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Differences among Different DGBLs Learners

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Abstract

Digital Game-Based Learning (DGBL) not only offers ideal learning results but also encourages students to be proactive in their learning. In this research, DGBL and Means-end Chains have been chosen as the theoretical basis for the study. The study took a look at the discrepancies in value between students of different majors and competition participation experiences. Business and Management major students felt that *Virtual chips* could *Reduce pressure and accountability* and in addition to allowing them to gradually *Accumulate investment experience* and *Reduce the error rate*, it would give them more opportunities to *Practice for financial planning*. In contrast, students who major in Finance emphasized the consequences of *Practice for financial planning* from the attribute of *Diverse investment tools* for virtual trading and *Enhanced team learning* through *Team work*. With regards to competition experience, students with competition experience preferred to achieve the learning consequences of *Increased practical experience* and *Accumulated investment experience* through the *Digital learning function* and *Virtual platform* and they achieved the terminal value of *Sense of security* through *Reducing the error rate*. For students with no prior competition experience, they expected to gain opportunities for *Practice for financial planning* through virtual trading games with *Diverse investment tools* in order to pursue the terminal values of *Sense of achievement* and *Fun and enjoyment of life*.

Keywords: digital game-based learning, media in education, virtual trading, means-end chain theory

1. Introduction

In today's era of rapid technological advancement and knowledge explosion, PC use has emerged as a companion for the youths of generation G in their acquisition and development of day-to-day habits (Prensky, 2007). For students, a PC is not a serious tool of learning but rather a communication device and platform for entertainment (Wijekumar, Meyer, Wagoner, & Ferguson, 2006). The power of computers and the accessibility of information have exposed the potential of knowledge use and creation to the whole world (Sallis & Jones, 2002). Not only that, the Internet has also changed the educational environment; several teaching methodologies and materials are designed to achieve their objectives through the virtual learning environment of the Internet (Chou & Liu, 2005). The strengths of utilizing multimedia for the purpose of education lies in the rapid and effective delivery of information to all students in order to maintain their interest in the curriculum (Chen & Liu, 2008). The advancement of technology has led to the digitization of many courses and coupled with the fact that most students have their own PCs and access to the Internet; many studies have been undertaken to examine the application of Game-based Learning in PC learning technologies (Papastergiou, 2009; Robertson & Howells, 2008; Vos, van der Meijden, & Denessen, 2011). Digital gaming has not only become an important premise of recreation for children and adolescents (Hong, Cheng, Hwang, Lee, & Chang, 2009) but is also gradually becoming a part of life for teenagers and different student demographics (Fromme, 2003).

According to a report published by Global Entertainment and Media Market, the total worth of the global digital game market in 2012 came to approximately US$63.4 billion and that figure is expected to reach US$ 86.9 billion by 2017. The Asia-Pacific region contributed US$ 26.982 billion (as much as 43.28% of the total worth of the digital game market) in 2012 and is expected to reach US$ 39.739 billion to the market by 2016 (Price water house Coopers, 2013). In addition, Ambient Insight (2013) also pointed out that the net worth of global Game-based Learning and Simulation-based Learning markets in 2012 came to US$ 1.548 billion (US$ 1.029 billion from the Asia-Pacific region) and US$ 2.364 billion (US$ 374 million from the Asia-Pacific region) respectively. Both markets are expected to grow to US$ 2.31 billion (US$ 1.475 billion from the Asia-Pacific region) and US$ 6.649 billion (US$ 1.774 billion from the Asia-Pacific region), respectively, in 2017. These

statistics sufficiently reflect the significant role that the Asia-Pacific region plays in the global markets for digital games and game-based learning and that relevant development and application in the field of education that has been building at an incredible pace.

In order to determine the discrepancies in value between students of different majors and competition participation experiences seek from Digital Game-based Learning (DGBL), the research has chosen Means-end Chains (MECs) as its theoretical framework, which were designed to reveal the structure of students' "game attribute – learning consequence – terminal values" chain for virtual trading. Hopefully, the results of the study will serve as a useful reference for digital educational game developers for innovative product development.

