Journal of Information Technology Education: Research **Volume 15, 2016**

Cite as: Lee, H-M., Long, J., & Visinescu, L. L. (2016). The relationship between a business simulator, constructivist practices, and motivation toward developing business intelligence skills. *Journal of Information Technology Education: Research, 15,* 593-609. Retrieved from http://www.informingscience.org/Publications/3602

The Relationship between a Business Simulator, Constructivist Practices, and Motivation toward Developing Business Intelligence Skills

Hsun-Ming Lee, Ju Long, and Lucian L. Visinescu
Texas State University, San Marcos, Texas, USA

samlee@txstate.edu; julong@txstate.edu; llv19@txstate.edu

Abstract

Developing Business Intelligence (BI) has been a top priority for enterprise executives in recent years. To meet these demands, universities need to prepare students to work with BI in enterprise settings. In this study, we considered a business simulator that offers students opportunities to apply BI and make top-management decisions in a system used by real-world professionals. The simulation-based instruction can be effective only if students are not discouraged by the difficulty of using the BI computer system and comprehending the complex BI subjects. Constructivist practices embedded in the business simulation are investigated to understand their potentials for helping the students to overcome the perceived difficulty. Consequently, it would enable instructors to more efficiently use the simulator by providing insights on its pedagogical practices. Our findings showed that the constructivist practices such as collaboration and subject integration positively influence active learning and meaningful learning respectively. In turn, both active learning and meaningful learning positively influence business intelligence motivational behavior. These findings can be further used to develop a robust learning environment in BI classes.

Keywords: motivation, constructivist, simulation, active learning, collaboration, business intelligence

Introduction

Business intelligence (BI) systems in enterprise computing environments combine operational data with analytical tools to present complex and competitive information to planners and decision makers (Negash, 2004; Zeng, Li, & Duan, 2012). BI applications have been dominating the technology priority list of CIOs worldwide (Yeoh & Koronios, 2010); consequently, universities should teach a broader range of business intelligence skills in BI classes and programs (Chiang, Goes, & Stohr, 2012). To succeed, schools need to integrate the concept of "learning by doing" in the BI curriculum through hands-on projects, internships, and industry-guided practicum (H. Chen, Chiang, & Storey, 2012).

To comprehensively learn BI, students need to take decision-making roles in complex information processing, which involves (a) source systems (such as Enterprise Resource Planning (ERP) systems and Web data) that provide data to the decision support data repository and (b) tools and applications employed for data access and analysis by a variety of users (Watson 2009). To develop the BI skills by

Editor: Athanassios Jimoyiannis
Submitted: May 23, 2016; Revised: August 3, October 25, 2016; Accepted: November 8, 2016

doing, students must use computers to perform sequences of coordinated tasks in a complex business context. Therefore, the students' perceptions of task difficulty, due to the learning of complex BI, can negatively affect their interest when engaging in the learning activities (Eccles & Wigfield, 1995; Freeze & Schmidt, 2015; Li, Lee, & Solomon, 2007).

Research findings suggested that constructivist-based teaching is effective to promote, sustain, and increase student motivation in learning (Garcia & Pacheco, 2013; Milner, Templin, & Czerniak, 2011). Moreover, many constructivist teaching approaches have adopted computer simulations, offering a real-world context in constructivist discovery processes, to facilitate students' active engagement (Dalgarno, 2001; González-Torre, Adenso-Diaz, & Moreno, 2015; Jimoyiannis & Komis, 2001). Constructivism states that knowledge is a function of how we create meaning from our experiences; therefore, each of us conceives of external reality based upon our unique set of experiences with the world and how we process them (Jonassen, Davidson, Collins, Campbell, & Haag, 1995). Although constructivist instruction is well-known for its advantages of increasing student motivation, there is a lack of understanding about how constructivist practices influence students' engagement and motivation in a computer-simulated environment.

This study aims to explore the importance of simulation-based constructivist practices, which have a lot of potentials to motivate students in challenging learning experiences empowered by the use of authentic real-world contexts and professional information systems in schools. In particular, we employ a computer-based business simulation to engage students in developing their BI skills. Eccles and Wingfield's expectancy-value model of motivation (Eccles & Wingfield 2002; Wigfield & Eccles, 2000) provides us a useful framework for evaluating the constructivist practices implemented in the simulation. The measures of motivation used in the model are considered to be the most immediate and direct predictors of achievement performance (Wigfield & Cambria, 2010). Based on the model, this research examines students' perceptions of BI simulation instruction and investigates impacts of the instructional practices used in the business simulation. The knowledge derived from this research enables instructors to allow for more positive learning experiences that foster skill development in BI. Furthermore, from the results of this study, researchers can gain more insights on constructivist practices through a systematic view, when searching for more effective instruction methods based on computer simulation.

Theoretical Background

Expectancy-Value Theory of Motivation

According to the expectancy–value theory of motivation (Wigfield & Eccles, 2000), individuals' choices and performances can be explained by their beliefs about how well they will do on an activity (expectancy) and the extent to which they value the activity (value). To further identify distinguishable factors, the theory specifies several subcomponents of value beliefs, including (a) intrinsic interest value: the inherent enjoyment or pleasure one gets from engaging in an activity, (b) attainment value: the importance of doing well on a task, and (c) extrinsic utility value: the usefulness of the task for achieving future goals (Eccles & Wigfield, 1995).

Recent studies showed that many curriculum designs applied the expectancy–value theory to measure how learners responded to pedagogical structure, and therefore the curricula were able to ensure a motivating climate for learning. These studies typically used a questionnaire developed to assess components of the expectancy–value theory. For example, in a Systems Dynamics course taught at Washington State University, an assessment tool based on the theory is used to guide the creation and modification of a project-based learning method (Panchal, Adesope, & Malak, 2012). At a major university in the mid-Atlantic United States, Altstaedter and Jones (2009) adopted Web-based inquiry tasks to incorporate the study of culture into a foreign language class. Consequently, they validated the tasks as a viable means showing that students reported statistically higher expectancy and values in the foreign language and its culture.

