The Stock Market Game™ Study
Final Report

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EXECUTIVE SUMMARY

The Stock Market Game™ is an educational program supported by the Securities Industry and Financial Markets Association (SIFMA) Foundation for Investor Education. The program is designed to teach students the importance of saving and investing through building their financial literacy skills. Students manage fantasy investments online, competing against other individuals and teams both in their classroom and around the world. To supplement the hands-on game play, The Stock Market Game provides teachers with a series of unit-based lessons to assist with student learning.

The FINRA Investor Education Foundation made a grant to Learning Point Associates to conduct a study of the impact of the game on students and teachers. Specifically, the study was designed to answer four research questions:

1. What is the impact of The Stock Market Game on academic achievement in mathematics for students in Grades 4–10?
2. What is the impact of The Stock Market Game on investment knowledge for students in Grades 4–10?
3. How do teachers implement The Stock Market Game?
4. What is the effect of The Stock Market Game on teacher investment practices?

Methodology

During the 2008–09 school year, Learning Point Associates conducted a randomized controlled trial (RCT) and surveyed teachers of The Stock Market Game nationwide. The RCT examined the causal impact of playing the 10- or 15-week versions of The Stock Market Game on student mathematics achievement and investor knowledge. The nationwide survey provided information on implementation of the game and teacher investment practices. Prior to the study, data-collection instruments were developed, administered, psychometrically evaluated, and, where appropriate, revised. After implementation of the RCT, final data were analyzed (1) psychometrically to create summarized scale scores and (2) statistically using hierarchical linear modeling to measure program impact and implementation.

Study Instruments

Four types of instruments were developed for the study. These instruments included several age-appropriate student versions.

- Mathematics test (Grades 4–6, Grades 7–10)
- Investor knowledge test (Grades 4–5, Grades 6–8, and Grades 9–10)
- Student survey (Grades 4–6, Grades 7–10)
- Teacher survey

The mathematics and investor knowledge tests included pretest and posttest versions, administered before and after a 10- to 15-week game session. The mathematics tests were built from publicly available items from the National Assessment of Educational Progress (NAEP) and assessed concepts related to the content of The Stock Market Game. The investor knowledge tests were developed with the help of experts in the area of testing financial literacy and aligned to the curriculum content of The Stock Market Game.

The student surveys were designed to measure students' engagement with the game, how much students enjoyed and learned from interacting with each other, their development of financial life skills, and the application of student learning outside the classroom.

The teacher survey was designed to measure how teachers implemented the game and to provide a profile of teacher investment practices. Measurement of the game's implementation focused on teacher classroom activities, use and helpfulness of game-related materials, and whether teachers connected the game to events in the outside world. Measurement of teacher investment practices focused on the influence of teaching The Stock Market Game on engaging in financial planning, conducting financial research, and using investment products and services.

Sample

In the months before the study, teachers who were currently registered for The Stock Market Game for the upcoming school year or who had previously registered were invited to participate in the RCT. Approximately 1,200 teachers signed up to participate. Of these, 823 teachers were selected to be a part of the study (based on the grades they would be teaching and the length of the game session). Approximately half the sample was randomly assigned to use The Stock Market Game in their classrooms in the fall of 2008 (the treatment group), and the other half was assigned not to use the program (the control group). Not all 823 teachers participated in the study; 568 teachers confirmed participation (296 treatment and 272 control).

Of the 568 teachers who confirmed participation in the study, 555 submitted student test data. For the investor knowledge test, 522 submitted data (269 treatment and 253 control); for the mathematics test, 509 submitted test data (265 treatment and 244 control). In addition, 187 treatment classrooms submitted student survey data (the student survey was not requested of control classrooms).

All teachers who have registered for The Stock Market Game were invited to take the teacher survey. Approximately 11,800 teachers were invited, and 4,804 teachers completed the survey (including responses from 230 treatment teachers and 229 control teachers).