2. Theoretical Framework

Games have become a tool that guides learning to help students be prepared for learning in a shorter amount of time (Hsiao, 2007). The use of games for the presentation of course content can trigger students' motivation to learn and inspire them to grow independently while gaming. A pleasant gaming environment is not only beneficial to students' development in the future but also allows them to achieve the terminal value of fun and enjoyment of life (Vos et al., 2011). In short, gaming is the maximized collection of entertainment, with both playing and participation being crucial elements for gaming (Adams, 2009). Games offer clearly defined elements including objectives, rules, conditions for competition, challenging environments, security and entertainment (Alessi & Trollip, 2001).

Prensky (2003) believes that compared to the regular curriculum offered by schools, teenage students devote more focus on playing digital games than on their school work. Schmidt and Cohen (2013) also predicted that in the next decade, the total number of the world's virtual population will exceed the actual global population. Despite the fact that current digital technologies cannot offer a faithful representation of the real world, it is nonetheless adequate enough to simulate real world scenarios with a certain degree of resemblance to reality. Through high interactivity, such simulations allow users to immerse themselves in a scenario/context that is somewhat similar to the real world. And through their participation in learning activities within a simulated scenario, learners will be able to gain experience as if they were in the real world (Dede, 2009).

3. Methodology

3.1 Research Process

In order to construct the structure of "game attributes – learning consequences – terminal values" for students playing virtual trading games and determine their correlations, the study has followed Reynolds and Gutman (1988) suggestions to use Laddering, Content Analysis, Implication Matrix and Hierarchical Value Map (in this order) as the research process.

Firstly, for the purpose of this research, a number of open-ended questions were posed to the learners to gather their responses and through guidance by the interviewer, learners were able to freely describe their own experience with virtual trading until the learner uttered, "That's about it", "I don't know" or was unable to reply further, at which point the interview for that chain path would conclude. After the data had been collected, it was processed through the quantification technique of Content Analysis (Franzosi, 2008). Content Analysis allows for the systematic and objective categorization of trivial and complex interview data for the extraction of important information during the process of simplifying the data contents (Kassarjian, 1977). Content Analysis emphasizes the consistency between category definition and units of analysis, and this means that different researchers will be able to categorize contents to similar category definitions and units of analysis, thereby rendering the outcomes consistent (Neuendorf, 2001).

After the data had been organized and sorted, the study used an Implication Matrix to record the chain correlations between different elements in quantifiable methods in order to summarize the tiers of various values constructed by the respondents (Reynolds & Gutman, 1988). The figures of the Implication Matrix represented the number of chains between elements (i.e. A-C, C-C, C-V); the higher the number, the stronger the chain. For the next step, the Implication Matrix was converted to a Hierarchical Value Map (HVM). HVM offers a comprehensive picture of the chain relationships of elements for virtual trading identified and constructed by learners, and adequately explains the perceived structure of "attribute–consequence–value" (Reynolds & Gutman, 1988). For a fair comparison for groups with slightly different sample sizes, "top-down cut-off" has been chosen as the method of calculation for the cut off value in the study (Leppard, Russell, & Cox, 2004). With top-2 as the baseline for the illustration of the HVM, the HVM would be able to faithfully represent the varying number of ladders and identify the different benefits for groups of different sample sizes.

3.2 Sample and Data Collection

The study has adopted the approach of Purposive Sampling to select 50 users of virtual trading game platforms currently enrolled at different universities in Taiwan for in-depth interviews. Consent of the respondents was obtained prior to the interviews, which were recorded in full with voice recorder and hand written notes. Since Reynolds and Gutman (1988) also noted that creating a relaxing and friendly atmosphere would help respondents to better express their ultimate desires at deep psychological levels, the study has also taken steps to prevent respondents from being unable to clearly express their thoughts due to anxiety or stress by choosing classrooms that respondents were familiar with or coffee shops that respondents would feel more relaxed in. Among the 50 respondents, 16 were male (32%) and the remaining 34 were female (68%); 35 of them major in Business and Management (70%) and the remaining 15 major in Finance (30%). On a related note, 23 (46%) of the respondents had previous experience in virtual trading competitions and the other 27 (54%) had no prior experience.

3.3 Data Reliability and Credibility

In order to process trivial and complex interview data to systematically and objectively categorize specific phrases for quantifiable calculations, the study has carried out multiple training sessions for coders to interpret abstract semantics prior to data analysis in order to increase their coding experience and improve their inter-subjectivity while coding. All data collected for the purposes of this study was analyzed by five coders, who engaged in several discussions during the process of analysis to achieve consensus by adopting the principles of accuracy, exhaustively and exclusion for coding and analysis. The study identified a total of 33 variables. In addition, the 50 respondents constructed a total of 126 value ladders (on average 2.52 per respondent) and 362 chains (on average 7.24 per respondent) (as shown in Table 1).

