ability to learn using Digital Games.

Research Design

The 41 scholars in the sample were given a 2 hour period in which to play through IBM's Innov8

game. After the completion of either the game or the 2 hour period the students were asked to fill in a short questionnaire to gauge their experience of the game. The following seven questions were asked:

1. I enjoyed the Innov8 session:
2. I found Innov8 easy to use:
3. I have played computer games before:
4. I have played computer games before in school or for education:
5. I learnt something from the Innov8 session:
6. I now understand the role of Information Systems in an organization better:
7. I now understand Business Process Management better:

They were given a possible range of answers in the form of a Lichter scale ranging from: Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree. These answers were codified on a scale from 1 to 5.

IV. ANALYSIS

The author's performed three separate analyses on the data set to attempt to answer the three questions raised in the previous section. Firstly the averages of the replies to the seven questions were calculated to determine the scholars enjoyment in playing Innov8, their previous experience with games and whether they felt that learnt something from the session: The results were as follows:

Table 1: Average for Questions

Question	Average
1. I enjoyed the Innov8 session	3.61
2. I found Innov8 easy to use	3.22
3. I have played computer games before	4.56
4. I have played computer games before in school or for education	3.15
5. I learnt something from the Innov8 Session	3.78
6. I now understand the role of Information Systems in an organization better	3.85

7. I now understand Business Process Management better	3.61
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Secondly two correlation analyses were drawn, correlating Question 3 and 4 (“I have played computer games before” and “I have played computer games before in school or for education”) with Questions 4, 5 and 6 which all deal with how much the scholar felt they learnt from the session, about Information Systems and about Business Process Management. The correlations are as follows:

Table 2: Correlation Coefficient

	5. I learnt something from the Innov8 Session	6. I now understand the role of Information Systems in an organization better	7. I now understand Business Process Management better
3. I have played computer games before	-0.02279	0.06604	-0.00814
4. I have played computer games before in school or for education	0.33219	0.505678	0.265177

These results will be discussed in more detail in the next section.

V. FINDINGS

The first question the author’s wanted to address was the issue of whether the scholar’s felt they had learnt anything from the session. As shown in the previous section the average results for questions 5, 6 and 7 were: 3.78, 3.85 and 3.61 out of 5, respectively. This indicates that the scholars felt that they had learnt something in the session and that their knowledge of both Information Systems in Organizations and Business Process Management had improved.

The second question relates to the correlation between a scholar having played games before and thus having some level of experience with games, and with level of learning they felt they obtained during the session. The first of the correlations is with question 5 (“I learnt something from the Innov8 Session”) which is -0.02279 . The second of the correlation is with question 6 (“I now understand the role of Information Systems in an organization better”) which is 0.06605 . And the final correlation is with question 7 (“I now understand Business Process Management better”)

which is -0.00814.

All three these correlations are very low and thus show that within this sample group there appears to be no correlation between the respondents having played games previously and them feeling that they have learnt anything.

The third questions concerns the correlation between a scholar having played games for education or in school and with the level of learning they felt they obtained during the session. The first of the correlations is with question 5 ("I learnt something from the Innov8 Session") which is 0.33219. The second of the correlation is with question 6 ("I now understand the role of Information Systems in an organization better") which is 0.505678. And the final correlation is with question 7 ("I now understand Business Process Management better") which is 0.265177.

All three of these calculations indicate that there is some correlation at least and thus show that within this sample group there appears to be some correlation between the respondents having played games for education or in school previously and them feeling that they have learnt anything.

VI. CONCLUSION

Based on the findings above it would appear that there is an unexpected correlation between prior gaming experience within the educational context and the depth of subject matter retention in a subsequent DGBL experience. The authors conducted a literature review which suggested that the hypothesis, that prior gaming experience in any context would have the highest correlation with subject matter retention, is true. This discrepancy between the literature and the authors' results was unexpected and further research is warranted.

Given the limited nature of the sample size the authors are of the opinion that a more extensive study is required. Even so due to the demographic nature of the respondents, i.e. they were all prospective IT students, one would expect them to be comfortable with Gaming for learning and yet it was found that they had greater comfort with Game for learning if they had some previous experience with it.

The authors recognize the fact that this research data does not investigate the cause of this unexpected correlation but propose the following as possible causes for this phenomenon:

Firstly it could be due to the fact that because educational games are designed specifically for educational purposes they appear to be more effect for subject matter retention than commercial of the shelf games as well as priming them for future DGBL experiences.

Secondly scholars who are interested in the IT field would be more likely to have had educational game exposure at pre-tertiary level as they would be more willing to play these kinds of games.

These and other possible causes could be the focus of further research in this area.

In conclusion it would appear, from the research, that prior gaming experience in the educational context is more influential on subject matter retention than prior non-educational gaming experience irrespective of the subject matter of the game.

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ABOUT THE AUTHORS

Pieter Joubert completed his Bachelors Information Technology at the University of Pretoria before working in industry as a test and programmer for an Electronics Warfare company for two years. He returned to academia and completed his Masters in Philosophy with a specialization in Informatics. He is currently pursuing a PHD in Information Technology while teaching and

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Sumarie Roodt completed her BCom: Informatics at the University of Pretoria before working in financial services for 6 years. During her time in the banking sector she performed a number of roles, including being a project manager, a strategic alliances portfolio manager and then a strategy consultant. Sumarie decided to pursue her MBA full-time at the University of Cape Town's Graduate School of Business and was then selected to attend the University of Chicago's Graduate School of Business for a semester. Sumarie is now a full-time lecturer at the University of Pretoria and is currently busy with her PhD in Informatics. Her specialty is social software for education.