Study Results

The study of The Stock Market Game and the nationwide administration of the teacher survey: yielded findings on the following measures:

- The impact of the program on student achievement

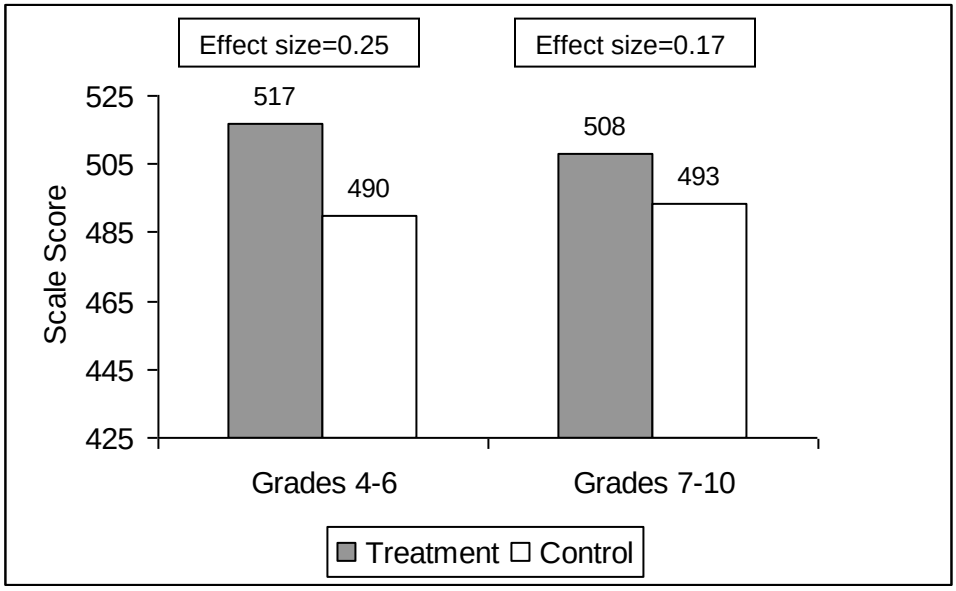
- Student experiences playing the game as well the effect of those experiences on their academic achievement
- Teacher implementation of the program and the effect of implementation on student learning
- Teacher perceptions of the effect of teaching the game on their own investment practices

Impact on Student Achievement

Overall, results from the RCT showed that students who played The Stock Market Game significantly outperformed students who did not play the game on both the mathematics and investor knowledge tests.

Mathematics achievement was analyzed separately for students in Grades 4–6 and students in Grades 7–10.[1] For students in Grades 4–6, those in the treatment group scored approximately 27 points higher than those in the control group. This difference is equivalent to an effect size of 0.25, with a confidence interval ranging from 0.11 to 0.40. For students in Grades 7–10, the treatment group scored approximately 15 points higher than the control group. This difference is equivalent to an effect size of 0.17, with a confidence interval ranging from 0.02 to 0.32.