The theory is powerful and popular since its constructs can be linked to students' learning outcomes. In the study of Altstaedter and Jones (2009) discussed earlier, students reported their reading, writing, vocabulary, and grammar in the foreign language had improved after participating in the inquiry learning. Studying students' persistence within an engineering program at a large public university, Jones, Paretti, Hein, and Knott (2010) indicated that the theory's constructs were helpful to predict achievements and career choices pertaining to engineering as well.

Constructivist Practices

Constructivism, originating from Piaget's theory of intelligence (1963), explains learning as a psychological process that people actively and subjectively construct knowledge via interaction with their environment (Fosnot & Perry, 2005). Piaget describes intellectual development as progress through six successive stages, starting from the use of reflexes and reaching the stages of discovery by active experimentation and invention through mental combinations. Since Piaget's ground-breaking study, the growth and popularity of constructivism has benefitted from an avalanche of literature contributions that support and expand Piaget's theory, including those from discourses of cognitive constructivism and social constructivism (K. C. Powell & Kalina, 2009). In cognitive constructivism, ideas are constructed individually through a personal process. On the other hand, social constructivism emphasizes that social interactions and cultural influences are also integral elements of the process through which the learner constructs ideas.

The social constructivist theory recognizes motivation as a key element of classroom culture and emphasizes that instructors need to assist learning by looking at how the environment shapes and transmits what students think, feel, and intend to act (Sivan, 1986). For this reason, many constructivist practices, including active learning, collaboration, subject integration, and authentic (meaningful) learning, have been consistently promoted for the improvement and innovation of learning environments (Karagiorgi & Symeou, 2005; Léger et al., 2011; Tatli & Ayas, 2013; Vekiri, 2013).

Previous studies indicated that constructivist practices in a simulation game were valuable to foster student learning. For instance, Siddiqui, Khan, and Akhtar (2008) provided active learning using a "supply chain simulator" to emulate an international supply chain network. They pointed out that simulation was useful for students to practice critical thinking and decision making skills. Darban, Kwak, Deng, Srite, and Lee (2016) utilized a simple ERP simulation game in an introductory-level Information Systems course and showed that team collaboration effectiveness had positive impacts on students' effort and intention to learn. Annavarjula, Folami, Ramirez, and Zdravkovic (2014) adopted a multinational business management simulation with an emphasis on subject integration in an International Business curriculum. As a result, they found that simulation helped students became more confident about their understanding of various subject areas. G D Chen et al. (2013) created a "Digital Learning Playground" as an authentic learning environment, which helped students focus on the learning content and increased students' willingness to participate in class activities.

Literature Review and Research Model

Using Business simulation games (simulator) offers innovative instruction by engaging students in a simulation of the real world and immersing them in an authentic management situation (Ben-Zvi, 2010). Many universities have used business simulation in their programs to teach topics such as decision support systems, inventory management, and project management (Ben-Zvi, 2007; Hartman, Watts, & Treleven, 2013; Meyer & Bishop, 2011). A business simulator for BI, such as the ERPSim-BI game developed by Léger (2006) and his colleagues (Babin, Leger, Robert, & Bourdeau, 2011) at HEC Montréal, allows students to learn integrated business processes used by professionals and to understand the effect of decision-making in the real enterprise context (Cronan, Douglas, Alnuiami, & Schmidt, 2011). In addition, it can provide BI tools, such as prebuilt Excel pivot tables, with real-time business data to support strategies and decisions in a simulated market place. This computer environment technically applies constructive practices to support the learning of modern BI, which facilitates strategic decision making and business problem solving using information technologies.

Past studies have reported lists of skills that students need to develop in the BI classes at the college level (Wixom et al., 2011, Wixom et al., 2014). The reports emphasized that, in addition to becoming familiar with a wide range of topics, all undergraduate and graduate students majoring in business should obtain skills and knowledge about recognizing opportunities, diagnosing problems, and finding solutions in order to be effective in the modern business empowered by BI technologies. Communication and real-world business experiences are other important skills for students to be able to apply BI successfully.

Using business simulation, we expected that positive learning experiences in developing BI skills would influence students' motivation toward BI. More specifically, the students would generate value and expectancy beliefs about BI when perceiving positive support (constructive practices) in mastery of essential BI skills, such as those of discovering solutions of their encountered problems and understanding real world business. We posited our hypotheses in active learning, collaboration, subject integration, and meaningful learning as factors to influence motivational beliefs. The hypotheses that tested students' motivational beliefs regarding BI after simulation are shown in Figure 1.

