Title: Students' Learning Experiences in the Digital Age
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Summary

This paper addresses the issue of what students at university value in relation to pedagogy in the 21st Century. Modern students live in a technological age spending much of their leisure time immersed in technology; they are what Prensky (2001a) calls Digital Natives. Proponents of this view (Oblinger & Oblinger, 2005) argue that this prolonged exposure to technology influences student values in terms of their study experiences. This longitudinal study investigates student experiences of traditional lecture based delivery modes and compares it to digital delivery modes utilising computer games. Over the course of a three year period the mode of delivery was transformed from wholly traditional in the first year to fully digital in the third year while the content and assessment were kept constant. Student experiences were rated using an Experience Sampling Method (Hektner, Schmidt & Csikszentmihalyi, 2007) designed to capture real time experience and measure feelings of flow (a term coined by Csikszentmihalyi to indicate optimal experience). Results indicate that students who experienced the digital mode were happier and more involved. Also, they experienced higher concentration levels and perceived sessions as more challenging. However, they found learning less sociable and more confusing. Flow characteristics revealed boredom for students in the traditional setting but anxiety and flow in the digital setting. These results suggest that by aligning teaching mode with the digital culture, student learning experiences can be improved. However, there are some negative aspects that need to be addressed and investigated further.

Given that the majority of students who are now completing University degrees have been brought up in a technological era it would be reasonable to assume that they would expect their learning environment to match the high level of digital interactions that they have been accustomed to in their earlier years. A number of writers have articulated that the Net Generation is different and that they are only engaged if they are learning by interaction, through experience and in an exploratory way (Oblinger & Oblinger, 2005; Prensky, 2001; Tapscott, 1998). This paper describes some of the initial findings (based on the first 2 years) of a 3 year longitudinal study designed to explore the impact and practicality of using computer games to teach a level 1 (first year) tertiary course. In particular, this paper addresses the issue of how the use of computer games in a tertiary education course impacts student experiences compared to a traditional approach.

Background

Anyone with teenage sons or daughters knows the power of the digital game to instil immense amounts of intrinsic motivation. The new generation of tertiary students have been raised in a computer age. By the time these current students graduate almost all would have played computer games at some time with the vast majority being regular digital game players (Jones, 2003; Oblinger, 2004). Massively multi player online role-playing games are attracting millions of players across the world. Players invest massive amounts of time, money and energy into playing these games (Gee, 2003; Prensky, 2002). The games are particularly advanced and conducive to adaptation for educational purposes, being social, interactive and highly motivational. Businesses are now beginning to adapt and build these types of games for training purposes (Prensky, 2001; 2002a; 2003). The lecture is still the preferred method of delivery by most tertiary institutions. However, there could be many advantages gained from the use of interactive technology for course/content delivery such as flexible access to course materials, alignment of distance and campus delivery modes, improved motivation (and consequently improved learning), improved marketing and above all greater satisfaction from a digitally aware and experienced tertiary population.

Method

Participants

Participants comprised two separate cohorts of students enrolled in a first year Bachelor of Arts Education course:

Cohort 1
Fifty nine students (42 male, 17 female) enrolled in a first year education course (Course Code: Educ122, 2006).

Cohort 2
Thirty one students (21 male, 10 female) enrolled into Educ122 in 2007.

Design

General Course Design
The course was a first year BA in Education Special Topic entitled 'Computer Games and Education' with the course code Educ122. It ran in Semester 2 (12 weeks in duration, split into two terms of 6 weeks) of 2006 and 2007. In the first term students were taught basic educational psychology through weekly lectures, (2hrs per week) and attended weekly labs (also 2hrs per week) where they learnt to use the Neverwinter Nights Aurora toolset. At the end of term 1 student's were given a formal assessment to test their understanding of the lecture content (worth 50% of their final grade). This assessment took the form of an examination in which students were asked to answer a number of short answer questions. In the second term students continued to attend labs but were tasked with completing an assignment (in groups) to design, build and test a game module that taught a given

aspect of Educational Psychology that had been covered in the first terms lectures. Lectures continued in the second term but had a content focus of 'game design and theory'.

An Experience Sampling Method (ESM) was used to collect data on student's subjective experiences during the course with student's completing one ESM form for every hour of instruction.

Cohort 1 (2006)
In the first year course content was delivered using a traditional lecture format in a standard lecture theatre with tiered seating.

Cohort 2 (2007)
In the second year half of the education course content (4 topics) was delivered using a traditional lecture format in a standard lecture theatre with tiered seating. The remaining education course content (4 topics) was delivered using custom built computer modules with the course content embedded in the game. All other aspects of the course were kept constant including the formal assessments (exam identical).