Figure 1. Average Score on Mathematics Tests for Treatment and Control Groups

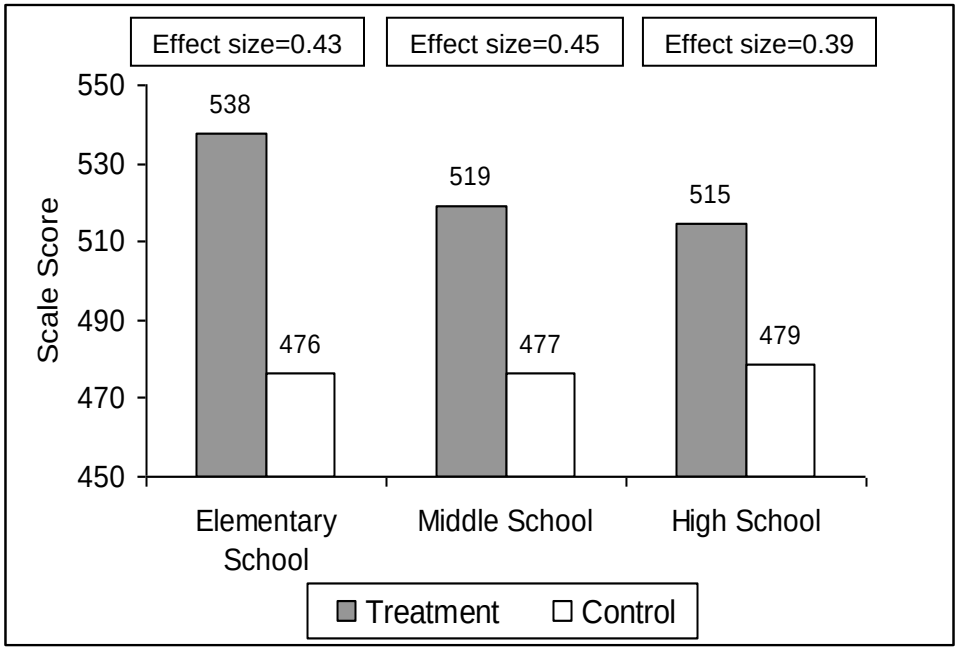


Analysis of students' investor knowledge was carried out separately for students in Grades 4–5 (elementary school), 6–8 (middle school) and 9–10 (high school). For students in

[1] Several modeling approaches were used in order to support the findings from the treatment-on-the-treated model. See full report for details.

elementary school, the treatment group scored approximately 62 points higher than the control group, corresponding to an effect size of 0.43 with a confidence interval ranging from 0.24 to 0.61. For students in middle school, the treatment group scored approximately 42 points higher than the control group, corresponding to an effect size of 0.45 with a confidence interval ranging from 0.29 to 0.60. For students in high school, the treatment group scored approximately 36 points higher than the control group, corresponding to an effect size of 0.39 with a confidence interval ranging from 0.16 to 0.62.

Figure 2. Average Scores on Investor Knowledge Tests for Treatment and Control Groups



Student Experiences

Most students reported that they enjoyed, and learned from, playing The Stock Market Game. Students reported that playing on a team during The Stock Market Game was a positive experience that led to improvement of educationally relevant skills, such as conflict resolution, communication, and the development of financial life skills. Some students also reported engaging in activities outside the class that related to topics covered by the game.

More than 75 percent of students reported that they enjoyed playing The Stock Market Game and that they enjoyed specific activities, such as selecting companies to invest in and trading stocks on the computer. Most students also reported that they enjoyed playing on a team and that playing led to the development of other skills such as better communication, compromise, and conflict resolution. More than half the students agreed that playing The Stock Market Game influenced them to think more about budgeting and financial planning. Some students also reported taking the experience of The Stock Market Game outside the classroom, such as by talking to friends and parents about the game and watching television programs containing financial content.

Looking at student experience in relation to student learning yielded some interesting results. Middle and high school students who reported greater engagement with the game tended to have higher scores on the investor knowledge tests than students who were less engaged with the game. This was not true, however, for elementary students. Students in middle and high school who reported more enjoyment and learning from interactions with their team members and classmates tended to have lower investor knowledge scores. There were no significant relationships between student experience with the program and performance on mathematics assessments.

Teacher Implementation

To implement the program, most teachers used basic teaching practices that are easy to incorporate into daily classroom activities. More than half the teachers surveyed reported using typical classroom activities such as introducing basic concepts, using worksheets, and discussing current events and careers related to the stock market. In addition, some teacher reported using more advanced activities such as playing the game with students, assigning game-related projects, inviting guest speakers to class, and taking field trips with the students.

Greater teacher implementation of The Stock Market Game had minimal relationship with scores on the mathematics assessment; greater implementation was, however, associated with higher investor knowledge scores for middle school students. In addition, several measures of the more specific elements of teacher implementation were related to greater student learning.

