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The Educational Value of Simulation as a Teaching Strategy in a Finance Course

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Abstract

Finance education relies on quantitative analyses and exercises. Lack of quantitative skills undermines student motivation. Interactive teaching methods including case-based learning, problem-based learning, and simulations have been proposed as means to improve student engagement and enhance learning. This study describes an application of a sequence of stock market simulation exercises in a finance investment course. The empirical analysis applies a model of the educational value of this pedagogical strategy to evaluate its impact on cognitive, behavioural, and affective learning dimensions. The results demonstrate that, in the cognitive category, student exam scores on the topics covered by the simulation were significantly higher compared to a control section that did not use the simulation. In the behavioural category that concerns student skills and the affective category that focuses on student satisfaction, survey responses demonstrate a positive impact of the use of simulation on skill-building and satisfaction with the course.

Key words*: Finance Education; Simulation; Investments; Experiential Learning.*

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Introduction

Finance and economics courses in a university-level business program typically have a strong quantitative component. As the business world faces growing complexity, however, the quantitative and analytical skills of business students lag behind (McClure & Sircar, 2008). Student demographics in business education are increasingly diverse and include multiple socio-economic and age groups (Azriel et al., 2005). The disparity in the quantitative and analytical skills of diverse student groups presents a challenge for keeping students motivated when they fail to grasp quantitative concepts in class. One solution that has been proposed in the finance and economic education literature is the use of interactive learning methods, including experiential learning (Kolb, 1984; Hakeem, 2001; Eckardt et al., 2015), the case study method (Becker & Watts, 1995, 1998; Christensen & Hansen, 1987), and problem-based learning (Hung et al., 2008; Chulkov & Nizovtsev, 2015).

Experiential learning in business education has been studied in a variety of disciplines including accounting (Eckardt et al., 2015), business statistics (Hakeem, 2001), economics (Carlson & Velenchik, 2006; Chulkov & Nizovtsev, 2012), information systems (Ben-Zvi, 2010), management (Azriel et al., 2005; Lin & Tu, 2012), and marketing (Ranchhod, 2014). These studies generally demonstrate that interactive teaching methods help increase student involvement, motivation, and learning in the business classroom.

Experiential learning is an all-encompassing concept defined as a participatory method of learning such that the learner processes information in an active and immersive learning environment (Feinstein et al., 2002). Kolb (1984, p. 236) states that participants involved in experiential learning "must be able to observe and reflect on experiences from many perspectives; they must be able to create concepts that integrate their observations into logically sound theories; and they must be able to use these theories to make decisions and solve problems."

As the use of experiential learning in business education expands, the literature segments into areas focusing on the specific pedagogical strategies. In fact, Feinsten et al. (2002) argue that simulations, games, and role-playing exercises all have specific pedagogical functions and benefits and should not be seen in an interchangeable fashion. Ranchhod et al. (2014) define games as "a goal-directed, competitive activity against the computer or another player … conducted within a framework of agreed rules." Meanwhile, simulation is defined as a "simplified model of reality structured as a system, which includes clearly specified variables and dynamic relationships between these variables." A simulation is a dynamic and realistic exercise representing a real-life business system (Sauve et al., 2007).

This study describes an application of a sequence of stock market simulation exercises in a finance investment course. It further examines the impact of simulation on student performance on exams and reports survey results on student attitudes towards the simulation exercises. While the effectiveness of simulation has been studied in other business disciplines, the goal of this study is to describe the implementation of simulation and examine its impact in the finance classroom, complementing earlier work that focuses the operationalization of the finance simulation exercises (Parle & Laing, 2017).

The article proceeds in the following fashion. The next section defines simulation in business education and reviews the extant literature on the use of simulation. The third section describes the simulation assignment used and presents the simulation-specific learning outcomes as well as the implementation and assessment guides. The fourth section reports empirical findings on the observed impact of simulation on student learning as well as student attitudes. The final section provides a conclusion.

Literature Review

Simulations in business education serve as an effective pedagogical tool for experiential learning. The definition of simulation used by Ranchhod et al. (2014) presents it as a dynamic, simplified, and realistic model of a business world environment. Simulations allow participants to manipulate system variables and provide real-time feedback in order to understand the functioning of the system studied. Thus, the dynamic and interactive character of simulations is a natural base for experiential learning, in which participants explore the simulation environment, react to real-world challenges, and learn the concepts embedded in the system they examine (Prensky, 2001).

Feinstein et al. (2002) note that simulations are less reliant on inter-personal communication than role-playing exercises or games. However, Ranchhod et al. (2014) propose that games and simulations are compatible, and can complement each other in order to enhance the effectiveness of learning. The gaming or competition element may be incorporated into simulations in order to enhance the experiential learning process and provide additional motivation to students through competition. While a competitive element is not a requirement for simulations, motivational interest in a simulation often stems from the game-like atmosphere that it presents, and its "contrast with traditional procedures for teaching and learning" (Hyman, 1978, p. 154). A number of studies note that utilizing simulation techniques positively affects learner motivation (Towne et al., 1993; Ranchhod et al., 2014).

Simulations allow students to practice their skills in making decisions and skills of planning alternative strategies as well as evaluating the outcome of their decisions (Hyman, 1978). Students get feedback on their decisions and typically have the opportunity to try alternative strategies. Extant studies argue that an effective learning environment is one that allows learners to explore and learn independently (Collins & Brown, 1988; White & Horowitz, 1987). Simulation typically fits this mold.