Instruments

Computer Games
The commercial computer game Neverwinter Nights and its Aurora Toolset (Distributed by Atari) was used to construct the game modules (by course lecturers) and students were taught to use the toolset to construct their own modules. This game was chosen as the preferred game engine as it was relatively easy to use for constructing original modules; the toolset contained a large amount of customizable material and it was graphically superior to many simple to use games engines. This is a role playing game (RPG) set in medieval times. Individual modules constructed for the purposes of delivering the educational content were embedded into an overall hub module. The overall narrative that players encountered described the player entering the University of Canterbury in medieval times and having to follow a career path from first year student to the heady heights of being the Vice Chancellor.

ESM
Student experiences were rated using an Experience Sampling Method (Hektner, Schmidt & Csikszentmihalyi, 2007) designed to capture real time experience and measure feelings of flow. The Experience Sampling Form (ESF) selected for this study was adapted from the one used in the 'Talented Teenagers' study (Csikszentmihalyi, Rathunde & Whalen, 1997, p52-53) and contained subjective questions designed to sample participant's mood, thoughts, general feelings and feelings about the activity. A table giving the experience indicators considered in this paper is shown below.

Table 1. A list of the experience indicators

Feelings About the Situation	Mood Scales	Feelings about the Activity	Physical Indicator
Ho well were you concentrating? Was it hard to concentrate? How self conscious were you? Did you feel good about yourself? Were you in control of the situation? Were you living up to your own expectations? Were you living up to others expectations?	Alert – drowsy Happy – sad Irritable – cheerful Strong – weak Active – passive Lonely – sociable Ashamed – proud Involved – detached Excited – bored Closed – open Clear – confused Tense – relaxed Competitive – cooperative	Challenges of the activity Your skills in the activity Was the activity important to you? Was the activity important to others? Were you succeeding at what you were doing? Do you wish you had been doing something else? Were you satisfied with how you were doing? How important was this activity in relation to your overall goals?	Did you feel any pain or discomfort as you were beeped?

Procedure

Students enrolled for Educ122 'Computer Games and Education' in the traditional way through the University enrolment process. During Session 1 students were told about the format of the course and that the course was also part of a study to explore the efficacy of Computer Games for the delivery of educational content. Students were asked to agree to take part in the study and consent forms were completed. In addition, students were introduced to the ESF and it was explained what the purpose of the form was and how and when they should complete it. In subsequent sessions students collected an ESF on entering the room and completed it when instructed to do so by an objective observer at a random time during the session (one form per 1 hour session). Forms were collected at the end of each session.

Analysis

The majority of the data was expressed through rating scales therefore the data was initially transformed into z-scores (mean=0, SD=1) which is a standard way of controlling for individual differences. In the first instance experiences of each lecture topic that had been delivered using both modes (traditional and digital) were compared across years (2006-traditional, 2007-digital). Consequently, t-tests were computed to compare mean scores for Cohort 1 (traditional delivery) and Cohort 2 (digital delivery) by lecture for each of the 29 experience indicators.

A further analysis was computed that analysed whether there were any overall differences in experience between the traditional delivery mode and the digital delivery mode for students in the 2007 cohort. Consequently, a one way ANOVA was computed with the 29 experience indicators as dependant variables and the two delivery modes acting as independent variable.

Finally, individual students' flow states were calculated and incidences compared between traditional and digital delivery modes. The method used to calculate the flow experience was to first categorize the students' perception of challenge and skill as high or low based on whether the z-score for the variable was above or below the mean for that individual (mean calculated as a zero z-score). These two ratings were then combined to give a flow rating; high challenge & high skill = flow; low challenge & low skill = boredom; low challenge & high skill = relaxation; high challenge & low skill = anxiety. The percentages of students in each of these flow conditions for each delivery mode were then calculated (across cohorts and within cohorts).

Results

Table 2. Showing all results reaching statistical significance and means and standard deviations for Cohort 1 (traditional mode) and Cohort 2 (digital mode)

Rating Scale Descriptor	T score	Sig	Traditional Mode Mean (sd)	Digital Mode Mean (sd)
Lecture 4 Level of concentration	-2.70	.009	-.62 (1.0)	.07 (1.0)
Mood is *lonely – sociable	2.41	.019	.22 (.91)	-.31 (.78)
Mood is* involved - detached	2.16	.035	.35 (.96)	-.19 (1.0)
Mood is *clear - confused	-2.39	.020	-.22 (.88)	.39 (1.17)
Mood *competitive - cooperative	2.07	.043	.07 (.81)	-.40 (.98)
Challenges of the activity	-4.23	.000	-.73(1.10)	.37 (.98)
Succeeding with activity	2.24	.029	.11 (.94)	-.47 (1.13)
Lecture 5 Level of concentration	-2.24	.029	-.38 (.95)	.14 (.82)
Challenges of the activity	-2.79	.007	-.42 (.85)	.19 (.83)