Teaching The Stock Market Game with a greater breadth and depth of practices was found to be related to the following experiences for the younger students: stronger engagement with the game; stronger positive interactions with classmates; and greater extension of learning beyond the classroom. In addition, teaching The Stock Market Game with more advanced methods of linking the game to outside resources was important to the experiences of older students, leading to greater extension of learning beyond the classroom.

Teacher Investment Practices

Overall, more than half the teachers surveyed reported engaging in financial planning practices, conducting financial research, and using investment products and services. For some of these teachers, The Stock Market Game influenced these practices.

At least 75 percent of teachers reported engaging in financial planning practices (e.g., setting financial goals and analyzing their risk tolerance), and more than half the teachers reported conducting financial research (e.g., reading the business section of the newspaper and subscribing to a financial magazine) and using investment products and services (e.g., opening an investment account and investing in the stock market). For all the activities related to financial practices, research, and products, between 28 and 62 percent of teachers reported The Stock Market Game had a moderate or major influence on their doing so.

INTRODUCTION

Learning Point Associates was awarded a grant by the Financial Industry Regulatory Authority (FINRA) Investor Education Foundation[2] to conduct a study of the effect of The Stock Market Game on students and teachers. This report details this study by first giving a brief description of The Stock Market Game, then a discussion of the study methodology and the findings.

The Stock Market Game™

The Stock Market Game is an educational program supported by the Securities Industry and Financial Markets Association (SIFMA) Foundation for Investor Education.[3] The program is designed to teach students the importance of saving and investing by building their financial literacy skills. It is currently in use in all 50 states in North America and around the world and has been played by more than 11.5 million students.

The Stock Market Game centers on teams of students managing real-time virtual (Internet-based) investments. Students use research and program-provided news updates to invest a hypothetical $100,000 in a portfolio, which simulates the results of their investments as though it were in the real marketplace. The program offers several game sessions in the fall and spring of each school year, most of which are 10 to 15 weeks in duration, with some that run for the full academic year. During these sessions, students compete with teams in their classroom and teams in their states to increase the value of their portfolio. This competition adds to the appeal of the program for many students as well as provides the opportunity to build interpersonal skills, such as leadership and negotiation.

To supplement teaching about the stock market, saving, and investing, the program provides teachers with a series of unit-based lessons. The lessons build on four units: (1) Before You Invest, (2) Selecting Your Investments, (3) Tracking Your Investments, and (4) At the End of the Trading Session. Composing the units are 12 core lessons covering essential financial and investment topics, including company, stock, ticker, and risk. Each of these lessons is designed to provide students with the skills and knowledge that will enable them to be smart future consumers in the savings and investment markets. In addition to the core lessons, the program provides noncore lessons and projects, which allow teachers to extend the program beyond the basic implementation.

The Stock Market Game also allows for teachers to differentiate the program according to the needs and ability levels of their students. The 12 core lessons are available for various educational and developmental levels. There are four age levels of lessons:

[2] Grant number 2007-06-017.

[3] The Stock Market Game was originally overseen by the Foundation for Investor Education, which in 2007 merged with The Bond Market Foundation and the New York District Economic Education Foundation to form the SIFMA Foundation.

- Elementary school (Grades 4–5)
- Middle school (Grades 6–8)
- High school (Grades 9–12)
- Postsecondary

Teachers of all subjects—including mathematics, social studies, and language arts—use the game, supplementing their course material with a real-world application of the skills they are teaching. Although all the core lessons are designed to be used in any course, students playing The Stock Market Game in a mathematics class may require different instruction from students playing in an economics class. Adaptation is made possible through additional activities and projects (such as *Math Behind the Market*) tailored to the type of course in which the game is to be employed.

Research Questions

The four research questions addressed by this study can be conceptualized in terms of various degrees of expectation.

One expectation of a supplemental education program is that it will improve students' understanding of program-related content and student performance on related assessments. For that reason, it was expected that students who play The Stock Market Game would improve their knowledge of topics related to savings and investing. In addition, a review of program content revealed the mathematical nature of The Stock Market Game, leading to another possible expectation related to student performance. Namely, could the mathematical component of the program material be strong enough to affect students' mathematics skills?

