Educating Information Systems Students on Business Process Management (BPM) through Digital Gaming Metaphors of Virtual Reality

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Abstract

Digital gaming continues to be an approach for enhancing methods of pedagogy. The study evaluates the effectiveness of a gaming product of a leading technology firm in engaging graduate students in an information systems course at a major northeast institution. Findings from a detailed perception survey of the students indicate favorable improvement in learning of business process management (BPM) methodology through the gaming software. However, improvement in learning through the system is indicated to be not as high in contrast to the case discussion reports and presentation project reports of the course involving research. These findings of the study may aid educators attempting to better integrate game-based learning with other methods of pedagogy.

Keywords: business process management (BPM), games, gaming, information systems education, instructional design, learning outcomes, pedagogy, second life, simulation, virtual reality

1. BACKGROUND

Digital gaming is an approximate $9 billion business, generating revenues of $6.6 billion in console software, $2 billion in mobile software, and $910 million in other software (DeMarle, 2008, p.92). Revenues increased to $9 billion in 2007 from $6 billion in 2001 and $2.6 billion in 1996 (Entertainment Software Association, 2007). Sales increased to 268 million units of software sold in 2007 from 74 million units in 1996 (DeMarle, 2008, p.92). Growth in the business is attributable to the attractiveness of electronic gaming to consumers of the current gaming generation of younger players and even the generation of increasingly older players (Vella, 2008). Because of the growth, educators continue evaluating the effectiveness of gaming in the learning of students.

Digital gaming is coming into the curricula of schools in an environment of simulation, video and virtual reality (Economist, 2007). Learning is considered to be enabled in the environment of simulation by an integration of elements of challenge, curiosity and fantasy (Akilli, 2007) that are familiar and immersing to gaming or Net Generation stu-

dents. Learning is also considered to be enabled by real life simplification in virtual reality (Heinich, Molenda, Russell and Smaldino, 2002), as illustrated on Linden Labs' Second Life (www.secondlife.com). Funded by government and industry, educators are evaluating the entertainment of gaming and the learning that may be fostered by virtual reality, video and simulation of gaming (Long, 2007 and Nagel, 2008). Schools are increasingly evaluating the effectiveness of gaming as a method of pedagogy in contrast to the effectiveness of established methods.

Designing digital gaming for effectiveness in the intelligent learning of students is a challenge for educators in the context of the below:

- How do educators design digital gaming as an experience in learning?
- How do educators not experienced in the culture of gaming genres develop gaming of simulations and virtual reality in current environments of learning? (Dede, 1996) and
- How does digital gaming enhance existing methods of pedagogy, including books, case discussion reports, or presentation project proposal reports, and impact the learning of the students?

Digital game-based learning (Prensky, 2001) may be an engaging experience, but may not be educational in information (Gibson, Aldrich and Prensky, 2007) and may not be for educators in schools but for trainers in business firms. Entertainment may not meet goals of learning (Dickey, 2006, p.261) Literature is diverse in methods of integrating fantasy, curiosity and challenge into gaming models of pedagogy in order to motivate students (Bowman, 1982, Malone, 1981 and Provenzo, 1991). New technology evolving in the field of gaming is a further challenge for instructional designers in finding methods of pedagogy (Dickey, 2007) for engaging Net Generation students, as is the diversity of gaming played by the students. Digital gaming – great gaming and great learning - is a complex endeavor for educators considering simulation and virtual reality as a method of pedagogy (Becker, 2007).

Gaming can benefit educators faster however in schools of computer science and information systems. Given the decline of current students majoring in computer science (Pollacia and Russell, 2007 & Vegso, 2006), educators in the schools could entice further students by furnishing courses (Wallace, Russell and Markov, 2008) and degrees (Zyda, Lacour and Swain, 2008) in the design of gaming of simulation and virtual reality as a discipline. Gaming could be concurrently a method of pedagogy for courses and degrees of the schools. Net Generation students could be enticed into the programs of the schools, inasmuch as they might be later hired in business firms to be not gaming hobbyists or specialists but highly paid generalists or practitioners in information systems (Pham, 2008 and Young, 2007). The effectiveness of gaming as a discipline in enticing students into schools of computer science and information systems, and the effectiveness of the learning of the students as a method of pedagogy, are currently inconclusive from the literature.

Gaming is inherently interdisciplinary so that educators in schools of computer science and information systems could experiment further in gaming as a method of pedagogy. Firms in industry continue to demand students in the schools be knowledgeable if not experienced in not only information systems but also in business (Lee and Han, 2008). Gaming could be included in courses in the schools so that students might learn the interrelationships of a business in an environment of learning that is integrating practitioner scenarios through realistic simulation and virtual reality (Cordis, 2007, DiMeglio, 2007 and Lavelle, 2008) akin to firms having virtual venues (Hemp, 2008). Literature is inconclusive as to the effectiveness of gaming as a method in enhancing the learning of business in schools of computer science and information systems, or as a method in enhancing existing methods of pedagogy in the schools (Chapman and Sorge, 1999), such as lectures that might be considered numbing to students. Nevertheless the learning of Net Generation students on business principles of information systems might be enabled in an environment of simulation and virtual reality that is attuned to Net Generation learning styles (Leon, Przasnyski and Seal, 2008). This study evaluates the effectiveness of digital gaming in the engagement

and the learning of business process management (BPM) in a course on information systems at a school of computer science and information systems.