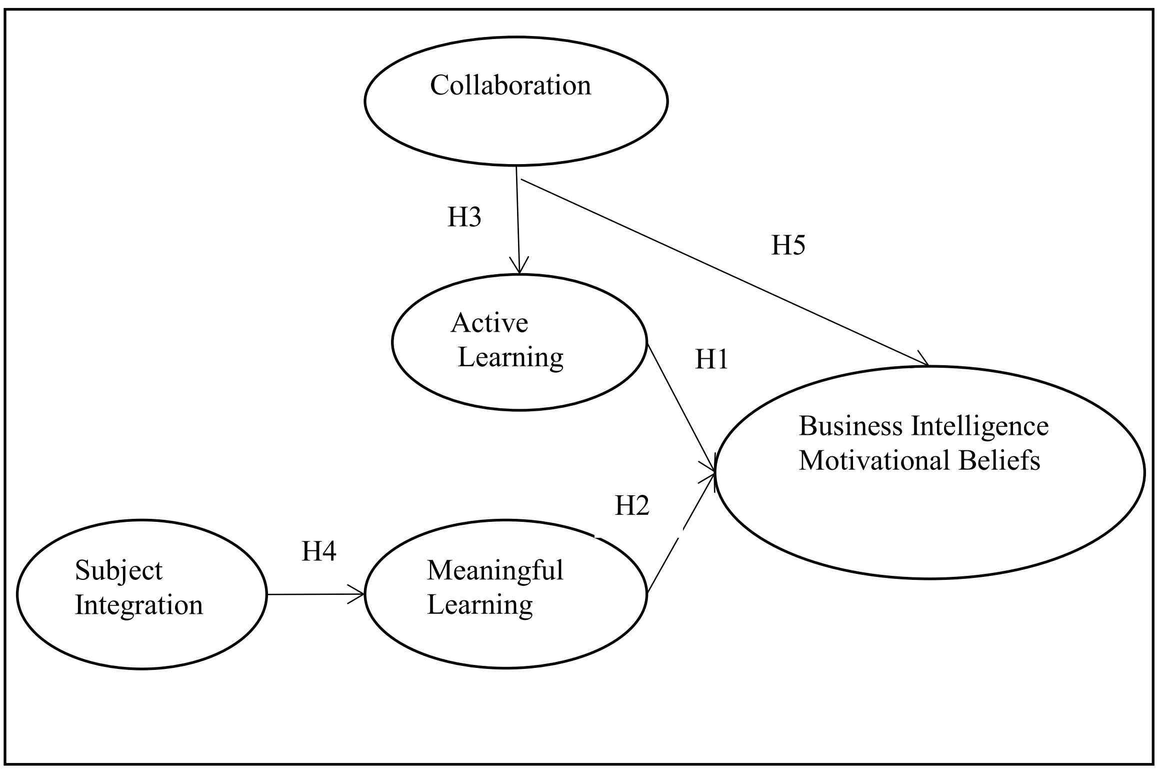


Figure 1: Theoretical Model

Active learning promotes instructional strategies that engage students in the learning process through the use of several powerful pedagogical approaches, with a focus on inquiry-based learning (Prince, 2004). Past research suggested that engaged learners coordinate their knowledge within their group in order to achieve their goals and intentions (Wigfield & Guthrie, 2000). The findings in previous studies indicated that inquiry-based instruction could effectively generate students' interest in science classes (Palmer, 2009) and increase their competency beliefs in science (Patrick, Manizicopoulos, & Samarapungavan, 2009). Therefore, we propose that:

H1: Active learning influences BI motivational beliefs.

Meaningful learning, also referred as authentic learning, exposes learners to a variety of real problems and provides authentic contexts that reflect the way how the knowledge is useful in real world situations (Herrington & Oliver, 2000). Research proposes that real problems may have a motivational effect because the learner is interested in finding out the result of the problem (Grabinger & Dunlap, 1995). Past study found that a learning platform supporting authentic learning experiences helped students focus on the learning content and increased their willingness to participate in class activities (G. D. Chen et al., 2013). Student outcomes from the use of an authentic learning program indicated positive increases in students' attitudes toward statistics and research (Thompson, 2009). Therefore, we propose that:

H2: Meaningful learning influences BI motivational beliefs.

Past research showed that professors have used different techniques to generate collaboration between students that would result in active learning. For instance, in the U.K. video-stimulated reflective dialogs were used to illustrate active learning (E. Powell, 2005). Moreover, in a classroom using an interactive whiteboard, collaboration supported by teachers was an important factor to promote active learning of science (Warwick, Mercer, Kershner, & Staarman, 2010). "Finally, learning is expected to benefit from collaboration among learners." (Van Berkel & Dolmans, 2006). Therefore, we suggest that:

H3: Collaboration positively influences active learning.

Meaningful learning depends on the relevant knowledge structure that integrates existing and new concepts (Novak, 2002). To achieve meaningful learning, students need to draw on multiple sources and perspectives as they analyze their solution to a problem (Herrington & Kervin, 2007; Leppisaari, Herrington, Vainio, & Im, 2013). In a study that integrates academic and vocational subject matter, it showed that students' knowledge expanded to other study disciplines because of the integrated knowledge they received (Conroy & Walker, 2000). In addition, it is often said that an integrated curriculum benefits the student to gain an eloquent understanding of reality (Drake, 1998). Therefore, we suggest that:

H4: Subject integration positively influences meaningful learning.

The ubiquity of computer use has advanced the popularity of collaborative learning, resulting in a large number of related studies in multiple fields: psychology, sociology, education, and technology (Keser, Uzunboylu, & Ozdamli, 2011). Serrano-Cámara, Paredes-Velasco, Alcove, and Velazquez-Iturbide (2014) viewed collaboration as a set of processes that help people interact to accomplish a specific goal. Their study suggested that collaborative learning supported by guided pedagogical methods increases student motivation for learning computer science subjects. Similarly, Saleh and his colleagues (2007) suggested that structuring collaboration in mixed-ability groups have a direct impact on motivation. Therefore, we suggest that:

H5: Collaboration positively influences BI motivational beliefs.

Methodology

An ERPSim-BI simulation game (Dairy Logistics Game) was used for our study. To effectively teach ERPSim-BI, two instructors attended workshops hosted by the ERPSim Lab at HEC Montréal. A learning module was delivered based on the "learning-by-doing" approaches for approximately four weeks of classes (three hours per week). This game was played in a lab environment where SAP clients were installed in personal computers connecting to both a SAP server and a Microsoft SQL Server database hosted by a SAP University Competence Center. The students met and played the game in a lab environment.

Using this simulator, instructors acted as coaches to provide directions and answer questions for most parts of class time. The student teams managed up to six dairy products analyzing sales data to determine customers' preferences in three regions of a market place. The simulator ran on a server generating customer sales, consuming inventory items, and updating general ledger balances based on a market model for all of the teams. The students needed to decide on inventory replenishment cycles (number of days), as well as ordering appropriate amounts of products, and transporting them from a central warehouse to regional warehouses using the SAP systems. The winner in the class was the team able to make the most profits according to the same business setting in the simulator.

The students also used Excel pivot tables to access the Microsoft SQL database, which archived the daily sales, inventory, and pricing data for each team. The Excel tools supported the students in visualizing a complete picture of business operations and in making decisions for increasing company profits. To assist with student learning, the ERPSim Lab provided an exercise for demonstrating how to build a dashboard for low inventories alerts and an online video for step-by-step guidance.