Beyond program effect on student performance, the study also aimed at uncovering the multiple facets of teacher implementation. This was done by investigating not only the degree of teacher implementation but the wide array of teaching practices used to educate students about the content of the game.

Student experiences were also considered important to understanding this program. Anecdotal reports indicated that students enjoy playing this game, but could there be any educational relevance beyond the program content? Specifically, could working with teams, researching stocks, or reviewing investment portfolios have any additional educational benefit to students?

In thinking through the possible effect of this 15-week supplemental program, another question surfaced. Although the game is intended to teach students about savings and investing, could teaching about savings and investing have an effect on *teachers*? Could teaching students about savings and investing actually lead to the development of better investment practices of teachers?

Therefore, this study, which began in the fall of 2007 and ended in the spring of 2009, was designed to answer the following four research questions:

1. What is the impact of The Stock Market Game on student academic achievement in mathematics for students in Grades 4–10?
2. What is the impact of The Stock Market Game on student investor knowledge for students in Grades 4–10?
3. How do teachers implement The Stock Market Game?
4. What is the effect of The Stock Market Game on teacher investment practices?

STUDY METHODOLOGY

The study of The Stock Market Game consisted of two components: a randomized controlled trial (RCT) and a nationwide administration of a survey to teachers. Before carrying out the RCT and administering surveys, instruments were piloted in the spring of 2008 to test, revise, and finalize study instruments, as well as to refine logistics related to study implementation. Information on the pilot phase is in *The Stock Market Game Study Interim Report*, submitted to the FINRA Foundation in September 2008. The interim report details the activities undertaken prior to carrying out the RCT and administering the teacher survey.

The Randomized Controlled Trial

The RCT component of this study began in the spring of 2008 with participant recruitment and the actual study trial itself occurred in the first academic semester of the 2008–09 school year. The purpose was to conduct a study in which causal statements about the impact of playing The Stock Market Game on student achievement can be made. To measure achievement, two tests were developed: a mathematics tests and an investor knowledge test.[4]

RCT Sample

Power analysis indicated that 120 classrooms (60 treatment and 60 control) per test would be needed to detect an effect size of 0.2.[5] In order to recruit participants, the research team designed and established a Web-based study sign-up page, and all teachers in the SIFMA Foundation registration database were invited to sign up. This sign-up webpage indicated only that teachers who signed up would be considered for the study; it did not indicate that teachers would participate in the study. In addition, the research team conducted a webinar for the local state coordinators of The Stock Market Game outlining the research design and study requirements and spoke at their annual coordinator convention.

Approximately 1,200 teachers signed up to participate in the study. Of these, 823 met the eligibility requirements (i.e., teaching the 15-week game and having students in Grades 4–10) and were selected to be a part of the study. There were 406 classrooms that were randomly assigned to play The Stock Market Game (the treatment group) and 417 were assigned not to play (the control group). Not all teachers assigned actually participated in

[4] To ensure that the tests were age appropriate, five versions of these tests were developed: two versions of the mathematics test and three versions of the investor knowledge test. See Data-Collection Instruments section in this report.

[5] Power was set to 0.8 with the following assumptions: intraclass correlation = 0.10; 25 students per class; alpha = 0.05.

the study.[6] Of the 823 who were assigned, 568 teachers confirmed participation (296 treatment and 272 control).

Of these 568 teachers, 555 teachers submitted student test data. There were 522 classrooms that provided student test data for the investor knowledge test (269 treatment, 253 control) and 509 classrooms that provided student test data for the mathematics tests (265 treatment, 244 control). Table 1 summarizes recruitment and participation in the RCT.