Table 1. Attributes, consequences and values of virtual trading

	No. of ladders		No. of chains	
	Frequency	Mean	Frequency	Mean
Overall	126	2.52	362	7.24
Grouping based on majors				
Business and Management	87	2.49	249	7.11
Finance	39	2.6	113	7.53
Grouping based on prior competition experience				
Has Competition Experience	52	2.26	151	6.57
Has no Competition Experience	74	2.74	211	7.81

Holsti (1969) proposed that Intercoder Reliability could effectively assess the semantic reliability derived from content analysis. For this study, four researchers have been enlisted to inspect the data independently, free from the influence of one another. Russo, Donnelly, and Reid (2006) indicated that when intercoder reliability is at 0.80 or higher, it reflects a high degree of reliability. In this research, the average inter-rater agreement came to 0.803 with reliability at 0.942. These figures suggest the results of coding categorization to be highly reliable.

4. Results

4.1 Grouping Based on Majors

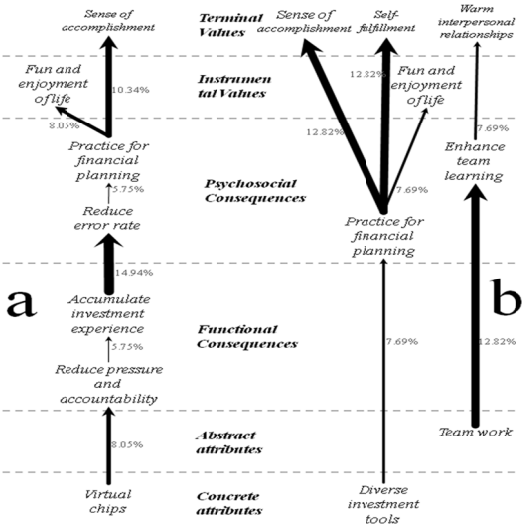

Fig. 1. a: HVM for Business and Management (n=35);
b: HVM for Financial (n=15) (Cut-off level = Top-2)

In the comparison of respondents based on their majors, the study has found significant discrepancies for the two groups (as shown in Figure 1). The study found that students who major in Business and Management were less skilled in making financial investments. And as such, they would require multiple learning consequences in order to achieve effective learning. Using ***Virtual chips*** to ***Reduce pressure and accountability*** enables students to ***Accumulate investment experience*** without having to carry any financial burdens and responsibilities. And with growing experience in investments, students will be able to ***Reduce the error rate*** for their investments and begin attempting ***Practice for financial planning***. Consequently, sound financial planning would bring the values of ***Sense of achievement*** and ***Fun and enjoyment of life*** to students (as shown in Figure 1. a). Wishart (2004) once suggested that it would be ideal to incorporate components of adversity that would train students' independent behavior in the design of education curricula. And as such, the study suggest teachers to incorporate negative investment scenarios whenever appropriate in their instructions rather than focusing solely on having students to perform well in smooth-going environments. This would not only improve students' problem solving abilities but also help them to ***Accumulate investment experience***.

Since students who major in Finance already have specific background knowledge in finance, they are more capable of achieving their investment objectives in virtual trading. Finance major students emphasize more on the attributes of ***Team work*** and ***Diverse investment tools***. Through ***Team work***, students were not only able to ***Enhance team learning*** from the exchanges of opinions but also achieve outstanding investment performance in virtual trading. Not only that, finance major students could also arrive at the terminal value of ***Warm interpersonal relationships*** from a pleasant learning atmosphere. As finance students are familiar with various investment tools, they were able to quickly ***Practice for financial planning*** and relevant knowledge through their selection from ***Diverse investment tools***. From the consequence of acquiring financial planning related knowledge, the students were able to pursue terminal values of ***Sense of achievement***, ***Self-actualization*** and ***Fun and enjoyment of life*** (as shown in Figure 1b). According to Mentz, van der Walt and Goosen (2008), cooperative learning emphasizes aspects of mutual cooperation and resource sharing within a team and allows individuals and the team to achieve their objective of joint learning through the sharing of responsibilities. Cooperative learning not only differs from traditional approaches of individual learning but also has become a very popular teaching strategy (Johnson & Holubec, 2008; Rink, 2006). And as such, the study suggests teachers to use different investment tools as learning objectives and adopt the approach of ***Team work*** to achieve cooperative learning. This should allow students to ***Practice for financial planning*** and benefit from the consequence of ***Enhanced team learning*** in the midst of a learning atmosphere that emphasizes mutual assistance and sharing.