Anderson and Lawton (2009) as well as Ranchhod et al. (2014) present a model of the educational value of simulations and simulation-based games. This general model, grounded in Bloom's taxonomy (Bloom et al., 1956) identifies specific learning goals applicable to business simulations. These learning goals are grouped into three categories of the potential value of simulation.

First is the cognitive value – improved understanding and retention at the conceptual, procedural, and strategic level. In this category, simulations can (i) teach students the terminology, concepts, and principles of a business discipline; (ii) present the interdependence between various business functions (marketing, finance, production, sales etc.); (iii) demonstrate the procedural difficulty of applying business concepts in complex realistic situations; (iv) enhance knowledge retention.

Second is the behavioral category of value that encompasses skill practice and development. In this category, simulations can (i) enable students to implement course concepts by making decisions and experiencing the consequences of their actions in an interactive environment; (ii) improve students' teamwork and relational skills; (iii) generate practical experience in taking and implementing business decisions; (iv) improve students' analytical and decision-making skills.

Third and final is the affective category of value, in which simulations can (i) improve student attitudes towards the discipline; (ii) enhance students' motivation and engagement; (iii) increase students' satisfaction regarding the learning experience. The empirical analysis presented in this article adopts this model of the educational value of simulations and use its framework to evaluate the effectiveness of simulations in the finance classroom.

Description of the Course and the Simulation Assignments

This study is based on a finance investment course at a regional campus of a public U.S. university. This investment course is concurrently offered for both M.B.A. and undergraduate students. This course provides a conceptual and analytical framework for formulating investment policies, analyzing securities, and constructing portfolio strategies for individuals and institutions. Topics include risk and return analysis, portfolio theory, valuation of stocks and bonds, financial institutions, market efficiency, and derivative securities.

The learning outcomes of this course include the following:

(i) describe the features of the major types of marketable securities that trade in the world markets;
(ii) understand the structure and function of the capital market and be familiar with issues related to debt issues, initial public offerings, seasoned offerings, and the role of investment bankers;
(iii) comprehend the theories and implications of market efficiency including information economics, market psychology, portfolio construction, and investment strategy;
(iv) use the Black-Scholes model to value options.

Topics covered in this course include asset classes, financial institutions, securities markets, mutual funds, futures markets, options markets, option valuation, bond prices, equity valuation, risk-return relation, and the efficient market hypotheses. Currently, learning outcomes (i) and (ii) are covered by a series of simulation exercises, while outcomes (iii) and (iv) are delivered in a more traditional lecture-based format. The course assessments are composed of 7 practice problem assignments, 4 homework assignments, 3 exams, 4 quizzes, 1 investment simulation presentation, 1 investment simulation report, 6 bi-weekly short investment reports, and 1 market summary presentation.

Simulation Learning Outcomes

The specific learning outcomes for the simulation exercises are mapped to the course-wide learning outcomes (i) and (ii). These outcomes and their educational value categories include the following:

1. Describe major financial markets and financial assets including stocks, bonds, mutual funds, options, and futures (Cognitive value)
2. Define and apply various security order types including limit buy/sell orders and stop buy/sell orders (Behavioral value)
3. Comprehend and apply portfolio diversification (Behavioral value)
4. Comprehend and apply risk-return tradeoff theories (Cognitive value)
5. Track and evaluate financial market movement and news events (Behavioral value)
6. Demonstrate professional writing and presentation skills (Behavioral value)

Simulation Implementation

All students enrolled in the investment course in the spring 2019 semester were required to participate in a series of assignments built around a realistic investment simulation, which provided hands-on stock market experience. Students used a virtual brokerage trading account provided by StockTrak - an educational simulation company - to trade over 14 weeks. They started with a fictional $5,000,000 account that they used to make global trades of stocks, bonds, mutual funds, options, and futures using the investment simulation platform. The trading data was real-life and was provided to the students via the StockTrak website. Additional settings of this simulation included the following:

- Interest earned rate was 3%, interest charged rate was 8%, day trading was allowed, short selling was allowed, trading on margin was allowed, and commissions were set at $10 per trade
- The minimum stock price for buying was $0.001 and the minimum stock price for shorting was $0.001
- Equities markets included all major North American, Latin American, European, and Asian markets

The investment simulation instructions were provided to students in several ways: in class, via a hardcopy handout, and through the learning management system (LMS) Canvas. In addition, detailed grading rubrics for the final report as well as the required format of the report were also provided to students at the beginning of the semester. An overview of the computer-based simulation platform was discussed in class at the beginning of the semester. Students were also assisted with the sign-up process of the simulation web site software. Besides, class time was specifically allocated for students to make their trades and ask the instructor questions. Students were given 14 weeks to make investment trades and adjust their portfolios. The rest of the semester time was for the students to evaluate the portfolio performance, prepare for the final presentation, and complete the final report. In addition to the final report and presentation, bi-weekly reports were also required to document the investment performance and actions taken over each two week period. These reports included portfolio performance, position changes, transactions, and major events that affected the performance in each two week period.

Besides working with the web-based simulation platform, some students were assigned to present a market summary every week according to a schedule. The market summary included major U.S. financial markets' performance, market news, and events that could potentially influence the financial markets. Incorporating the market summary with the investment simulation helped all students keep up with real-time events and make informed investment portfolio decisions. The instructor also discussed the portfolio performance and completed briefings with students according to a schedule.