Table 1. Summary of RCT Recruitment and Participation

Group	Recruited	Confirmed	Participated	
			Mathematics	Investor Knowledge
Treatment	406	296	265 65% of recruited 90% of confirmed	269 66% of recruited 91% of confirmed
Control	417	272	244 59% of recruited 90% of confirmed	253 61% of recruited 93% of confirmed

Student Survey Sample

In addition, 2,731 students in 187 treatment classrooms responded to the student survey. These data were not used in estimation of the impact of playing The Stock Market Game on student achievement, however; they were used to provide insight into how students experience the game.

The Nationwide Teacher Survey

Teachers who participated in the RCT as well as all other teachers who taught the game between winter of 2007 and fall 2008 were invited to complete the survey. The survey addressed two areas: implementation of the game and teacher investment practices (including teachers' perceptions of the effect of the game on those practices). Data from this component of the study provided formative insights to the SIFMA Foundation and the FINRA Foundation on how teachers are actually implementing this longstanding program nationwide. It also provided teachers' perceptions of the effect that playing the game has had on teacher investment practices.

[6] The exact reason for electing not to participate was not obtained from all teachers. Some common reasons for dropping out of the study, however, were a change in the teacher's class scheduling or a misunderstanding of the requirements of the study (e.g., teachers thought the students could play the game as long as the teacher did not engage in any instruction about the game).

Teacher Survey Sample

The nationwide survey was sent to 12,381 teachers. There were 4,804 surveys completed (and electronically submitted) representing a 39 percent response rate. These responses included 230 treatment teachers and 229 control teachers.

Data-Collection Instruments

Prior to the RCT and nationwide administration of the teacher survey, instruments were designed, pilot-study participants were recruited, pilot data were collected, psychometric functioning of the instruments was explored, and instruments were finalized.

To answer the research questions, six key instruments were created with various versions designed to be age- (or condition-) appropriate. Table 2 lists these instruments.

Table 2. Instruments Developed for the Study of The Stock Market Game

Instrument	Version
Mathematics pretest and posttest	Grades 4–6
	Grades 7–10
Investor knowledge pretest and posttest	Grades 4–5 (elementary school)
	Grades 6–8 (middle school)
	Grades 9–10 (high school)
Student survey	Grades 4–6
	Grades 7–10
Teacher survey	RCT
	Nationwide

The following sections detail the process of instrument development and describe the investor knowledge, mathematics, student survey, and teacher survey instruments.

Overview of Instrument Development

Instrument development involved four steps: designing the instruments, collecting pilot data, evaluating how the instruments functioned through psychometric modeling, and creating final instruments. This section summarizes these steps; for more detailed information about instrument development, please refer to *The Stock Market Game Interim Report*, submitted to the FINRA Foundation in September 2008.

DESIGN OF INSTRUMENTS

All instruments went through a similar design process. Items were either gathered from outside sources or written by members of the research team. The mathematics items were taken from publicly available NAEP (National Assessment of Educational Progress)[7] tests, and the investor knowledge test items were newly developed by outside experts in the area of financial literacy (details follow). These items were then categorized according to the topic that they measured, with these categorizations being represented in blueprints. Instruments were then assembled (e.g., items and response scales selected) and reviewed. After extensive review by internal team members and outside consultants, instruments were built for online administration, reviewed again, and made available to teachers and to students.

Blueprints. To ensure accurate measurement of constructs, blueprints were created for each assessment and survey. A blueprint is a document showing the alignment of the test or survey items to their respective constructs. Constructs are latent traits that are not directly measurable with one test item or survey question. For example, *learning* about fluctuation in stock prices or *interest level* in playing The Stock Market Game are considered *constructs.* Measurement of these constructs requires an analysis of response data from several items related to those constructs. The specifics of the various alignment techniques are discussed in each instrument design section in this report.

Review. The investor knowledge tests were reviewed by staff from two financial education organizations (the FINRA Foundation and the SIFMA Foundation). In addition, the mathematics tests were reviewed by two external consultants contracted by Learning Point Associates. Last, the psychometric analyses were reviewed by an outside consultant, also contracted by Learning Point Associates, who is considered an expert in the field of psychometrics.[8]

Test Instructions and Sample Test Items. All versions of the investor knowledge and mathematics assessments included identical test instructions and sample test items. The two versions of the student surveys included the same set of survey instructions.