The Learning Module

The students played 5 rounds of the simulation game during four weeks of classes (12 hours in total). Student teams meet before and after each round of the game in the classes. The playtime for each round was around 30 minutes. We describe the learning module as follows.

- The instructors briefly introduced ERP (procurement & sales processes) and BI.
- The students went through tutorials and played rounds 1 and 2 to get familiar with the navigation of SAP system and reading of tabulated reports in SAP. After the first two rounds, different business data, such as daily sales orders, were generated by the simulators according to the business decisions such as pricing made by individual teams.
- The students built and used BI tools for round 3, 4, and 5. To get students ready to work for these rounds, the instructors guided the students in creating and reading various Excel tables, graphs, and dashboards using the business data of their companies. The instructors gradually introduced new tools before each round.
- Before each round, the students worked together in the class to discuss their actions to run their companies.
- After each round, the instructors discussed the game's results (debriefing) and answered students' questions.

Using this module, we emphasized to the students that the archived and collected business data from a data warehouse can be of great strategic value to a business organization.

The Research Design

Participants in the study were undergraduate junior and senior students with majors in business at a large public university. Students had diverse background with majors in marketing, finance, accounting, management, and computer information systems. They were all enrolled in a required enterprise information systems and business intelligence course. Students had no prior experiences in using ERP systems. It was also the first time for the students to engage in ERP simulation games. Their skills in computer simulation were very basic. For many, this was the first time they utilized computer simulation in a course. The sample in this study was gathered through three sections of the same course that used the same class materials and delivery methodologies. In total, the sample size was 93.

Based on Eccles' expectancy–value theory, our research aims to examine learners' expectancy and beliefs concerning learning BI. We are interested in studying expectancy, attainment value, utility value, intrinsic value, and interests in learning BI using a business simulation game. In addition, we also propose that constructivist practices used in the simulation will effectively enable the students to overcome the complexity of learning BI. More specifically, utilizing the game's innate pedagogical characteristics, we examine various instructional practices' impact on the learners' formation of expectancy and value beliefs towards BI. The pedagogical practices we focus on include active learning, student collaboration, subject integration, and meaningful learning.

Survey Instruments

Two survey instruments were utilized in this study. The items on the survey instruments were assessed based upon learners' self-reported perceptions using a 7-point Likert scale. Both instruments adopted have been tested for their validity in the extant research (Vekiri, 2013).

The first instrument (Appendix A) consisted of 17 items that assess learners' expectancy and value beliefs. The 17 items can be classified into four distinctive categories including expectancy (3 items), attainment value (3 items), utility value (3 items), intrinsic value (3 items), and interest value (5 items). These items were constructed based on the perceived task–value scale of Eccles and Wigfield (1995) and were adapted from the instrument used by Vekiri (2013) in the study of school age children's ICT expectancy and beliefs.

The second instrument (Appendix B) consisted of 13 items that examine the learners' perception of the instructional practices using a simulated BI environment (i.e., ERPSim-BI). The 13 items can be classified into four distinctive categories, including active learning (5 items), student collaboration (2 items), subject integration (3 items), and meaningful learning (3 items). This instrument was adapted from the instrument tested and validated from extant studies (Maor & Fraser, 1996, 2005; Vekiri, 2013). The complete data set consists of a total number of 93 valid responses. Among these respondents, 48 are female, 45 are male. Their age distributions are mostly between 19 to 22 years.

Results

For analyzing our collected data we used the partial least square approach (PLS). This method is suitable especially for cases in which the number of variables is larger than the number of respondents. In addition, PLS is recommended for situations in which the scientist is interested in the predictability of its model. In order to test our model we first assessed the sufficiency of the measurement model and after that we evaluated the structural model.

The measurement shows that reliability, convergent and divergent validity were not an issue in this study. On the diagonal Table 1 shows the AVE values which are greater than the inter-construct correlation. In addition, each measured item loaded higher on the construct it supposed to measure than on the other constructs, as showed in the next table (Table 2).

Table 1: Correlations among latent variables, Cronbach Alpha, and Composite Reliability

COMPOSITE RELIABILITY	CHRONBACH'S ALPHA		ActivLe	Colab	SubjInt	MeanLea	2ndBI
0.911	0.877	ActivLe	0.82	0.558	0.762	0.718	0.631
0.957	0.91	Colab		0.958	0.572	0.506	0.524
0.962	0.94	SubjInt			0.945	0.808	0.692
0.962	0.94	MeanLea				0.945	0.63
0.947	0.929	2ndBI					0.884

Table 2: Factor loadings and cross-loadings

	ActivLe	Colab	SubjInt	MeanLea	AttiBI
AL1	**0.848**	0.009	0.36	-0.518	0.07
AL2	**0.815**	0.096	-0.646	0.284	-0.057
AL3	**0.876**	0.126	-0.451	0.356	0.103
AL4	**0.746**	0.021	0.123	0.179	-0.067
AL5	**0.806**	-0.264	0.651	-0.295	-0.066
SC1	-0.019	**0.958**	-0.042	-0.003	0.003
SC2	0.019	**0.958**	0.042	0.003	-0.003
SI1	0.017	0.01	**0.929**	-0.228	0.07
SI2	-0.089	-0.104	**0.955**	0.067	0.01
SI3	0.072	0.094	**0.95**	0.156	-0.078
ML1	-0.001	-0.03	-0.08	**0.943**	0.034
ML2	0.048	0.079	-0.01	**0.945**	0.01
ML3	-0.047	-0.048	0.09	**0.948**	-0.044
lv_Expe	0.234	0.277	-0.263	-0.004	**0.776**
lv_Util	-0.092	0.028	0.022	-0.001	**0.901**
lv_Atte	-0.017	-0.103	-0.212	0.293	**0.886**
lv_Intr	-0.027	0.004	0.039	-0.095	**0.952**
lv_Inte	-0.064	-0.17	0.374	-0.184	**0.896**

As the measurement in our research is reliable, we have proceeded with the evaluation of the structural model. The path coefficients with their p-values as well as R-squared values are reported (Figure 2). We have modeled the business intelligence motivational belief (AttiBI) as a second order construct including expectancy, utility value, attainment value, intrinsic value, and interest value. We have tested our hypotheses by modeling the AttiBi construct as both formative and reflective, and our results were not significantly changed using the jackknifing method, a method known for being recommended for small sample data (Chiquoine & Hjalmarsson, 2009).