The following timeline provides a summary of the stages of this investment simulation over a typical 16-week semester:

- Weeks 1 – 2: Simulation registration, introduction, and setup
- Weeks 2 – 14: Investment portfolio construction and adjustment, market summary, and portfolio briefings
- Weeks 15 – 16: Portfolio performance evaluation, final report, and final performance presentation

Simulation Assessment

Several assessment tools were employed to evaluate student performance: bi-weekly portfolio reports, market summary presentations, a final report, and a final presentation. These assessments ensured that students' portfolio construction and adjustments were recorded over the investment period; that students were informed of the real-world events; and that students were able to incorporate the market movements into their portfolio diversification.

The assessment criteria were mapped to the simulation learning outcomes. The detailed grading rubrics are provided in the Appendix B and identify the learning outcomes and assessment criteria used. Specifically, the following assessment criteria were mapped to the grading rubrics.

1. Efforts to diversify the portfolio (including stocks, bonds, mutual funds, options, futures, attempts to short sell, and trade foreign stocks)
2. Cognitive and behavioral skills used for portfolio construction and diversification
3. Justification of investment decisions and connection of portfolio selection with core finance theories

4. Discussion of the macroeconomic, financial market, and stock-specific news events and analyses of the influence of financial market condition on portfolio performance
5. Efforts to produce a high-quality report and presentation

Empirical Analysis and Results

Consistent with the model of the educational value of simulation and its framework, the empirical analysis of the effectiveness of the simulation in the finance classroom presented below uses two sets of tests. The first set is based on the analysis of exam scores – it focuses on the cognitive value and includes a comparison of student performance for the treatment and control groups. The second set of tests examines the behavioral value and affective value of the simulation exercises using a survey of students. The behavioral category of value encompasses skill practice and development, while the affective value examines students' attitudes, motivation, and engagement with the course content and their learning experience. This study was reviewed by the appropriate Institutional Review Board (IRB) and received approval. The use of data collected from students for this study meets ethical guidelines since the data was used anonymously and was collected in regular educational settings for the purpose of developing educational outcomes.

Prior studies document the role of simulation in such diverse disciplines as computer science (Strycker, 2016), engineering (Chaves et al., 2015), physics (Adams, 2016), medicine (Dankbaar, 2016), nursing (Sarabia-Cobo, 2016), political sciences (Jones & Bursens, 2015), languages (Franciosi, 2016), and social sciences (Cózar-Gutiérrez & Sáez-López, 2016). To investigate the cognitive value and explore the performance in the investment course, this study employed a treatment group (the simulation-based section) and a control group (a completely lecture-based section). The treatment group was composed of 29 students, who went through the investment simulation. In comparison, the control group had 27 students, who went through a purely lecture-based section without the investment simulation. The topics covered in both sections were similar. The investment simulation corresponded to two specific course-level learning outcomes: (i) describe the features of the major types of marketable securities that trade in the world markets; (ii) understand the structure and function of the capital market and be familiar with issues relating to debt issues, initial public offerings, seasoned offerings, and the role of investment bankers.

Of the topics covered in this course, some are theoretical while others are practical. For instance, bond prices, equity valuation, risk-return relation, and the efficient market hypotheses are examples of theoretical topics. In comparison, securities markets, mutual funds, futures markets, and options markets are more practical topics in which students are able to connect and apply their knowledge with the investment simulation. As a result, for the purpose of cognitive value comparison, this study examines and compares student exam performance of each course section for the topics covered by the simulation and topics not covered by the simulation, respectively. This quasi-experimental test design helps to examine the direct influence of the simulation on student performance. The exam format in both course sections consisted of multiple-choice questions to assess students' understanding of qualitative concepts and problem-solving questions to evaluate the comprehension of quantitative topics.

The simulation section and the lecture-based section performance comparison results are displayed in Table 1. Panel A presents the results for the topics covered by the simulation while Panel B reports the results for the topics not covered by the simulation. The table reports the mean and variance of the exam grades for each section, the number of observations, and the sample mean t-test of the exam grades.

The overall sample size was 56 students in two course sections. Both sections had similar numbers of students, implying that our results are less likely to be biased

due to a substantial difference in sample size. As shown in Panel A, the mean of the exam grades for the simulation section was 84.10, while for the lecture-based section it was 73.67. A two-sample mean t-test on this sample resulted in a t-statistic of 3.23 and a p-value of 0.002, suggesting that the exam performance of the simulation section is significantly higher than that of the lecture-based section on the topics covered by the simulation exercises. As reported in Panel B, the mean exam grades for the simulation section and the lecture-based section were 81.21 and 82.28, respectively. The insignificant t-statistic (-0.36) implies that student performance did not significantly differ between the two sections and students performed equally well on the topics not covered by the investment simulation. The evidence also confirms that there was no bias due to various achievement levels between the two sections overall. In summary, the results demonstrate that student performance on the topics covered by the simulation was significantly improved compared to the control section that did not use the simulation.