Development of Online Assessments. The electronic productions group at Learning Point Associates created online versions of all assessments and surveys. The research team worked to ensure the assessments were user-friendly, as well as accurate and functioning within the online environment. Before administration, team members reviewed items for accuracy and reviewed Web pages for functionality. In addition, data collection was tested by responding to the items and reviewing the data files for analytic usability. Areas needing adjustment were communicated to the electronic productions group, and the review process was repeated for each additional version until the final versions were completed.

[7] For more information, visit the Institute of Education Sciences National Center for Education Statistics at http://nces.ed.gov/nationsreportcard/mathematics/contentareas2005.asp.

[8] Ellen Viruleg and Larry Osthus served as consultants on the development of the mathematics tests, and Everett Smith, Ph.D., served as a consultant on psychometric analyses.

Collecting Pilot Data

Throughout the spring of 2008, 81 teachers and their students completed study instruments. Classrooms were assigned to complete one type of instrument (e.g., the investor knowledge test) in order to reduce the burden on these classrooms. Nearly 60 percent of teachers who agreed to participate in this phase of the study administered all the requested instruments. In addition, almost 88 percent of participating teachers administered at least one of the requested instruments. All teachers were asked to complete the teacher survey. Of the 81 participating teachers, 68 percent (55 teachers) completed the survey.

Psychometric Evaluation of the Study Instruments

Psychometric analysis was conducted to examine the reliability and validity of the construct(s) measured by the instrument. Overall, results indicated that tests and surveys functioned well psychometrically, but some instruments required minor revisions. These revisions are briefly discussed in the following section.

Creating Final Instruments

Both versions of the mathematics pretests and posttests functioned well psychometrically. Students who took the Grades 4–6 mathematics pre- and posttests performed particularly well. Therefore, the difficulty of these tests was increased to ensure that the instrument would measure student growth and differentiate across respondents.

The investor knowledge tests also functioned well. Since these were new items, never used by students before, the pilot provided information about the relative difficulty of these items. Using this information, items were reordered according to level of difficulty. In addition, slight adjustments were made to a few test items in response to the psychometric analysis and expert review of the tests.

The results from the psychometric analyses showed that both versions of the surveys (i.e., the versions for the younger and older students) measured constructs effectively. To improve functioning of the surveys, some items were removed and some items, although not functioning well within a construct, remained. Furthermore, six new items were added to the survey designed for the younger students to increase reliability.

In addition to these instrument-specific changes, one change was made to all tests with regard to student motivation. When pilot teachers viewed the final assessment results, several raised concerns that student motivation to put forth their best effort on the test was low, resulting in lower test scores than expected. As with any low-stakes assessment, ensuring that students try their hardest, especially in the upper grades, remains a challenge. Therefore, new wording was added to the test instructions reminding students of the importance of trying to do their best.

Mathematics Tests

Mathematics tests were compiled using publicly available mathematics items from the National Assessment of Educational Progress (NAEP). For this study, a pretest and a posttest were created for each of two grade ranges: Grades 4–6 and Grades 7–10. For the

Grades 4–6 tests, items were selected from NAEP Grade 4 and Grade 8 items. For the Grades 7–10 tests, items were selected from the Grade 8 NAEP items. Item banks for all tests were developed using items from the 2003 and 2005 NAEP assessments.