2. INTRODUCTION TO STUDY

The effectiveness of digital gaming in engagement and learning is evaluated in *Global Information Systems Principles*, a core course in the curricula of the Seidenberg School of Computer Science and Information Systems of Pace University in New York City. The course consists of the below learning objectives:

- Comprehend criticality of business competitive strategy and technology;
- Describe role of business organizational strategy in management of technology;
- Identify current decision-making issues in management of business process strategy and technology;
- Improve creativity, critical-thinking and problem-solving in potential management of business process strategy and technology; and
- Initiate informed discussion of issues in management of leading edge technologies in a global industrial society.

Enhancement of a customer service process by business process management (BPM) is a focus of the course for students. The course includes a book, Management Information Systems: Managing the Digital Firm (Laudon and Laudon, 2008), case discussion reports on business strategy and management of technology (40% of final grade) and presentations of project proposal reports on business process strategy and technology in firms in industry (40%) requiring research, and a digital gaming product on BPM, customer service process and service-oriented architecture (SOA) technology (20%), as assignments for the students. *Global Information Systems Principles* is a course for graduate students of the university.

The digital gaming product is BPM Simulator: INNOV8, downloadable gaming software of IBM granted to the principal author who is also the instructor of *Global Information Systems Principles*. INNOV8 consists of a 3D environment of a game or meta-verse (Kumar, Chhugani, Kim, Kim, Nguyen and Dubey, 2008) setting (Rollings and Adams, 2003) in which students are challenged by choices as consultants in the improvement of a customer service process at a After, Inc. business firm, in a cinematic customized design of virtual reality. As consultants to After, Inc., they are empathic in emotional proximity (Dickey, 2006, p.251) to Logan, the consultant personality in After, Inc. From discovery of the process to construction of the model of the process, analysis, design and deployment of the process, and management and optimization of the performance of the process, students are engaged in experimental quests and scenes as they explore offices and interact with office personalities at After, Inc., in the improvement of the process. They progress in levels of old customer service process, new service process, and monitoring of the new process, as they respond to simple to complex scenes and stimuli which make the story (Thompson, Berbank-Green and Cusworth, 2007). They may not progress until they respond satisfactorily to the system. Striving is important in personal progression (Malone and Lepper, 1987). INNOV8 is a form of an experiential learning method – "if you do it, you learn it" and a form of a goal setting method – "you learn more if you are striving towards a goal". Students might learn BPM practices if not creativity, critical-thinking, and problem-solving skills (Reeves, Malone and O'Driscoll, 2008), as they improve the customer service process of After, Inc., the learning objective of INNOV8 and of the instructor, who desired not to do elaborate lecturing on BPM that might be numbing to information systems and computer science students exposed to BPM for the first time.

Figures 1a – 1j in Appendix A depict the design of BPM Simulator: INNOV8.

BPM Simulator: INNOV8 is not inconsistent with the literature on digital gaming. Learners in *Global Information Systems Principles* may form a foundation for knowledge of BPM from INNOV8, in instruction properly sequenced in simple to complex scenes and quests of customer service process solutions, leading to motivation and stable structures (Becker, 2007). Students may learn BPM in the obstacles included in the narrative of plausible scenes and quests at After,

Inc. They may learn the problems of practitioners in problem-solving process solutions of business organizations as players in the virtual reality (Gee, 2005) of After, Inc., in a manner of increased self-efficacy (Bandura, 1997) similar to simulation without virtual reality (Faria and Nulsen, 1996). Learning problems and solutions may enable them to be more marketable to business organizations if not potentially productive as professionals (O'Sullivan, 2008). Literature on gaming (Bransford, Brown and Cocking, 1999) indicates that learning is facilitated if gaming is assessment-centered (engaging, interactive and responding), community-centered (engaging with players), knowledge-centered (engaging with principles) and learner-centered (relevant to reality), factors evident in INNOV8, excluding community-centered gaming.

The instructor included BPM Simulator: INNOV8 in *Global Information Systems Principles* in the periods of spring 2008, fall 2008 and spring 2009, and 39 students played INNOV8 in the semesters. Though INNOV8 may be played an average of 1 to1½ hours per student in computer labs at school sites if students respond satisfactorily to the scenes and tasks, the instructor required that INNOV8 be further played 1½ to 3 ½ hours per student on computers at personal sites of the students and later reviewed in 2 to 3 hours at the school. INNOV 8 was played one-on-one by the students, as Simulator is not a massively multiple online role player game (MMORPG) but a simple single player system. The students played INNOV8 without the help of the instructor, as they played it as though they were playing gaming on Second Life venues of virtual reality, and as there were system tutorials. In informal inquiry, the students indicated that INNOV8 helped in the learning of BPM, once they played INNOV8 and shared solutions with the instructor, though the effectiveness of INNOV8 as a learning method in *Global Information Systems Principles* might be considered further in a formal study.

Therefore, this study evaluates the effectiveness of BPM Simulator: INNOV8 in learning BPM in the course on *Global Information Systems Principles*.