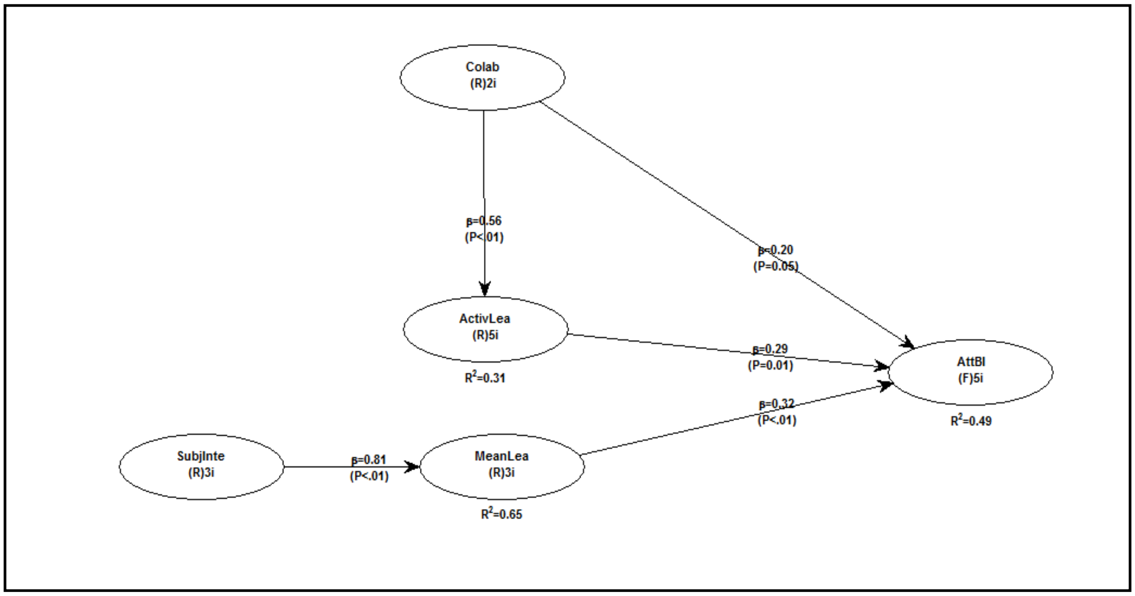


Figure 2: Results of PLS Model.

Our results show the following:

1) collaboration positively influences active learning. The path coefficient is 0.56 (p-value smaller than 0.01) and the R-squared=0.31(Adjusted R-squared=0.30),

2) subject integration positively influences meaningful learning. The path coefficient is 0.81 (p-value smaller than 0.01) and the R-squared=0.65(Adjusted R-squared=0.64), and

3) active learning, meaningful learning, and collaboration influence the business intelligence motivational behavior. The path coefficients are 0.29 (p-value smaller than 0.01), 0.32 (p-value smaller than 0.01), and 0.20 (p-value = 0.05) with an R-squared=0.49(Adjusted R-squared=0.47).

Based on our findings we suggest that constructivist practices embedded in the business simulation have strong potentials for helping the students to overcome the perceived difficulty in using ERP systems. The statistically significant results and strong statistical explanation power as shown in high adjusted R-squared numbers all showed that the constructivist practices such as collaboration and subject integration positively influence active learning and meaningful learning. In turn, both active learning and meaningful learning positively influence business intelligence motivational behavior.

These results have been corroborated through extant research. For instance, many constructivist practices, including active learning, collaboration, subject integration, and authentic (meaningful) learning, have been consistently promoted for the improvement and innovation of learning environments (Karagiorgi & Symeou, 2005; Léger et al., 2011; Tatli & Ayas, 2013; Vekiri, 2013). For another example, active learning has been found to promote instructional strategies that engage students in the learning process through the use of several powerful pedagogical approaches, with a focus on inquiry-based learning (Prince, 2004). In another study, meaningful learning, also referred to as authentic learning, is shown to expose learners to a variety of real problems and provides authentic contexts that reflect the way how the knowledge is useful in real world situations (Herrington & Oliver, 2000). Lastly, it is shown that collaboration supported by teachers was an important factor to promote active learning of science (Warwick et al., 2010), thus collaboration positively influences active learning.

Our findings further extended the above research in the ERPSim environment. The results could shed some lights on developing a robust learning environment in BI classes. It could enable instructors to more efficiently use the simulator by providing insights on its pedagogical practices.

Discussions and Conclusions

Based on Eccles' expectancy–value theory, our research aims to examine learners' expectancy and beliefs concerning learning BI. We are interested in studying expectancy, attainment value, utility value, intrinsic value, and interests in learning BI using a business simulation game. In addition, we also propose that constructivist practices used in the simulation will effectively enable the students to overcome the complexity of learning BI. More specifically, utilizing the game's innate pedagogical characteristics, we examine various instructional practices' impact on the learners' formation of expectancy and value beliefs towards BI. The pedagogical practices we focus on include active learning, student collaboration, subject integration, and meaningful learning.

One unique contribution of our research is the utilization of ERPSim. By introducing learners to a simulated environment that closely resembles the complexity of an actual ERP and BI system, the simulator preserved the valuable opportunity for the students to learn a truly complex ERP and BI system. Our findings showed that many of the constructivist practices used by the simulation are helpful factors in engaging students to study BI. For instance, collaboration among students positively influences active learning whereas subject integration positively influences meaningful learning. Both active learning and meaningful learning positively influence the motivational behavior of students to study business intelligence. Our research proposes a model that should be seen as a potential explanation for the underlying mechanisms triggering the motivational attitude in learning environments. Although, we acknowledge the limitations specific to this type of research, we believe that our research can serve as a starting point for new inquiries related to different teaching techniques especially in the school of business.