4.2 Grouping Based on Prior Competition Experience

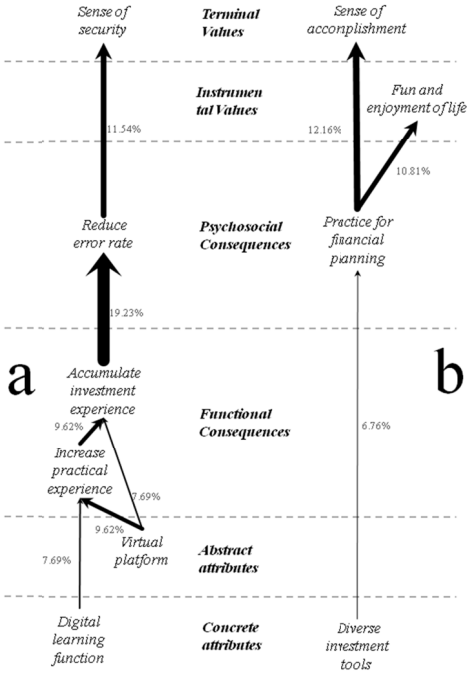

Fig. 2. a: HVM for Has Competition Experience (n=23);
b: HVM for Has no Competition Experience (n=27) (Cut-off level = Top-2)

The study has taken one step further to divide the respondents into two groups based on their previous competition experience (or lack thereof). The findings show that students with prior competition experience demonstrated better learning consequences from virtual trading while students with no competition experience stayed at the practice stage (as shown in Fig. 2).

Students with competition experience emphasized more on the attributes of ***Digital learning function*** and ***Virtual platform***. ***Digital learning function*** enables students to learn about virtual trading through internet access and the construction of ***Virtual platform*** makes it possible to engage in financial trading in a simulated environment. The two attributes not only allow students to ***Increase practical experience*** and ***Accumulate investment experience*** but also ***Reduce error rate*** through investment, and in turn arrives at the terminal value of ***Sense of security*** (as shown in Fig. 2.a). Students with competition experience were more likely to integrate theory and practice under the stress of competitions. Leveson (2004) pointed out that students will benefit more when they are able to construct meanings they can comprehend on their own. And thus, the study suggests teachers to opt for approaches that focus on guided learning in order to steer students to think in the right direction. When students are able to construct approaches to learning on their own and benefit from the consequences of ***Increased practical experience*** and ***Accumulated investment experience*** through their participation in competitions, it would no doubt bring positive learning results for them.

For students with no competition experience, they focused more on the attribute of ***Diverse investment tools*** in virtual trading. The study found that students without competition experience demonstrated relatively weaker motivation for learning. Consequently, they have devoted more time to passively engage in their discovery of investment tools. These students believed that the benefits of ***Diverse investment tools*** are not limited to the enrichment of their investment practice; it can also deliver the consequence of ***Practice for financial planning*** and thereby leading them to the terminal values of ***Sense of achievement*** and ***Fun and enjoyment of life*** (as shown in Figure 2. b). Past research proposed that online competitions could lead to multi-faceted development for students, including the enhancement of their confidence, intrinsic and extrinsic motivation for learning (Ozturk & Debelak, 2008). Therefore, the study recommends teachers to encourage their students to take part in competitions so that they could benefit from better learning results through the event. In addition, teachers should not expect their students to achieve outstanding performance in the competition but rather focus on

helping students to cultivate the right attitude towards taking part in competitions – as long as students do not experience negative feelings for not winning a competition, competitions are always positive and meaningful for learning (Van Eck, 2006).