- How does INNOV8 improve learning BPM as a method of pedagogy?
- How does INNOV8 improve BPM creativity, critical-thinking and problem-solving on process solutions? and
- How does INNOV8 improve or not improve learning BPM, and creativity, critical-thinking and problem-solving skills, in contrast to extant methods of pedagogy in the course: book, case discussion reports, and presentation project proposal reports?

Findings of improvement or non-improvement in outcomes have to be dependent on the perceptions of the students playing INNOV8 coupled with formal investigative study. Findings from an initial investigation of outcome perceptions might benefit educators considering digital gaming and virtual reality as a method of pedagogy, in a period of research that is focused frequently on the ineffectiveness not the effectiveness of gaming (Beedle and Wright, 2007).

3. FOCUS OF STUDY

The focus of the formal study is to evaluate the following:

- Effectiveness of BPM Simulator: INNOV8 in improvement in learning BPM in a course on *Global Information Systems Principles*;
- Effectiveness of INNOV8 in improvement in learning BPM creativity, critical-thinking and problem-solving skills on process strategy and technology in the course; and
- Extent of effectiveness of INNOV8 in improvement in learning BPM as a method of pedagogy in contrast to a book, case discussion reports, and presentation project proposal reports as established methods of pedagogy in the course.

This study evaluates further the extent of the helpfulness of the metaphors of personalities, scenes and quests of INNOV8 in the learning of students at the Seidenberg School and investigates the navigation and usability of the system. INNOV8 is a product of a leading technology firm granted to a

sample of institutions, such as Pace University (Daniel, 2008). Though technology firms are hyping digital gaming software, such as INNOV8, as the future of learning, findings on gaming and virtual reality as a method of pedagogy in schools of information systems is limited in the literature, necessitating initiative of institutions in researching the method (Zyda, 2007). This study is focused on furnishing guidance on digital gaming methodology that might be beneficial to educators, if not game designers and instructional designers, integrating gaming in curricula for information systems students (Kao, 2007).

4. METHODOLOGY OF STUDY

The methodology of the study consisted of a perception survey of 39 graduate students in the *Global Information Systems Principles* course and independent study of the principal author, in the Spring and Fall 2008 and Spring 2009 semesters, in the Seidenberg School of Computer Science and Information Systems of Pace University, in downtown New York City. The population consisted of an average age of 26.18 years, of which 26.42 years were female (n = 19 students) and 25.95 years were male (n = 20). These students were experienced gamers on computers, Internet, and Second Life-like virtual reality, or on gaming systems in other courses in the extant or other institutions. They averaged 6.36 hours monthly on gaming systems, and close to half of the population exceeded 6.36 hours (n = 17 students). Half of the population was international non-citizenship (n = 20), furnishing diverse and interesting perspectives on BPM Simulator: INNOV8.

The survey focused on 92 items primarily relating to the following:

- Effectiveness in improvement of learning BPM strategy and technology from book of course, case discussion reports, presentation project proposal reports, and INNOV8;
- Effectiveness in improvement of learning BPM creativity, critical-thinking and problem-solving skills from book, case discussion reports, project proposal reports, and INNOV8 system of course; and
- Effectiveness of metaphors of personalities, quests and scenes of INNOV8 system and helpfulness of navigation and usability of system.

The students furnished their answers anonymously to item statements on a Likert-like 9-point scale from possible responses of very strongly agree (8) to very strongly disagree (1) and neither agree nor disagree (0), and several statements were in negative undertones in order to screen acquiescence response sets (Gall, Gall and Borg, 2003). All of the students completed the perception survey, of which the statements are in Appendix B, and were compensated with extra credit in the final grades of the course. The instrument of survey was reviewed for insurability of interpretability in a pilot review by a sample of students in spring 2008.

The methodology of the study included moreover a review of the personal reflections on the INNOV8 system by the students.

The answers from the survey were interpreted statistically by the second author of the study, for implications to instructors in information systems.

5. ANALYSIS

Findings of Perception Survey of Students

The perceptions of the students in response to the item statements in the survey were analyzed by descriptive statistics, namely central tendency (means), variability (standard deviations), and correlation coefficients, and by inferential statistics, namely the Wilcoxon rank sum test (McClave and Sincich, 2006 & Ross, 2004).

The students perceived the *Global Information Systems Principles* course to be effective in improvement of learning BPM strategy and technology (means = 6.81) with female and male perceptions (7.08 and 6.56) high. They perceived the INNOV8 gaming system to be effective in facilitating a learning mood (6.13), but perceived the presentation project proposal reports (6.98) and the case discussion reports (6.58) to be more effective than INNOV8 (5.93), though INNOV8 was perceived to be more effective

in the improvement of learning than the book of the course (4.98) as the book related to BPM. Female and male perceptions of the learning were highest with the project proposal reports (7.03 and 6.93) than with INNOV8 (5.94 and 5.91), and were lowest with the book of the course (5.14 and 4.82). Non-international and international students perceived the project proposal reports (6.93 and 7.03) and the discussion reports (6.63 and 6.53) similarly with INNOV8 (5.81 and 6.04). Students in general were less positive in learning BPM in INNOV8 than if the instructor further lectured on BPM (5.10) or required other reports (4.33). Students would however recommend INNOV8 in the forthcoming course of the next semester (6.82).

The means and standard deviations of the effectiveness in learning BPM strategy and technology are detailed in Table 1 and Table 2 of Appendix B.