Table 1:
Cognitive Value: Comparison of Student Performance on Exam Topics Covered by Simulation

	Panel A: Topics covered by Simulation		Panel B: Topics not covered by Simulation	
	Simulation section	Lecture-based section	Simulation section	Lecture-based section
Mean	84.10	73.67	81.21	82.28
Variance	111.95	177.38	132.60	113.68
Observations	29	27	29	27
Degrees of Freedom	50		54	
t Stat	3.23		-0.36	
P(T<=t) two-tail	0.002		0.72	

In order to explore the behavioral value and the affective value of the simulation for students, a survey was used in the section of the investment course that experienced the simulation exercises in class. This investment course was offered for both undergraduate and M.B.A. students in the spring 2019 semester. Over 95 percent of the students enrolled in the course completed the survey. The survey focused on several categories. First, the survey collected student demographic information and investment profiles. Second, a series of questions were asked regarding the behavioral value of the simulation to students. These factors that involve development of skills were measured numerically with a 5-point Likert scale. The possible responses on the scale ranged from 1 "Strongly disagree" to 5 "Strongly agree". Third, a series of questions asked about the students' attitudes toward the investment simulation, which falls into the affective value category. For instance, these questions covered involvement and participation as well as the connection between the simulation and lecture materials. The questions were measured based on the same 5-point numerical scale. Fourth, open-ended questions asked the participants to explain in writing their most and least favorite part of the simulation assignments, the difference between the simulation-based class and a regular lecture-oriented finance class, and the most important skills they developed from the simulation exercises. The full survey questionnaire is shown in the Appendix A.

Table 2 presents the summary statistics for the survey sample, including the students' gender, class standing, age, and concentration. The final survey sample was composed of 29 participants of which 31 percent were female and 69 percent were male. Watson and McNaughton (2019) document that women are generally considered more risk-averse than men and they tend to choose more conservative investment strategies so a diverse survey sample is important.

In the survey sample, 24 out of 29 students were senior undergraduates and 3 were graduate students. This implies that a majority of the students in this section had a basic understanding of finance and some academic background in finance. The students enrolled in this section were mainly finance majors with a small number of students in other business majors such as management, accounting, marketing, and others. 72.41 percent of the participants were younger than 24. Chattopadhyay and Dasgupta (2015) document that aged investors are more risk-averse than their younger, inexperienced counterparts. Bellante and Green (2004) also show that the relative risk aversion increases modestly as investors grow older. Overall, the survey sample had variation in gender, class standing, age, and concentration and thus can be expected to yield reliable results.

Table 2:
Survey Sample Summary Statistics

	Number of Responses	Percentage
Participants	29	100%
Gender		
Female	9	31.03%
Male	20	68.97%
Class standing		
Junior (3rd year undergraduate)	2	6.90%
Senior (4th year undergraduate)	24	82.76%
Graduate student	3	10.34%
Age		
24 or below	21	72.41%
25 or above	8	27.59%
Concentration		
Finance/Economics	20	68.97%
Management	3	10.34%
Accounting	2	6.90%
Marketing	3	10.34%
Other	1	3.45%

The survey collected information on the students' investment profile and attitudes towards a variety of financial assets. Both factors are significant determinants of investors' portfolio choices and investment decisions. Within the survey sample, 17 students had investment experience of less than a year and 11 students had 1 to 5 years of experience with financial assets, which include stocks, bonds, mutual funds, exchange-traded funds, futures, options, and financial derivatives. The evidence indicates that the majority of students had little experience with real-world investing, which makes the experiential learning with the simulation exercises especially important.

The survey also included two questions regarding students' risk aversion as investors. Risky assets were defined as stocks, bonds, or financial derivatives. Over 70 percent of the participants were willing to allocate less than 30 percent of their personal savings in these risky assets. The findings have several implications. First, as documented in Table 1, 72.41 percent of the sample participants had an age of below 24. They were traditional students with college loans and part-time jobs. A substantial amount of their savings was used for rent, essentials, and food. They generally did not have additional savings to invest at this stage of their life. Second, since most of the participants had less than five years of investment experience, lacking prior experience made them more risk-averse and less likely to invest in risky securities. The survey

directly asked about students' investment preference among the safest financial assets, a combination of safe and risky financial assets, and risky financial assets. Interestingly, only one student was willing to invest in financial derivatives while the rest of the class preferred either stocks, bonds, or their combinations. This evidence confirms that students in this course section had a low level of risk tolerance, which affected their investment behaviour and decisions.

Table 3:
Students' Investment Profile and Attitudes

Investment Profile Summary Statistics	Number of Responses	Percentage
Participants	29	100%
What is your experience of any type with financial investment?		
Less than 1 year	17	58.62%
1-5 years	11	37.93%
5-10 years	1	3.45%
more than 10 years	0	0.00%
What percentage of your savings are you willing to invest in risky assets (such as stocks, bonds, or financial derivatives)?		
Less than 10%	8	27.59%
10%-30%	13	44.83%
30%-50%	6	20.69%
more than 50%	2	6.90%
When investing your savings, which of the following financial assets do you prefer?		
Only safest financial assets, such as savings account or government bond	2	6.90%
Mostly safe financial assets, such as corporate bonds	6	20.69%
A balanced combination of safe and risky financial assets	13	44.83%
Mostly risky financial assets, such as stocks	7	24.14%
Only the riskiest financial assets, such as financial derivatives, futures and options	1	3.45%

The analysis of the cognitive value of the simulation above has shown that student performance on the topics covered by the simulation was significantly improved compared to a control section that did not use the simulation. Simulations have been demonstrated to be successful in promoting teamwork and team dynamics (Lin, 2016), collaboration (Hannig et al., 2012), social and emotional skills (Ahmad et al., 2013), as well as project management, self-reflection, and leadership skills (Siewiorek, 2012). The survey further explored how investment simulation influenced such behavioural value for the students. Specifically, it concentrated on the development of the following skills: effective financial information analysis, professional development, teamwork, and complementation of the course content. These aspects were measured numerically with a 5-point Likert scale.