Another unique contribution of our study is that, based on the framework of expectancy-value model of motivation (Eccles & Wigfield 2002; Wigfield & Eccles, 2000), we evaluate the constructivist practices implemented in the simulation. We utilized the partial least square approach (PLS) to analyze our data. In order to test our model we first assessed the sufficiency of the measurement model and after that we evaluated the structural model.

Through the PLS model we constructed, we have shown that measures of motivation used in the model are considered to be the most immediate and direct predictors of achievement performance. As expected, we have demonstrated that positive learning experiences in developing BI skills influence students' motivation toward BI. More specifically, the students generate value and expectancy beliefs about BI when perceiving positive support (constructive practices) in mastery of essential BI skills, such as those of discovering solutions of their encountered problems and understanding real world business. Our hypotheses in active learning, collaboration, subject integration, and meaningful learning as factors to influence motivational beliefs have all been supported.

Based on the model, we have examined students' perceptions of BI simulation instruction and investigated impacts of the instructional practices used in the business simulation. The knowledge derived from this research enables instructors to create more positive learning experiences that foster skill development in BI. Furthermore, from the results of this study, researchers can gain more insights on constructivist practices through a systematic view, when searching for more effective instruction methods based on computer simulation.

The research could have offered more depth and generality if the survey can be done on a more diverse sample, such as IT professionals and users of ERP systems with different age and education levels. In the future, we shall examine and integrate additional instructions used to play the simulation game. It is hoped that continuously improved teaching based on the business simulators, such as the enhancement of debriefings, will lead to a robust learning experience for students and consequently influence them to gain strong motivational beliefs in BI. The present study can be used as a guide to move toward that goal.

Another interesting future research is to examine the trust building among the team members and measure the effects on motivations and learning experiences of students. As team members work together and become more aware of each other's strengths and weaknesses, their expectations and support becomes better aligned with each team member's competencies. This should result in better team members' task performances and an increase in the level of trust. Therefore, in future research, we will incorporate trust among team members as a critical prerequisite for team effectiveness and examine how the level of trust will affect the performance, commitment, and morale of a team in the simulation game.

References

Annavarjula, M., Folami, L. B., Ramirez, A., & Zdravkovic, S. (2014). Use of integrative curriculum to enhance international business education. *International Journal of Education Research, 9*(1), 15-25.

Altstaedter, L. L., & Jones, B. (2009). Motivating students' foreign language and culture acquisition through web-based inquiry. *Foreign Language Annals*, *42*(4), 640-657.

Babin, G., Léger, P. M., Robert, J., & Bourdeau, S. (2011). ERPsim BI: A problem-based learning approach in teaching business analytics. *Microsoft Dynamics Academic Preconference Refereed Proceedings, 2*(1), 1-7.

Ben-Zvi, T. (2007). Using business games in teaching DSS. *Journal of Information Systems Education*, *18*(1), 113-124.

Ben-Zvi, T. (2010). The efficacy of business simulation games in creating decision support systems: An experimental investigation. *Decision Support Systems*, *49*(1), 61-69.

Chen, H., Chiang, R. H., & Storey, V. C. (2012). Business intelligence and analytics: From big data to big impact. *MIS Quarterly*, *36*(4), 1165-1188.

Chen, G. D., Nurkhamid, Wang, C. Y., Yang, S. H., Lu, W. Y., & Chang, C. K. (2013). Digital learning playground: Supporting authentic learning experiences in the classroom. *Interactive Learning Environments*, *21*(2), 172-183.

Chiang, R. H., Goes, P., & Stohr, E. A. (2012). Business intelligence and analytics education, and program development: A unique opportunity for the information systems discipline. *ACM Transactions on Management Information Systems*, *3*(3), 12.

Chiquoine, B., & Hjalmarsson, E. (2009). Jackknifing stock return predictions. *Journal of Empirical Finance*, 16(5), 793-803.

Conroy, C. A., & Walker, N. J. (2000). An examination of integration of academic and vocational subject matter in the aquaculture classroom. *Journal of Agricultural Education*, *41*(2), 54-64.

Cronan, T. P., Douglas, D. E., Alnuaimi, O., & Schmidt, P. J. (2011). Decision making in an integrated business process context: Learning using an ERP simulation game. *Decision Sciences Journal of Innovative Education*, *9*(2), 227-234.

Dalgarno, B. (2001). Interpretations of constructivism and consequences for computer assisted learning. *British Journal of Educational Technology*, *32*(2), 183-194.

Darban, M., Kwak, D. H. A., Deng, S. L., Srite, M., & Lee, S. (2016). Antecedents and consequences of perceived knowledge update in the context of an ERP simulation game: A multi-level perspective. *Computers & Education*, *103*, 87-98.

Drake, S. M. (1998). *Creating integrated curriculum: Proven ways to increase student learning*. Thousand Oaks, CA: Corwin Press.

Eccles, J. S., & Wigfield, A. (1995). In the mind of the actor: The structure of adolescents' achievement task values and expectancy-related beliefs. *Personality and Social Psychology Bulletin*, *21*(3), 215–225.

Eccles, J. S., & Wigfield, A. (2002). Motivational beliefs, values, and goals. *Annual Review of Psychology*, *53*, 109–132.

Fosnot, C. T., & Perry, R. S. (2005). Constructivism: A psychological theory of learning. In C. T. Fosnot (Ed.), *Constructivism: Theory, perspectives, and practice* (pp. 8-38). New York: Teachers College Press.

Freeze, R. D., & Schmidt, P. J. (2015). To use or not to use - ERP resistance is the question: The roles of tacit knowledge and complexity. *Decision Sciences Journal of Innovative Education*, *13*(2), 247-272.

Garcia, I., & Pacheco, C. (2013). A constructivist computational platform to support mathematics education in elementary school. *Computers & Education*, *66*, 25-39.

González-Torre, P. L., Adenso-Díaz, B., & Moreno, P. (2015). A constructivist approach to studying the bullwhip effect by simulating the supply chain. *European Journal of Engineering Education, 40*(6), 623-637.