The students further perceived the course to be effective in the improvement of learning creativity (6.38), critical-thinking (6.85) and problem-solving (6.59) skills on process strategy and technology. They perceived the project proposal reports (6.92 and 6.72) and the discussion reports (6.46 and 6.79) to be more effective than INNOV8 (6.28 and 6.28) in the learning of creativity and critical-thinking skills. They perceived the discussion reports (6.49) to be however less effective than INNOV8 (6.54) in problem-solving skills. They rated the book of the course (4.64, 4.67 and 4.62) the least effective in the learning of the three skills. The perceptions on the skills were indistinguishable from female and male or international and non-international students.

The means and standard deviations of the effectiveness in learning creativity, critical-thinking and problem-solving skills are in Table 3.

Finally, the students rated the functionality of INNOV8 as effective in navigation, replayability and usability as a system (5.58). Personalities (6.59) and scenarios (6.97) in the system were perceived to be realistic of industry reality. Male perception (5.66) of the functionality was higher than female perception (5.49). Perceptions of international students (5.73) were higher than non-international students (5.42). Students required limited support of the instructor (3.21) or of other students (3.38) to play INNOV8.

The means and standard deviations on the functionality of INNOV8 are in Tables 4 and 5, and on all item statements of the survey in Table 6.

The means and standard deviations indicating INNOV8 to be not as effective or not statistically significant relative to the discussion and project reports substantiated correlations and Wilcoxon rank sum test. The linear correlations between pairs of mean ratings of the course, book of the course, discussion reports, project proposal reports, and INNOV8 variables were generally not statistically different from zero correlation at the five percent significance level. There were high to moderate correlations at the 5% significance level between pairs of ratings of the project proposal reports and the discussion reports generated by female and non-international students with less than 6.36 hours monthly on gaming systems – no such correlation was found between pairs of INNOV8 and any other variable. Most of the correlations between pairs of male ratings of INNOV8 were weak and not statistically different from zero correlation at the 5% significance level, while the correlations of female ratings of INNOV8 were strong and statistically different from zero correlation at the 5% level. Finally, it was found with the Wilcoxon rank sum test that for each of the course, book, discussion report, project report and INNOV8 variables rated across gender, international or on-international, and prior gaming systems, the sets of pairs of the ratings of the students had medians that were statistically the same at the 5% level of significance.

Review of Reflections of Students

The reflections of a composite diversity of a sample of the students are below:

- "INNOV8 gave appearance of an actual business environment, not a game, giving creditability to the goal of learning … gives a good idea of what BPM is about … gives importance of different departments in

completing a process … interdependencies … interacting with problems requiring solutions … great application in introducing BPM";

- "easy to follow … encourages player to progress by trail and error … focused on learning … may repeat several times … multiple 'what if' scenarios …real life simulations … requires you to really think … structural and systematic … like a treasure hunt";
- "educating along with having fun … 'hands on' learning instead of listening to a lecture or reading a book … having fun and thinking is revolutionary in itself … more motivation to learn by playing INNOV8 … not passive or sitting in a room";
- "[furnishes] helpful hints and tips … helpful tutorials … keeps players interested and involved [in the playing] … not frustrated on the mechanics";
- "Innov8 is like games [such as] Counter Strike and The Mummy that are played everywhere";
- "more fun than learning … more playing than learning … needs to be combined with lecturing [in order to] learn BPM in depth … data in detail … not an extensive study of BPM … should have more terminology";
- "mouse is not controlling direction … navigation problems … not Microsoft standards";
- "[should be] option to customize processes … one process … opportunities to customize projects [in the system] … should be tougher";
- "should be multiple-player [system] so that students might [play] with other students in teams;" and
- "INNOV8 is in adolescence … I believe IBM might [develop] a more … comprehensive and dynamic version of INNOV8 … INNOV8 might help in [initiating] an instructional methodology which might be eventually more prevalent ..."

These reflections are consistent with the findings of the perception survey.

Summary of Survey and Reflections

The findings of the survey and the reflections indicate that the INNOV8 gaming system was effective in helping students to begin to learn BPM, especially in contrast to the book of the course. The system was not as effective as the presentation project proposal reports and the case discussion reports, which required interactivity and socializing of the students with the instructor and other students, and reflection and research of the students, throughout the semester. The system was also not as effective as the proposal reports in the learning of creativity, critical-thinking and problem-solving skills and not as effective as the discussion reports in the learning of critical-thinking and creativity skills. In essence, INNOV8 was found to be not statistically significant in the learning of BPM relative to the discussion and project reports. The functionality of INNOV8 was effectively navigable, realistic of industry reality, and usable as a single-player system, but lacked multiple-player team-playing. In short, findings indicate that INNOV8 is an effective but limited method of pedagogy in learning BPM strategy and technology.

6. IMPLICATIONS OF STUDY

"I have been introduced to a different world of computing… and a different environment … I feel like an anthropologist who has discovered a new civilization. [I am] still learning about the culture and practice of games, and it is a different world." (Waldo, 2008)

The findings from perceptions of the students in the study are indicating engagement and essentially favorable improvement in learning BPM in the independent playing of the BPM Simulator: INNOV8 gaming system. The students in the Seidenberg School finished the course and learned a flavor of multi-disciplined practices of business process strategy and information technology through the INNOV8 system. Helped by INNOV8, the instructor increased the integration of the system in *Global Information Systems Principles* and lectured in a limited manner on BPM. Literature indicates issues in insuring the focus of students in on-line learning if not in on-line game playing (Bos and Shami, 2006). The BPM Simulator: INNOV8 system focused the students and fundamentally met the learning objectives of the instructor.