5. Conclusions and Implications

5.1 Conclusions

The study compares the respondents in different groups (separated based on their majors and their competition experience) and found that students of different majors/with or without competition experience had significant discrepancies in the game attributes and learning consequences they emphasized. Business and Management major students felt that ***Virtual chips*** could ***Reduce pressure and accountability*** and in addition to allowing them to gradually ***Accumulate investment experience*** and ***Reduce the error rate***, it would give them more opportunities to ***Practice for financial planning***. In contrast, students who major in Finance emphasized the consequences of ***Practice for financial planning*** from the attribute of ***Diverse investment tools*** for virtual trading and ***Enhanced team learning*** through ***Team work***. With regards to competition experience, students with competition experience preferred to achieve the learning consequences of ***Increased practical experience*** and ***Accumulated investment experience*** through the ***Digital learning function*** and ***Virtual platform*** and they achieved the terminal value of ***Sense of security*** through ***Reducing the error rate***. For students with no prior competition experience, they expected to gain opportunities for ***Practice for financial planning*** through virtual trading games with ***Diverse investment tools*** in order to pursue the terminal values of ***Sense of achievement*** and ***Fun and enjoyment of life***.

5.2 Managerial Implications

In order to enable students to gain more effective learning consequences through virtual trading games and increase their frequency of game participation, this study has taken the perspective of students as users to offer a number of suggestions to game developers to perform relevant improvements on their titles based on students' needs and wishes for specific learning consequences.

Results of the study revealed that the attribute of ***Team work*** could bring the consequence of ***Enhanced team learning*** for students. Relevant studies also indicated that commercial simulation software could facilitate emotional exchange and encourage diverse thinking as learning consequences for users if the software features a ***Team work*** playing style (Lin & Tu, 2012). Therefore, game developers could design their game to include multiplayer cooperation mode as an improvement over the existing model involving individual decision-making. Alternatively, game developers could also incorporate cross-functional team collaboration in the game by introducing elements of risk assessment, investment returns, investment portfolios of various investment tools, to create a common goal that students could cooperate to achieve. And through the process of adequate communication and coordination, students could benefit from the consequence of ***Enhanced team learning***.

Sung (2009) maintained that by appropriately integrating course contents and digital game design, it would not only enable learners to further increase their motivation, but also increase the learning results. In the research, we have learned that various investment information in virtual trading could ***Mirror the reality***. Nonetheless, students are still lacking in experience when faced with financial crises and special events (i.e. Finance crisis of 2007-08, natural disasters). Therefore, the study recommends game developers to design all global financial crises that occurred in the past or incorporate unexpected events in virtual trading games so that students could learn to take appropriate steps and thereby ***Increase practical experience***.

In addition, Marty and Carron (2011) also believes that in a DGBL environment, learners are more likely to be involved in the learning scenario. Yang (2012) made a similar point by stating that the introduction of DGBL could noticeably improve learners' problem-solving capabilities. And as such, the study suggests game developers to feature the attribute of a ***Digital learning function*** for virtual trading games as the main strategy for marketing and promotion by emphasizing that virtual trading could help students to ***Increase practical experience*** and ***Accumulate investment experience***. Not only that, game developers should also focus on students and novice investors as their primary clientele so that the learning consequence of ***Reduced error rate*** could enable players of virtual trading games to arrive at the terminal value of ***Sense of security***.

5.3 Pedagogical Implications

For students of different majors and competition experiences, apart from their distinctively different emphasis on game attributes, they also wanted different learning consequences and terminal values. However, it is important to bear in mind there is no one teaching strategy and principles that will work for all groups of students. Therefore, teachers should strive to adopt different teaching principles for different student demographics and

emphasize on different points of education for students of different groups.

Since management related education emphasizes training students to cultivate their abilities for problem identification, problem analysis, problem solving and leadership (Lin & Lin, 2014), the study therefore suggests teachers to make use of virtual trading games in order to take advantage of the fact that the use of ***Virtual chips*** could ***Reduce pressure and accountability*** to incorporate guidance for problem-solving in their instruction. This would enable Business and Management students to ***Accumulate investment experience*** in various investment conditions and challenges and reduce their error rate for different investments. While virtual trading with ***Diverse investment tools*** could help Finance students to ***Practice for financial planning***, diverse investment tools could also generate too high an information load for students. According to Salen and Zimmerman (2004), students are likely to give up learning when faced with the frustration of failure or overwhelming cognitive load. However, students would be able to acquire more knowledge and reduce their burden from given tasks and information if they were able to receive sufficient support and instruction in the game. And as such, the study suggests that teachers should take the time to cover various investment tools in detail rather than subjecting their students to too much information in a limited amount of time. In addition, teachers could also make more use of ***Team work*** to facilitate the delivery of knowledge and thereby ***Enhance team learning.*** This will in turn alleviate the strain on students to devote their personal effort to overcome difficulties with investment.

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