Grabinger, R. S., & Dunlap, J. C. (1995). Rich environments for active learning: A definition. *Research in Learning Technology*, *3*(2).

Hartman, N. S., Watts, C. A., & Treleven, M. D. (2013). Appreciating the complexity of project management execution: Using simulation in the classroom. *Decision Sciences Journal of Innovative Education*, *11*(4), 323-334.

Herrington, J., & Kervin, L. (2007). Authentic learning supported by technology: Ten suggestions and cases of integration in classrooms. *Educational Media International*, *44*(3), 219-236.

Herrington, J., & Oliver, R. (2000). An instructional design framework for authentic learning environments. *Educational Technology Research and Development*, *48*(3), 23-48.

Jimoyiannis, A., & Komis, V. (2001). Computer simulations in physics teaching and learning: A case study on students' understanding of trajectory motion. *Computers & Education*, *36*(2), 183-204.

Jonassen, D., Davidson, M., Collins, M., Campbell, J., & Haag, B. B. (1995). Constructivism and computer-mediated communication in distance education. *American Journal of Distance Education*, *9*(2), 7-26. doi: http://dx.doi.org/10.1080/08923649509526885

Jones, B. D., Paretti, M. C., Hein, S. F., & Knott, T. W. (2010). An analysis of motivation constructs with first-year engineering students: Relationships among expectancies, values, achievement, and career plans. *Journal of Engineering Education*, *99*(4), 319-336.

Karagiorgi, Y., & Symeou, L. (2005). Translating constructivism into instructional design: Potential and limitations. *Journal of Educational Technology & Society*, *8*(1), 17-27.

Keser, H., Uzunboylu, H., & Ozdamli, F. (2011). The trends in technology supported collaborative learning studies in 21st century. *World Journal on Educational Technology*, *3*(2), 103-119.

Li, W., Lee, A., & Solmon, M. (2007). The role of perceptions of task difficulty in relation to self-perceptions of ability, intrinsic value, attainment value, and performance. *European Physical Education Review*, *13*(3), 301-318.

Léger, P. M., (2006). Using a simulation game approach to teach enterprise resource planning concepts. *Journal of Information Systems Education*, *17*(4), 441-447.

Léger, P. M., Charland, P., Feldstein, H., Robert, J., Babin, G., & Lyle, D. (2011). Business simulation training in information technology education: Guidelines for new approaches in IT training. *Journal of Information Technology Education: Research*, *10*(1), 39-53. Retrieved from http://www.informingscience.org/Publications/1362

Leppisaari, I., Herrington, J., Vainio, L., & Im, Y. (2013). Authentic e-learning in a multicultural context: Virtual benchmarking cases from five countries. *Journal of Interactive Learning Research*, *24*(1), 53-73.

Maor, D., & Fraser, B. J. (1996). Use of classroom environment perceptions in evaluating inquiry-based computer-assisted learning. *International Journal of Science Education*, *18*(4), 401-421.

Maor, D., & Fraser, B. J. (2005). An online questionnaire for evaluating students' and teachers' perceptions of constructivist multimedia learning environments. *Research in Science Education*, *35*(2-3), 221-244.

Meyer, B. C., & Bishop, D. S. (2011). The ordering challenge: An online game to introduce independent demand inventory concepts. *Decision Sciences Journal of Innovative Education*, *9*(2), 315-320.

Milner, A. R., Templin, M. A., & Czerniak, C. M. (2011). Elementary science students' motivation and learning strategy use: Constructivist classroom contextual factors in a life science laboratory and a traditional classroom. *Journal of Science Teacher Education*, *22*(2), 151-170.

Negash, S. (2004). Business intelligence. *The Communications of the Association for Information Systems*, *13*(1), 54.

Novak, J. D. (2002). Meaningful learning: The essential factor for conceptual change in limited or inappropriate propositional hierarchies leading to empowerment of learners. *Science Education*, *86*(4), 548-571.

Panchal, J. H., Adesope, O., & Malak, R. (2012). Designing undergraduate design experiences—A framework based on the expectancy-value theory. *International Journal of Engineering Education*, *28*(4), 871.

Palmer, D. (2009). Student interest generated during an inquiry skills lesson. *Journal of Research in Science Teaching*, *46*(2), 147–165.

Patrick, H., Manizicopoulos, P., & Samarapungavan, A. (2009). Motivation for learning science in kindergarten: Is there a gender gap and does integrated inquiry and literacy instruction make a difference. *Journal of Research in Science Teaching*, *46*(2), 166–191.

Piaget, J. (1963). *The origins of intelligence in children* (M. Cook, Trans.). New York: W.W. Norton. (Originally published 1936)

Powell, E. (2005). Conceptualizing and facilitating active learning: Teachers' video-stimulated reflective dialogues. *Reflective Practice: International and Multidisciplinary Perspectives, 6*(3), 407-418.

Powell, K. C., & Kalina, C. J. (2009). Cognitive and social constructivism: Developing tools for an effective classroom. *Education*, *130*(2), 241-250.

Prince, M. (2004). Does active learning work? A review of the research. *Journal of Engineering Education*, *93*(3), 223-231.

Saleh, M., Lazonder, A. W., & de Jong, T. (2007). Structuring collaboration in mixed-ability groups to promote verbal interaction, learning, and motivation of average-ability students, *Contemporary Educational Psychology*, *32*(3), 314-331.

Serrano-Cámara, L. M., Paredes-Velasco, M., Alcover, C. M., & Velazquez-Iturbide, J. Á. (2014). An evaluation of students' motivation in computer-supported collaborative learning of programming concepts. *Computers in Human Behavior*, *31*, 499-508.

Siddiqui, A., Khan, M., & Akhtar, S. (2008). Supply chain simulator: A scenario-based educational tool to enhance student learning. *Computers & Education*, *51*(1), 252-261.

Sivan, E. (1986). Motivation in social constructivist theory. *Educational Psychologist*, *21*(3), 209-233.

Tatli, Z., & Ayas, A. (2013). Effect of a virtual chemistry laboratory on students' achievement. *Educational Technology & Society*, *16*(1), 159-170.