Though the findings from the perceptions of the students are indicating higher improvement in learning BPM through the gaming system relative to the book in the course, they were not as high relative to the presentation project proposal reports and case discussion reports required by the instructor. The students learned more of the organizational practices of process strategy and technology in project and discussion report researching than in INNOV8 playing. They learned more problems and recent solutions of strategy and technology in multiple organizations in the project report researching than in playing INNOV8, inasmuch as INNOV8 focused on solutions in a single organization in a programmed static system (Brown and Thomas, 2008). INNOV8 is a limited method of pedagogy in a semester than the perpetual researching and seeking of information inherent in discussion and project reports throughout a semester. The mix of the reports and the Simulator ideally met the objectives of the instructor.

The learning of soft skills through the gaming system is found to be not as high in perception relative to the case discussion reports on creativity and critical-thinking and the presentation project proposal reports on creativity, critical-thinking and problem-solving. Though INNOV8 included personalities and scenarios realistic of industry reality, they learned the mix of professional skills more through the interactivity of presenting the project reports and the discussion reports to the instructor and the other students and refining the reports in response to inquiry. The interactivity of personalities of students led to learning of interdependencies of organizational scenarios that required creativity, critical-thinking and problem-solving soft skills of the students. The project and discussion reports in general were perceived to be more realistic requiring soft skills than the simulation of the system. These reports, as methods of pedagogy more than the Simulator, met the objectives of the instructor in preparing the information systems students to be modestly proficient in soft skills required by industry.

The findings further *indicate that BPM Simulator: INNOV8 might incorporate increased instructional design functionality*. The gaming in Simulator might be integrated more as an intervention into the book, discussion reports, and project reports of *Global Information Systems Principles*. The learning metrics of outcomes and playing standards might be matured more in Simulator, though pedagogical and playing standards on such systems might be elusive (Vernadakis, Zetou, Tsitskari, Giannousi and Kioumourtzoglou, 2008) if not non-existent (Mayo, 2007) in the extant field of virtual reality (Lamont, 2007). The findings of the survey indicate learning might be improved more in involvement (Chapman and Sorge, 1999) in Simulator if it matured into a multiple-player system, integrating the navigation and usability of the single player system that was perceived generally positively by the students. These findings indicate the criticality of firms in the gaming industry collaborating with educators, in order to improve the instructional design functionality of gaming systems (DeMarle, 2008, p.93).

Finally, *the findings of this study furnish an encouraging foundation for educators evaluating the effectiveness of the integration of gaming systems into curricula with other methods of pedagogy*. The integration of gaming systems requires the experience of instructors in interventions of learning (Leon, Przasnyski and Seal, 2008) and the flexibility of the instructors in learning the genres of gaming systems and the potential of the technologies as a method of pedagogy. The effectiveness of gaming systems and of the integration of the systems with other methods of pedagogy require further pedagogical research by instructors interested in the systems and in virtual reality. Those instructors interested in the systems might interface with firms in the gaming industry granting the technologies to universities, such as with Pace University, and initiate research of the technologies as an instructional tool. The effectiveness or non-effectiveness of gaming and virtual reality systems in the instruction of Net Generation and other students in schools of computer science and information systems might be learned by instructors only when they initiate the research on the learning styles of the students and on the technologies.

7. LIMITATIONS AND OPPORTUNITIES IN RESEARCH

Though exploratory the findings of a study from an essentially small sample size of posttest students in one course of one instructor of defined instructional methods of pedagogy, and on one gaming system of one topic of one university, cannot be generalized optimistically to other universities without reservation. BPM Simulator: INNOV8 is furnished by merely one of the technology firms marketing gaming systems, limiting projection of findings on INNOV8. The system is not a multiple-player but a single player system, precluding projection of findings to multiple-player systems.

The instructor of the course will continue to evaluate INNOV8 in courses of *Global Information Systems Principles*, and if feasible in other courses of other instructors, in Fall 2009 and Spring 2010 semesters, increasing the number of graduate if not undergraduate students to study. He will continue to evaluate forthcoming versions of INNOV8 in 2009 and 2010 and furnish input to IBM. However, the instructor will consider evolving gaming systems of other technology firms, focusing on multiple-player systems on virtual reality with student teaming. He will continue to pursue grant opportunities simultaneously. Lastly, the instructor will be surveying gamer students in the computer clubs of the Seidenberg School, and in the population of students of Pace University, in order to continue research of the learning styles of the new generation of students that might be integrated into the curricula of the school.