	-3.39	.001	-.42 (.92)	.33 (.92)
Lecture 6 Is self conscious	-3.39	.001	-.42 (.92)	.33 (.92)
Mood is *alert - drowsy	2.45	.017	.55 (1.17)	-.07 (.87)
Mood is *happy – sad	2.34	.023	.48 (1.0)	-.06 (.88)
Mood is *irritable – cheerful	-2.35	.022	-.53 (.87)	-.02 (.89)
Mood is *active – passive	3.98	.000	.70 (1.02)	-.20 (.79)
Mood is *excited - bored	2.32	.024	.48 (.95)	-.02 (.78)
Challenges of the activity	-3.56	.001	-.73 (1.07)	.16 (1.02)

*Note that the first named experience is quantified as low scoring on the scale and the second named as high scoring on the scale

As expected, each lecture reveals unique student experience differences. However overall, results in table 1 indicate that: when delivery is <u>digital</u> student concentration is higher, mood is less sociable, more involved, more confused, more competitive, more challenged, having less success, more self conscious, more alert, happier, less irritable, more active and more excited.

Table 3. Showing all results reaching statistical significance and the means and standard deviations for Cohort 2 (2007) traditional mode and digital mode

Rating Scale Descriptor	F score	Sig	Traditional Mode Mean (sd)	Digital Mode Mean (sd)
Mood is *alert - drowsy	3.83	.051	.22 (1.02)	-.02 (.96)
Mood is *active – passive	10.85	.001	.33 (1.04)	-.07 (.93)
Mood is* involved – detached	7.13	.008	.24 (1.03)	-.07 (.87)
Challenges of the activity	39.38	.000	-.44 (.94)	.26 (.95)

*Note that the first named experience is quantified as low scoring on the scale and the second named as high scoring on the scale

The results in table 2 indicate that: when delivery is <u>digital</u> students are more alert, more active, more involved and the activity is more challenging.

Table 4. Percentage of students in the different flow states for traditional mode (Cohort 1, 2006, Cohort 2, 2007) and digital mode (Cohort 2, 2007)

	Boredom	Relaxation	Anxiety	Flow
Traditional Delivery (Cohort 1, 2006)	37%	24%	18%	21%
Traditional Delivery (Cohort 2, 2007)	41%	21%	13%	25%
Digital Delivery (Cohort 2, 2007)	25%	10%	35%	30%

Results of the percentage of students in the different flow states for traditional lecture in Cohort 1 and 2 and digital mode (Cohort 2) indicate that boredom was the most prevalent state whilst experiencing traditional lectures but they were more inclined to anxiety and flow during the gaming experience.

Discussion

The results of this study indicate that students' experiences are enhanced when learning is embedded within a computer game environment. This is not surprising as computer games are known to be fun and motivational for many people and the sample used in this particular study would be of students who were probably more inclined towards the playing of computer games given the title of the paper being studied. It does not necessarily indicate that all students would prefer this learning option or that other forms of digital engagement would also be as popular. However, if theorists such as Oblinger, Prensky and Tapscott are to be believed many of our young University students require this type of learning environment if they are to be engage at all.

Another promising experience reported by students was that they felt more involved, active, challenged and alert. Surely, this is what we want of our learners. If we have a constructivist view of learning then ensuring that our learners are active and challenged in learning situations is of paramount importance.

It is however important to note that some negative experiences were reported for the digital scenario compared to the traditional lecture. For instance participants reported much higher anxiety states according to the calculation of reported flow experiences in the game mode than in the traditional lecture mode. It is unclear as to why anxiety was higher in the game mode but is probably as a result of the challenging nature of the learning which is particularly likely given that the measure was based upon reported challenge and skill.

In addition, students' experiences in digital mode indicated that they were less sociable, more confused, having less success and self conscious. It is somewhat of a surprise to find that students would feel less sociable because although they were engaged at a single computer in a solitary activity they were also in a computer lab with many other students in a relatively relaxed environment where exchanges were frequent as opposed to a lecture theatre where silence is expected. The fact that they were more confused and having less success is less of a surprise because the nature of the task they were faced with was to explore, interact and problem solve in the game environment which would ultimately lead to some confusion and the feeling of less success.

Finally, students indicated that they were more self conscious when in game mode compared to lecture mode. This feeling is hard to fathom but could be due to the fact that they were in an active role and success was dependant upon how they responded to the situation as compared to a traditional lecture that is passive and puts the learner into an anonymous group situation.

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