Thompson, C. J. (2009). Educational statistics authentic learning CAPSULES: Community action projects for students utilizing leadership and e-based statistics. *Journal of Statistics Education*, *17*(1), 1-11.

Van Berkel, H. J., & Dolmans, D. H. (2006). The influence of tutoring competencies on problems, group functioning and student achievement in problem-based learning. *Medical Education*, *40*(8), 730-736.

Vekiri, I. (2013). Information science instruction and changes in girls' and boy's expectancy and value beliefs: In search of gender-equitable pedagogical practices. *Computers & Education*, *64*, 104-115.

Warwick, P., Mercer, N., Kershner, R., & Staarman, J. K. (2010). In the mind and in the technology: The vicarious presence of the teacher in pupil's learning of science in collaborative group activity at the interactive whiteboard. *Computers & Education*, *55*(1), 350-362.

Watson, H. J. (2009). Tutorial: Business intelligence – Past, present, and future. *Communications of the Association for Information Systems*, *25*(1), 39.

Wigfield, A., & Cambria, J. (2010). Students' achievement values, goal orientations, and interest: Definitions, development, and relations to achievement outcomes. *Developmental Review*, *30*(1), 1-35.

Wigfield, A., & Eccles, J. S. (2000). Expectancy-value theory of achievement motivation. *Contemporary Educational Psychology*, *25*(1), 68-81.

Wigfield, A., & Guthrie, J. T. (2000). Engagement and motivation in reading. *Handbook of Reading Research*, *3*, 403-422.

Wixom, B., Ariyachandra, T., Douglas, D., Goul, M., Gupta, B., Iyer, L., Kulkarni, U., John G. Mooney, J. G., Phillips-Wren, G., & Turetken, O. (2014). The current state of business intelligence in academia: The arrival of big data. *Communications of the Association for Information Systems*, *34*(1), 1.

Wixom, B., Ariyachandra, T., Goul, M., Gray, P., Kulkarni, U., & Phillips-Wren, G. (2011). The current state of business intelligence in academia. *Communications of the Association for Information Systems*, *29*(16), 299-312.

Yeoh, W., & Koronios, A. (2010). Critical success factors for business intelligence systems. *Journal of Computer Information Systems*, *50*(3), 23-32.

Zeng, L., Li, L., & Duan, L. (2012). Business intelligence in enterprise computing environment. *Information Technology and Management*, *13*(4), 297-310.

Appendices

Appendix A. Survey Assessing Learners' Expectancy and Value Beliefs

Expectancy

1. I think I will be able to respond satisfactorily to the demands of the Business Intelligence class.
2. I will be able to do even the hardest assignments in Business Intelligence class if I try enough.
3. I think I am able enough to manage in the Business Intelligence class.

Attainment value

4. It is important to me to know Business Intelligence.
5. It is important to me to be good at Information Systems.
6. It is important to me to do well in the Business Intelligence class.

Utility value

7. It is useful for my future to be good at Business Intelligence.
8. It will be important for my future career to know a lot about Business Intelligence.
9. My knowledge about Business Intelligence is useful to me in my career.

Intrinsic value

10. I like using Information Systems
11. I enjoy learning new things about Business Intelligence in Information Systems.
12. I want to keep improving my Business Intelligent skills.

Interest Value

13. I think Business Intelligence is interesting.
14. I am interested in the kind of courses involved in the Business Intelligence area.
15. I am interested in the challenges that Business Intelligence professionals face.
16. I am interested by the type of work that people in the Business Intelligence area do.
17. Business Intelligence professionals tackle interesting problems.

Appendix B. Survey Examining the Learners' Perception of the Instructional Practices.

<u>Active learning</u>

1. Our teacher encouraged us to think of and to try out alternative ways of doing a task or assignment.
2. Our teacher was happy when we discovered on our own new things about business intelligence.
3. Our teacher encouraged us to figure out on our own answers to our queries, interacting with the information system.
4. In the business intelligence lessons we had classroom discussions.
5. Some of the discussions or tasks in the business intelligence class came out from student queries, ideas or suggestions

<u>Student collaboration</u>

6. I could collaborate with my classmates on some of the tasks that we did in class.
7. We could ask questions and help each other.

<u>Subjection integration</u>

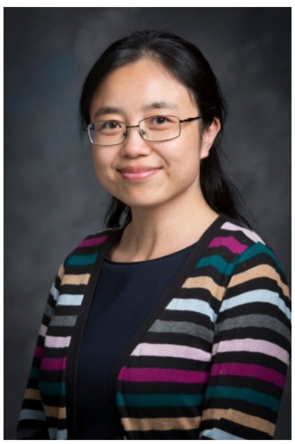
8. The tasks that we did gave me the opportunity to use knowledge and skills that I had obtained in other school courses.
9. The assignments helped me connect business intelligence to other school courses.
10. I learned things that I could use in other school classes.

<u>Meaningful learning</u>

11. What we learned helped me understand that many business needs would be harder to address without business intelligence.
12. Assignments helped me understand that business intelligence can be used to solve business problems
13. What we did helped me understand that business intelligence is useful in many occupations.

Biographies

Dr. Hsun-Ming Lee received his PhD in Industrial Engineering with a focus on information engineering from Arizona State University, USA. He is currently an Associate Professor of Computer Information Systems in the McCoy College of Business Administration at Texas State University, USA. His research interests include web engineering, technology-enhanced learning, and decision support systems.



Dr. Ju Long is an associate professor of Computer Information Systems at the McCoy College of Business at Texas State University. She has a Ph.D. degree from the University of Texas at Austin, and a Master degree from the University of Michigan in Ann Arbor. She studies technology's impact on business and how new technologies are changing our world. She has published in many academic journals in the areas of information technology security, open source software development, mobile technologies, and healthcare IT.

Dr. Lucian Visinescu is an assistant professor of Computer Information Systems at the McCoy College of Business at Texas State University. He has a Ph.D. degree from University of North Texas. His research is focused on website design and text mining. He has published in many academic journals, including CACM and DSS.