8. CONCLUSION

The study is beneficial for educators in findings of effectiveness in favorable improvement in the fundamental learning of business process management (BPM) through BPM Simulator: INNOV8 gaming as an individual method of pedagogy. Though improvement in learning through INNOV8 is found to be not as high in perception relative to presentation project proposal reports and case discussion reports requiring research, improvement is higher in perception relative to the book of the course and instructor lecturing. Improvement in learning of creativity, critical-thinking and problem-solving soft skills of the information systems students through INNOV8 is also found to be not as high in perceptions relative to the proposal and discussion reports, but higher in perception relative to book and lecturing. The study concurrently found that the features of the INNOV8 playing system might incorporate increased instructional design functionality and multiple-player system technology. The findings of this study are cautionary but encouraging for educators and instructional designers evaluating further integration of gaming-based interactive learning systems with other methods of pedagogy for all students.

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Appendix A: Design of BPM Simulator: INNOV8

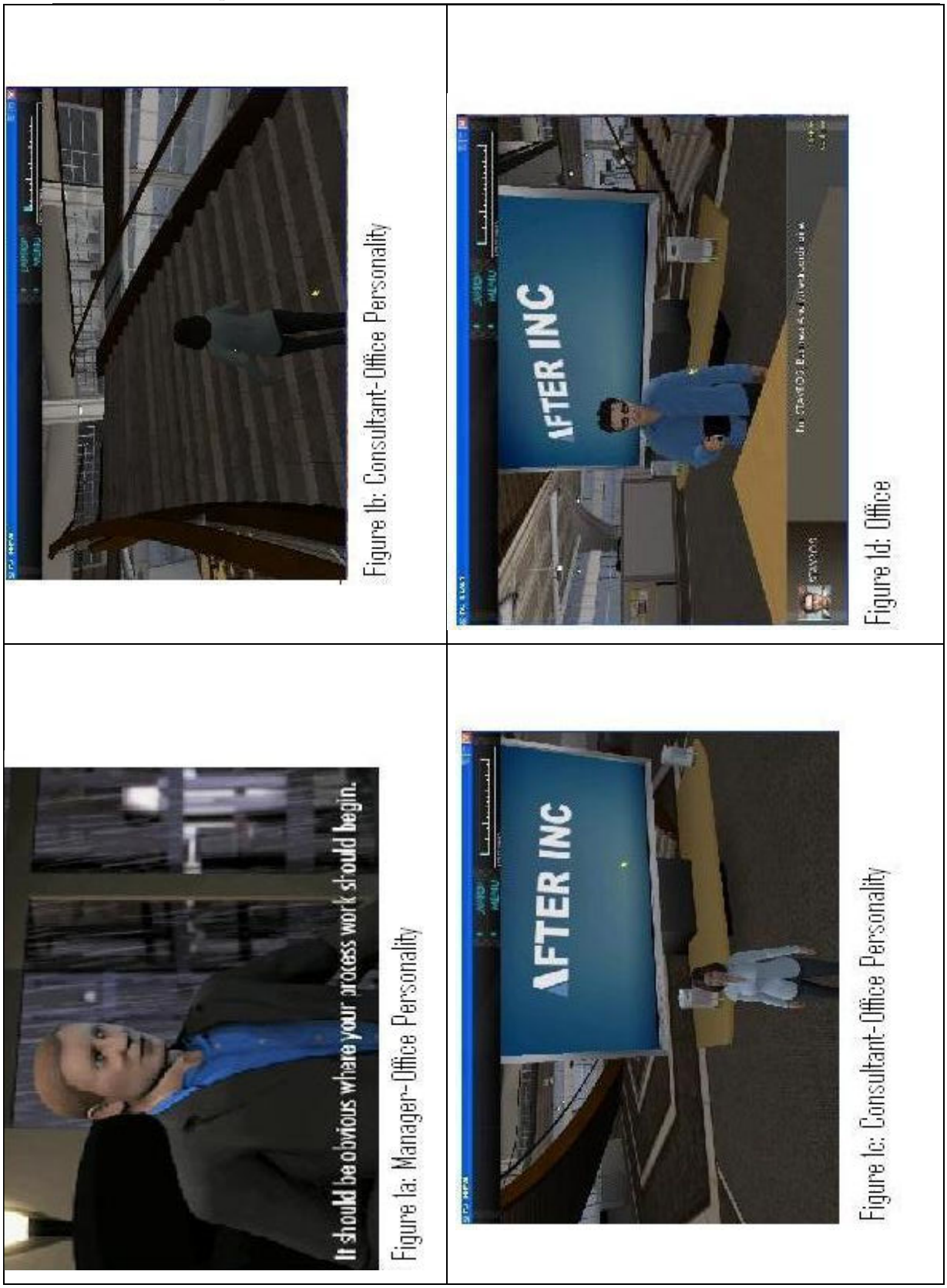

Figure 1a: Manager-Office Personality

Figure 1b: Consultant-Office Personality

Figure 1c: Consultant-Office Personality

Figure 1d: Office

Figure 1e: Office-Information Technology

Figure 1f: Office-Information Technology

Figure 1g: Office-Information Technology

Figure 1h: Planning Process

Figure Ii: Planning Process

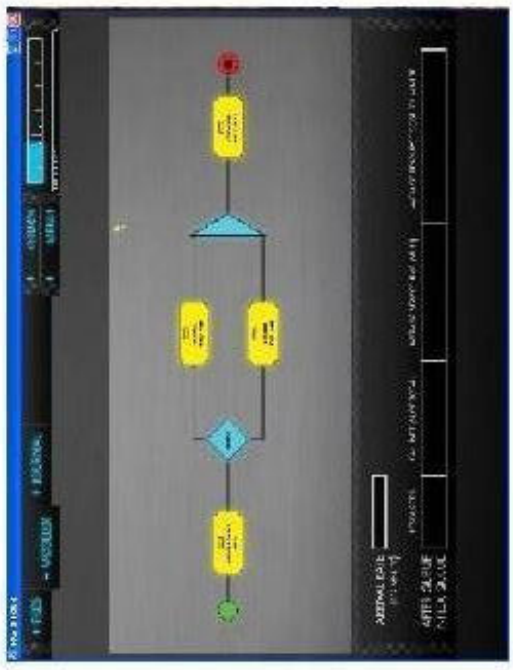

Figure Ij: Process

Appendix B: Findings of Perception Survey of Students

Table 1: Means and Standard Deviations of Survey – Effectiveness in Learning BPM Strategy and Technology (Summary)

All Students							
Book of Course		Discussion Reports		Project Reports		INNOV8 System	
Means	Standard Deviations	Means	Standard Deviations	Means	Standard Deviations	Means	Standard Deviations
4.98	1.37	6.58	1.37	6.98	1.40	5.93	1.32

Table 2: Means and Standard Deviations of Survey – Effectiveness in Learning BPM Strategy and Technology (Detail)

Female Students							
Book of Course		Discussion Reports		Project Reports		INNOV8 System	
Means	Standard Deviations	Means	Standard Deviations	Means	Standard Deviations	Means	Standard Deviations
5.14	0.99	6.56	1.07	7.03	0.95	5.94	1.40
Male Students							
Book of Course		Discussion Reports		Project Reports		INNOV8 System	
Means	Standard Deviations	Means	Standard Deviations	Means	Standard Deviations	Means	Standard Deviations
4.82	1.64	6.59	1.61	6.93	1.74	5.91	1.22
Non-International Students							
Book of Course		Discussion Reports		Project Reports		INNOV8 System	