Table 4 presents the results on the behavioural value of the simulation for the students. This table reports the average ratings for each question and the percentage of responses for each rating on the scale with 5 being "Strongly agree". The average rating for "effective financial information analysis" was 4.33, suggesting that most students agreed that simulation exercises contributed to their financial information analysis skills. No student disagreed with this argument and 89.66 percent of participants agreed to some extent that the investment simulation was an effective tool to advance financial analysis skills. Similar patterns were observed for "professional development" with a lower overall rating of 3.98. 75.86 percent of students either strongly or somewhat

agreed with this statement. For some simulation exercises, students worked within a group of two students. Their average rating to the "working in groups" question was the lowest among the four areas. 58.62 percent of students either strongly or somewhat agreed that the simulation helped them work more effectively in groups while 34.48% kept a neutral opinion. One possible reason is that as shown in Tables 1 and 2, students in the survey sample had diverse backgrounds, investment profiles, and risk tolerances. It would be challenging for a risk-averse student to work with another student that has a higher level of risk tolerance. Finally, around 80 percent of students viewed this investment simulation as helpful with the rest of the course content. Overall, based on the students' responses, the investment simulation was most helpful for improving their financial information analysis skills and building skills for the job market. The comparatively low ratings for teamwork suggest that there are some improvement opportunities to modify the simulation assignment design.

Table 4:
Behavioral Value: Skill Development in Simulation Exercises

	Mean	Strongly Agree (5)	Somewhat Agree (4)	Neither Agree nor Disagree (3)	Somewhat Disagree (2)	Strongly Disagree (1)
The simulation helped me analyze financial information more effectively	4.33	48.28%	41.38%	10.34%	0.00%	0.00%
The simulation helped me develop skills for the job market	3.98	31.03%	44.83%	20.69%	3.45%	0.00%
The simulation helped me work more effectively in groups	3.84	37.93%	20.69%	34.48%	3.45%	3.45%
Skills developed in the simulation exercises helped me with other parts of the course	4.00	34.48%	44.83%	13.79%	3.45%	3.45%
N = 29						

In addition to the behavioural value of the simulation, the survey also examined the affective value, which involves the students' perception of the simulation. This dimension includes student engagement (Kikot et al., 2013; Lu et al., 2014; Ke et al., 2016), motivation (Lukosch et al.,2016), and satisfaction (Lancaster, 2014; Sarabia-Cobo et al., 2016). Based on these three areas, the survey asked about learning facilitation, class participation in the simulation, choice between lecture-oriented and interactive classes, the satisfaction with learning from the simulation, and satisfaction with performance on the simulation. Similarly to the behavioural value part of the survey, these areas were measured numerically with a 5-point Likert scale. The possible responses on the scale ranged from 1 "Strongly disagree" to 5 "Strongly agree".

The affective value results are presented in Table 5. Learning facilitation and complementing the lecture received the highest average ratings with values of 4.66 and 4.60, respectively. These findings imply that students significantly acknowledged the benefits and the connection between the simulation and lecture content. Specifically, for both areas, over 70 percent of the surveyed strongly agreed with the statements and over 90 percent agreed to some extent.

Table 5:
Affective Value: Students' Attitudes to Simulation Exercises

	Mean	Strongly Agree (5)	Somewhat Agree (4)	Neither Agree nor Disagree (3)	Somewhat Disagree (2)	Strongly Disagree (1)
The simulation works in the course and facilitates learning	4.66	75.86%	17.24%	3.45%	3.45%	0.00%
Classmates actively participated in the simulation	4.47	55.17%	37.93%	6.90%	0.00%	0.00%
The simulation complements lecture materials	4.60	72.41%	20.69%	3.45%	3.45%	0.00%
I would prefer a lecture-oriented to an interactive class	2.57	6.90%	24.14%	17.24%	27.59%	24.14%
I am satisfied with the amount I learned from the simulation	4.31	48.28%	37.93%	13.79%	0.00%	0.00%
I am satisfied with my performance in the simulation exercises	3.57	27.59%	37.93%	10.34%	17.24%	6.90%
N = 29						

Class participation in the simulation and satisfaction with learning from the simulation yielded the second-highest ratings from participants. The average ratings for these two areas were 4.47 and 4.31, respectively. 93.1 percent of the students either strongly or somewhat agreed that "Classmates actively participated in the simulation." The answer distribution for "I am satisfied with the amount I learned from the simulation" was similar. Students generally had a positive perception and attitudes towards the impact of the simulation on learning.

In contrast, only 27.59 percent of participants were strongly satisfied with their own performance on the simulation exercises. This question had an average rating of 3.57. This result is reasonable given that a majority of the class had less than one year of investment experience. They were still in the learning stage, and the trial and error of portfolio selection did not always produce high portfolio performance. The responses about the choice between lecture-oriented and interactive class were distributed among the 5 rating scales. For the statement "I would prefer a lecture-oriented to an interactive class", 31.04 percent agreed overall while 51.73 percent disagreed overall. This result implies that students in the survey sample did not have a clear preference between a lecture-oriented and an interactive class.