Means	Standard Deviations	Means	Standard Deviations	Means	Standard Deviations	Means	Standard Deviations
4.76	1.65	6.63	1.62	6.93	1.77	5.81	1.34
International Students							
Book of Course		Discussion Reports		Project Reports		INNOV8 System	
Means	Standard Deviations	Means	Standard Deviations	Means	Standard Deviations	Means	Standard Deviations
5.18	0.98	6.53	1.07	7.03	0.94	6.04	1.28

Table 3: Means and Standard Deviations of Survey – Effectiveness in Learning BPM Creativity, Critical-Thinking and Problem-Solving Skills (Summary)

All Students								
	Book of Course		Discussion Reports		Project Reports		INNOV8 System	
Skills	Means	Standard Deviations	Means	Standard Deviations	Means	Standard Deviations	Means	Standard Deviations
Creativity	4.64	1.16	6.46	1.25	6.92	1.35	6.28	1.38
Critical-Thinking	4.67	1.11	6.79	1.20	6.72	1.30	6.28	1.23
Problem-Solving	4.62	1.41	6.49	1.34	6.69	1.49	6.54	1.12

Table 4: Means and Standard Deviations of Survey – Effectiveness of Functionality and Helpfulness of INNOV8 System (Summary)

All Students	
Means	Standard Deviations
5.58	1.34

Table 5: Means and Standard Deviations of Survey – Effectiveness of Functionality and Helpfulness of INNOV8 System (Detail)

All Students							
Female Students		Male Students		Non-International Students		International Students	
Means	Standard Deviations	Means	Standard Deviations	Means	Standard Deviations	Means	Standard Deviations
5.49	1.25	5.66	1.40	5.42	1.18	5.73	1.43

Table 6: Means and Standard Deviations of Survey – Item Statements (Detail)

	Means	Standard Deviations
II. Course		
6. The Course contributed to improved knowledge of the criticality of business strategy and technology.	6.90	0.99
7. The Course contributed to improved knowledge of the role of business strategy in the management of technolo-	7.03	0.90

gy.		
8. The Course contributed to improved knowledge of current issues in the management of business strategy and technology.	7.13	1.20
9. The Course contributed to improved creativity skills.	6.38	1.09
10. The Course contributed to improved critical-thinking skills.	6.85	1.06
11. The Course contributed to improved problem-solving skills.	6.59	1.37
III. Book of Course (Laudon and Laudon)		
12. The Book of the Course contributed to improved knowledge of the criticality of business strategy and technology.	5.64	1.22
13. The Book contributed to improved knowledge of the role of business strategy in the management of technology.	5.54	1.33
14. The Book contributed to improved knowledge of current issues in the management of business strategy and technology.	4.79	1.73
15. The Book contributed to the Course being engaging.	4.59	1.58
16. The Book contributed to improved creativity skills.	4.64	1.16
17. The Book contributed to improved critical-thinking skills.	4.67	1.11
18. The Book contributed to improved problem-solving skills.	4.62	1.41
19. The Book contributed to the Course being interesting.	5.00	1.28

20. The Book helped me learn Business Process Management (BPM) and business strategy.	5.00	1.52
21. The Book helped me retain information on BPM and business strategy.	4.95	1.54
22. The Book as a learning tool was helpful to me.	5.31	1.13
IV. Discussion Reports		
23. The Discussion Reports contributed to improved knowledge of the criticality of business strategy and technology.	6.67	1.11
24. The Discussion Reports contributed to improved knowledge of the role of business strategy in the management of technology.	6.51	1.14
25. The Discussion Reports contributed to improved knowledge of current issues in the management of business strategy and technology.	7.00	1.36
26. The Discussion Reports contributed to the Course being engaging.	6.64	1.22
27. The Discussion Reports contributed to improved creativity skills.28. The Discussion Reports contributed to improved critical-thinking skills.	6.46	1.25
28. The Discussion Reports contributed to improved creativity skills.	6.79	1.20
29. The Discussion Reports contributed to improved problem-solving skills.	6.49	1.34
30. The Discussion Reports contributed to the Course being interesting.	6.74	1.73
31. The Discussion Reports helped me learn Business	6.33	1.51

Process Management (BPM) and business strategy.		
32. The Discussion Reports helped me retain information on BPM and business strategy.	6.15	1.44
33. The Discussion Reports as a learning tool were helpful to me.	6.54	1.74
V. Presentation Project Proposal Report		
34. The Project contributed to improved knowledge of the criticality of business strategy and technology.	7.10	0.99
35. The Project contributed to improved knowledge of the role of business strategy in the management of technology.	7.00	1.50
36. The Project contributed to improved knowledge of current issues in the management of business strategy and technology.	7.23	1.25
37. The Project contributed to the Course being engaging.	7.38	1.27
38. The Project contributed to improved creativity skills.	6.92	1.35
39. The Project contributed to improved critical-thinking skills.	6.72	1.30
40. The Project contributed to improved problem-solving skills.	6.69	1.49
41. The Project contributed to the Course being interesting.	7.28	1.57
42. The Project helped me learn Business Process Management (BPM) and business strategy.	6.79	1.38
43. The Project helped me retain information on BPM and	6.56	1.74

business strategy.		
44. The Project as a learning tool was useful to me.	7.10	1.59
VI. Functionality of Game		
45. The assignment with the Game was clear (to me).	6.87	0.89
46. The Game was challenging.	5.87	0.77
47. The Game was engaging.	6.31	0.77
48. The Game was easy to navigate in Level 1.	5.90	0.94
49. The Game was easy to navigate in Level 2.	5.49	1.19
50. The Game was easy to navigate in Level 3.	5.10	1.19
51. The cues and the messages on the screens were helpful in navigating the Game.	6.00	1.40
52. The Game was easy to play overall.	5.87	0.89
53. The Game was interesting.	6.69	1.22
54. The personalities of the Game were generally realistic of industry reality.	6.59	1.31
55. The scenarios of the Game were generally realistic of industry reality.	6.97	1.22
56. The visual effects (e.g. thunder) of the Game resulted in a more interesting game.	5.97	1.58
57. The Game required the help of my colleague students.	3.38	2.10
58. The Game required the help of my team leader (following initial session).	3.44	2.34

59. The Game required the help of my professor.	3.21	2.34
VII. Fun and Learning		
60. The Game contributed to improved knowledge of the criticality of business strategy and technology.	6.36	0.81
61. The Game contributed to improved knowledge of the role of business strategy in the management of technology.	6.44	0.79
62. The Game contributed to improved knowledge of current issues in the management of business strategy and technology.	5.72	1.23
63. The Game contributed to the Course being engaging.	6.21	1.24
64. The Game contributed to the Course being interesting.	7.10	1.05
65. The Game helped me learn Business Process Management (BPM) and business strategy.	6.38	1.18
66. The Game helped me retain information on BPM and business strategy.	6.13	0.80
67. The Game was enjoyable.	6.77	1.72
68. The Game was fun.	6.38	1.18
69. The Game put me in a learning mood.	6.13	1.59
70. I learned more about BPM and business strategy.	6.41	1.07
71. I learned more about BPM and business strategy that might be applied to industry processes of any international organization.	6.36	1.29
72. I learned more about BPM and business strategy than	5.10	1.65

if the professor further lectured on BPM and strategy.		
73. I learned more about BPM and business strategy than if the professor required another Discussion Report on BPM and strategy.	4.33	1.78
74. The numbers and permutations required in Levels 2 and 3 of the Game helped me in learning more about BPM and business strategy.	5.92	1.46
75. The Game required me to be more creative about problem-solving industry process problems.	6.28	1.38
76. The Game required me to be more critically-thinking about problem-solving process problems.	6.28	1.23
77. The Game required me to more problem-solve solutions.	6.21	1.34
78. The Game permitted me sufficient time to problem-solve solutions.	6.54	1.12
79. The Game required me to think more about problem-solving solutions.	6.69	1.00
80. The Game as a learning tool was useful to me.	6.69	1.13
81. I would have liked to play the Game with other students in a team.	6.54	1.86
82. I would recommend the Game in its current or its enhanced format be continued in the forthcoming course of the next semester.	6.82	1.45
83. I would recommend the Course to other students because of the game in its current or its enhanced format.	6.18	1.80
84. I would not recommend Games in a BPM and Strategy Course.	2.13	1.69

85. I would not recommend any Games in any Course.	1.97	1.58

Note: Table 6 excludes Background Questions 1 – 6.

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