The survey concluded with four open-ended questions to explore the students' opinions about the investment simulation exercises. The first question asked about the students' most favorite part of the simulation exercises. The vast majority of the responses were positive and encouraging with one neutral comment, "I liked the investment activities, but I don't like the slow response time on StockTrak." Several students indicated that they liked the real-world application of the simulation without having to risk their own money. For instance, one student noted: "I enjoyed the opportunity to get hands-on experience in the market. It helped me learn about how trading works in the market." The second open-ended question was designed to collect some information on the least favorite parts of the simulation exercises. One stream of complaints was about the simulation platform, which had a 15-minute lag with the actual market. As the result, day trading did not work well on the StockTrak platform.

The third open-ended question compared this simulation-based class with a lecture-based class. 93 percent of the students stated that the simulation-based class was more practical, including such comments as: "I feel like we had the opportunity to learn about the topics through lectures and then get to use them in the simulation. This

helped me further understand each topic." Two students provided neural comments such as: "[I] found this class to be very time-consuming." The last question collected information on the skills students learned from the simulation. Several commonly mentioned skills include risk management, trading different financial assets, research and team-work skills. Overall, the responses to the open-ended questions were overwhelmingly positive and encouraging, suggesting that students not only learned the concepts of investment but also applied the knowledge into practice through the simulation. The overall evidence is consistent with the findings reported in Tables 4 and 5. The simulation assignments created an effective and interactive learning experience for the students.

Conclusion

Simulations in business education are an example of experiential learning that provides the learner with a dynamic, simplified, and realistic model of a business situation. Simulations are interactive by design as they allow learners to manipulate system variables and provide real-time feedback (Prensky, 2001). These characteristics make simulations a potentially powerful tool for improving student engagement and content retention in business courses in general, and finance courses in particular.

Simulations have been used in such wide-ranging areas as computer science (Strycker, 2016), engineering (Chaves et al., 2015), information systems (Ben-Zvi, 2010), languages (Franciosi, 2016), medicine (Dankbaar, 2016), nursing (Sarabia-Cobo, 2016), physics (Adams, 2016), and social sciences (Cózar-Gutiérrez and Sáez-López, 2016). In business education, the effectiveness of simulations was recently examined in management (Azriel et al., 2005; Lin & Tu, 2012), and marketing (Ranchhod, 2014). However, the impact of this method in the finance classroom is not as well documented. This study attempts to fill this gap and describes an implementation of an investment simulation assignment within the finance curriculum in a business school. The empirical analysis in this study uses the educational value model proposed by Anderson and Lawton (2009) as well as Ranchhod et al. (2014) to evaluate the impact of the simulation. The analysis demonstrates a robust positive impact of this integration of simulation on the cognitive, behavioral, and affective measures of educational value in the finance classroom.

The results are encouraging. They suggest that it is possible to replace certain traditional assignments and delivery methods with simulation exercises. The simulation has the potential to improve not only student knowledge and skills, but also the motivation and satisfaction in the course. With proper integration in the course, simulation serves as an effective teaching tool for experiential learning.

References

Adams, D. M., Pilegard, C., & Mayer, R. E. (2016). Evaluating the cognitive consequences of playing portal for a short duration. *Journal of Educational Computing Research*, 54(2), 173-195.

Ahmad, S. M. S., Fauzi, N. F. M., Hashim, A. A., & Zainon, W. (2013). A study on the effectiveness of computer games in teaching and learning. International Journal of Advanced Studies in Computers, Science and Engineering, 2(1), 1.

Anderson, P. & Lawton, L. (2009). Business simulations and cognitive learning: developments, desires and future directions, *Simulation & Gaming*, 40(2), 193–216.

Azriel, J., Erthal, M., & Starr, E. (2005) Answers, Questions, and Deceptions: What is the Role of Games in Business Education? *Journal of Education for Business*, 81(1), 9-13.

Becker, W., & Watts, M. (1995). Teaching tools: Teaching methods in undergraduate economics. *Economic Inquiry*, 33, 692–700.

Becker, W., & Watts, M. (1998). *Teaching economics to undergraduates: Alternatives to chalk and talk*. Cheltenham, UK and Northampton, MA: Edward Elgar.

Bellante, D., & Green, C. A. (2004). Relative risk aversion among the elderly. *Review of Financial Economics*, *13*(3), 269-281.

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.

Bloom, B., Englehart, N., Furst, E., Hill, W. & Krathwohl, D. (1956). *Taxonomy of Educational Objectives: The Classification of Educational Goals, Handbook I: Cognitive Domain*, New York, NY: David McKay.

Carlson, J., & Velenchik, A. (2006). *Using the case method in the economics classroom*. In W. Becker, M. Watts, S. Becker (Eds.). Teaching economics: More alternatives to chalk and talk. Cheltenham, UK and Northampton, MA: Edward Elgar.

Chattopadhyay, S., & Dasgupta, R. (2015). Demographic and Socioeconomic Impact on Risk Attitudes of the Indian Investors-An Empirical Study. *Asian Economic and Financial Review*, *5*(4), 601.

Chaves, R. O., von Wangenheim, C. G., Furtado, J. C., Oliveira, S. R. B., Santos, A., & Favero, E. L. (2015). Experimental evaluation of a serious game for teaching software process modeling. IEEE Transactions on Education, 58(4), 289-296.

Christensen, C., & Hansen, A. (1987). *Teaching and the case method*. Cambridge, MA: Harvard Business School.

Chulkov, D., & Nizovtsev, D. (2012). Rent-A-Car: an integrated team-based case study for managerial economics. *Journal of Business Cases and Applications*, 6, 1-14.

Chulkov, D., & Nizovtsev, D. (2015). Problem-based learning in managerial economics with an integrated case study. *Journal of Economics and Economic Education Research*, 16(1), 188-197.

Collins, A. & Brown, J. (1988). *The computer as a tool for learning through reflection*, in Mandl, H. and Lesgold, A. (Eds.), Learning Issues for Intelligent Tutoring Systems, New York, NY: Springer, 1-18.

Cózar-Gutiérrez, R., & Sáez-López, J. (2016). Game-based learning and gamification in initial teacher training in the social sciences: an experiment with MinecraftEdu. *International Journal of Educational Technology in Higher Education*, 13(1), 2-34.

Dankbaar, M., Alsma, J., Jansen, E., van Merrienboer, J., van Saase, J., & Schuit, S. (2016). An experimental study on the effects of a simulation game on students' clinical cognitive skills and motivation. *Advances in Health Sciences Education*, 21(3), 505-521.

Eckardt, G., Selen, W. & Wynder, M. (2015). Recognising the effects of costing assumptions in educational business simulation games, *e-Journal of Business Education & Scholarship of Teaching*, 9(1), 43-60.

Feinstein, A., Mann, S., & Corsun, D. (2002). Charting the experiential territory: Clarifying definitions and uses of computer simulation, games, and role play. *Journal of Management Development*, 21 (10), 732-744.

Franciosi, S. J. (2016). Acceptability of RPG simulators for foreign language training in Japanese higher education. *Simulation & Gaming*, 47(1), 31-50.

Hakeem S. (2001). Effect of experiential learning in business statistics, *Journal of Education for Business*, 77(7), 95-98.

Hannig, A., Kuth, N., Özman, M., Jonas, S., & Spreckelsen, C. (2012). eMedOffice: A web-based collaborative serious game for teaching optimal design of a medical practice. *BMC medical education*, 12(1), 104.

Hung, W., Jonassen, D., & Liu, R. (2008). *Problem-based learning*. In J. Spector, J. van Merrienboer, M. Driscoll (Eds.) Handbook of research on educational communications and technology, 3rd Ed. New York: Lawrence Erlbaum Associates.

Hyman, R.T. (1978), *Simulation Gaming for Values Education: The Prisoner's Dilemma*, New Brunswick, NJ: University Press of America.

Jones, R., & Bursens, P. (2015). The effects of active learning environments: How simulations trigger affective learning. *European Political Science*, 14, 254-265.

Ke, F., Xie, K., & Xie, Y. (2016). Game-based learning engagement: A theory-and data-driven exploration. *British Journal of Educational Technology*, 47(6), 1183-1201.

Kikot, T., Costa, G., Magalhães, R., & Fernandes, S. (2013). Simulation games as tools for integrative dynamic learning: The case of the management course at the University of Algarve. *Procedia Technology*, 9, 11-21.

Kolb D. (1984). *Experiential Learning: Experience as a source of learning and development*, Prentice-Hall: Englewood Cliffs, NJ.

Lancaster, R. (2014). Serious game simulation as a teaching strategy in pharmacology. *Clinical Simulation in Nursing*, 10(3), e129-e137.

Lin, Y. L., & Tu, Y. Z. (2012). The values of college students in business simulation game: A means-end chain approach. *Computers & Education*, 58(4), 1160-1170.

Lin, Y. L. (2016). Differences among different DGBLs learners. *International Journal of Business and Management*, 11(1), 181.

Lu, J., Hallinger, P., & Showanasai, P. (2014). Simulation-based learning in management education: A longitudinal quasi-experimental evaluation of instructional effectiveness. *Journal of Management Development*, 33(3), 218-244.

Lukosch, H., Kurapati, S., Groen, D., & Verbraeck, A. (2016). Microgames for situated learning: A case study in interdependent planning. *Simulation & Gaming*, 47(3), 346-367.

McClure, R., & Sircar, S. (2008). Quantitative literacy for undergraduate business students in the 21st century. *Journal of Education for Business*, 83(6), 369-374.

Parle, G., & Laing, G. (2017). Investment Portfolio Simulation: An Assessment Task in Finance. *e-Journal of Business Education & Scholarship of Teaching*, 11(1), 118-126.

Prensky, M. (2001). *Digital Game-Based Learning*, New York, NY: McGraw-Hill.

Ranchhod, A., Gurău, C., Loukis, E., & Trivedi, R. (2014). Evaluating the educational effectiveness of simulation games: A value generation model. *Information Sciences*, 264, 75-90.

Sarabia-Cobo, C. M., Alconero-Camarero, A. R., Lavín-Alconero, L., & Ibáñez-Rementería, I. (2016). Assessment of a learning intervention in palliative care based on clinical simulations for nursing students. *Nurse Education Today*, 45, 219-224.

Sauvé, L., Renaud, L., Kaufman, D. & Marquis, J. (2007). Distinguishing between games and simulations: a systematic review, *Educational Technology & Society*, 10(3) 247–256.

Siewiorek, A., Saarinen, E., Lainema, T., & Lehtinen, E. (2012). Learning leadership skills in a simulated business environment. Computers & Education, 58(1), 121-135.

Strycker, J. (2016). Utilizing a Simulation within an Online School Technology Leadership Course. *Online Learning*, 20(1), 130-144.

Towne, D.M., Jong, T. & Spada, H. (Eds) (1993). *Simulation-Based Experiential Learning*, New York, NY: Springer-Verlag.

Watson, J., & McNaughton, M. (2007). Gender differences in risk aversion and expected retirement benefits. *Financial Analysts Journal*, *63*(4), 52-62.

White, B.Y. & Horowitz, P. (1987). *Thinker Tools: Enabling Children to Understand Physical Laws*, Cambridge, MA: Bolt, Beranek & Newman.

Appendix A. Survey Questionnaire

Student Demographic Characteristics

1. Gender: Male, Female
2. Class standing: Freshman, Sophomore, Junior, Senior, Graduate
3. Age: 24 or below 25 or above
4. Major: Please enter your major field

Investment Profile

1. What is your experience of any type with financial investment?
   Less than 1 year 1-5 years 5-10 years more than 10 years

2. What percentage of your savings are you willing to invest in risky assets (such as stocks, bonds, and other financial assets)?
   Less than 10% 10%-30% 30%-50% more than 50%

3. When investing your savings, which of the following financial assets do you prefer?
   - Only safest financial assets, such as savings account or government bond
   - Mostly safe financial assets, such as corporate bonds
   - A balanced combination of safe and risky financial assets
   - Mostly risky financial assets, such as stocks
   - Only the riskiest financial assets, such as financial derivatives, futures and options

Skill Development

1-5 levels: Strongly disagree, disagree, undecided, agree, and strongly agree

1. The simulation helped me analyze financial information more effectively
2. The simulation helped me develop skills for the job market
3. The simulation helped me work more effectively in groups
4. Skills developed in the simulation exercises helped me with other parts of the course

Student Attitudes

1-5 levels: Strongly disagree, disagree, undecided, agree, and strongly agree

1. The simulation is appropriate in the course and facilitates learning
2. Classmates actively participated in the simulation
3. The simulation complements lecture materials
4. I would prefer a more lecture-oriented to an interactive class
5. I am satisfied with the amount I learned from the simulation
6. I am satisfied with my performance in the simulation exercises

Student Opinions

1. What is your most favorite part of the simulation exercises?
2. What is your least favorite part of the simulation exercises?
3. What would you say is the main difference between this simulation-based class and a regular lecture-oriented finance class?
4. Which are the most important skills you developed from the simulation exercises?

Appendix B. Simulation Final Report Grading Rubric

	Points				Points Possible
Introduction (Description of an investment philosophy and an asset allocation plan) Simulation Learning Outcome (LO) 6	Does not give any information about what to expect in the report (2 pts) 0 pts if missing	Gives very little information about what to expect in the report (4 pts)	Gives too much information—more like a summary (7 pts)	Presents a concise lead-in to the report (10 pts)	10 pts
Discuss your portfolio performance LO 1&2&3&4	Analysis is missing from the report (0 pts)	Analysis is very basic, many points are missed and most points are not properly explained (6 pts)	Analysis is sufficient, each point is explained in brief, and some evidence is provided (10 pts)	Analysis is detailed; each point is explained well and evidence is provided. Tables and graphs are included. (15 pts)	15 pts
Efforts to diversify the portfolio (including stocks, bonds, mutual funds, options, futures, attempts to short sell and trade foreign stocks) LO 1&3	Analysis is missing from the report (0 pts)	Analysis is very basic, many points are missed and most points not properly explained (6 pts)	Analysis is sufficient, each point is explained in brief, and some evidence is provided (10 pts)	Analysis is detailed; each point is explained well and evidence is provided. Tables and graphs are included. Transaction information is detailed. (15 pts)	15 pts
Justifies the reasons for your trades from a portfolio perspective LO 3&4	Analysis is missing from the report (0 pts)	Analysis is very basic, many points are missed and most points not properly explained (6 pts)	Analysis is sufficient, each point is explained in brief, and some evidence is provided (10 pts)	Analysis is detailed; each point is explained in detail and evidence provided. Tables and graphs are included. (15 pts)	15 pts
Macroeconomic, financial, and stock-specific news events LO 5	Analysis is missing from the report (0 pts)	Analysis is very basic, many points are missed and most points not properly explained (6 pts)	Analysis is sufficient, each point is explained in brief, and some evidence is provided (10 pts)	Analysis is detailed; each point is explained in detail and evidence is provided (15 pts)	15 pts
Conclusion LO 6	Missing from the report (0 pts)	Analysis is very basic, many points are missed and most points not	Analysis is sufficient, each point is explained in brief, and some	Analysis is detailed; each point is explained in detail and evidence is	10 pts

		properly explained (4 pts)	evidence is provided (7 pts)	provided (10 pts)	
Grammar & Spelling LO 6	Report has many spelling and punctuation errors. Numerous grammatical errors exist and impede meaning. (2 pts)	Report has some spelling or punctuation errors. Some grammatical errors exist but generally do not impede meaning. (4 pts)	Report has a few spelling or punctuation errors. Few grammatical errors exist and do not impede meaning (7 pts)	Report has no spelling or punctuation errors. Very few grammatical errors exist. (10 pts)	10 pts
Report Format LO 6	Report does not follow the required format (0 pts)	Report follows some guidelines (4 pts)	Report follows most of guidelines (7 pts)	Report follows all guidelines and is professional (10 pts)	10 pts
				Total	