Items from NAEP were selected only if they aligned with the mathematical concepts addressed by The Stock Market Game curriculum. To do this, the research team extensively reviewed the SIFMA Foundation–created mathematics program, *Math Behind the Market.* This text is a supplemental program designed to assist teachers on how to include more mathematics-related material when teaching The Stock Market Game. After review of the content covered in *Math Behind the Market*, and content areas covered by NAEP, items considered for the mathematics tests were selected from each of the following three categories.[9]

- *Number Properties and Operations.* The ability to make sense of numbers and to use numbers to solve problems. Grade 4 items focus on whole numbers and fractions; the Grade 8 exam also includes items on rational numbers.
- *Data Analysis and Probability.* The ability to understand, use, and communicate about data, including data representation, data sets, sampling, and probability. The Grade 4 test includes items on statistical measures (e.g., median and mean) and the comparison of data sets. The Grade 8 test adds items relating to other concepts, such as sampling and bias.
- *Algebra (for 7–10 test only)***.** The understanding and communication of algebraic concepts, including patterns, variables, representations, and equations. Items ask students to recognize simple patterns and expressions, as well as comprehend linear equations.

Items were grouped into three difficulty levels based on the percentage of students who answered the item correctly during nationwide administrations of the NAEP assessments. Items categorized as basic were answered correctly by at least 80 percent of students, moderate items were those answered correctly by 41 percent to 79 percent of students, and advanced items were those answered correctly by less than 40 percent of students.

The distributions of test items according to difficulty categorization and content areas are presented in Tables 3 and 4.

[9] Two additional content areas are covered by NAEP: Measurement and Geometry. These areas were not covered by the tests created for this study.

Table 3. Percentage of Difficulty Levels Represented in Newly Created Mathematics Item Banks (Grades 4–6)

NAEP Content Area	Test for Grades 4–6				
	Basic (Grade 4)	Moderate (Grade 4)	Advanced (Grade 4)	Basic (Grade 8)	Moderate (Grade 8)
Number properties and operations	0.0%	36.7%	6.7%	10.0%	36.7%
Data analysis and probability	3.3%	23.3%	6.7%	13.3%	23.3%
Algebra	—	—	—	—	—
Total	3.3%	60.0%	13.3%	23.3%	60.0%

Table 4. Percentage of Difficulty Levels Represented in Newly Created Mathematics Item Banks (Grades 7–10)

NAEP Content Area	Test for Grades 7–10		
	Basic (Grade 8)	Moderate (Grade 8)	Advanced (Grade 8)
Number properties and operations	5.0%	10.0%	5.0%
Data analysis and probability	10.0%	20.0%	10.0%
Algebra	10.0%	20.0%	10.0%
Total	25.0%	50.0%	25.0%

Planning for a total of 30 items in the Grades 4–6 test and 40 items in the Grades 7–10 test, final items were selected using a stratified sampling approach, and enough items were randomly selected within each of the content areas and difficulty levels to fulfill the desired distributions. For example, basic items covering data analysis and probability represented 10 percent of the Grades 7–10 test, so four items were randomly selected from that category. In order to compare performance between the pretests and posttests, for both the Grades 4–6 and the Grades 7–10 tests, 50 percent of the items on the posttest were repeat items from the pretest.

Investor Knowledge Tests

The investor knowledge tests were aligned to the curriculum structure of The Stock Market Game with a pretest and a posttest for students in the following groups: elementary school (Grades 4–5), middle school (Grades 6–8), and high school (Grades 9–12). The SIFMA Foundation contracted with several testing experts to create three sets of 50 to 60 multiple-choice test items for each of these groups. Items measured the following four subject areas of The Stock Market Game curriculum:

- *Economic concepts:* general investor knowledge items about economic principles and the stock market, such as identifying the three major U.S. stock exchanges

- *Investment strategies:* strategies investors use to select stocks, such as diversifying a portfolio
- *Investor research:* skills and tools investors use to learn about stocks and market performance, such as reading a stock table
- *Calculations:* information about the ways in which investors determine the financial inputs and outputs of purchasing stock, such as calculating the price/earnings ratio

The percentage of test items that corresponded to the four subject areas is presented in Table 5.

Table 5. Percentage of Subject Area Represented by the Investor Knowledge Tests*

Subject Area of The Stock Market Game	Elementary School	Middle School	High School
Economic concepts	28%	20%	18%
Investment strategies	43%	50%	48%
Investor research	18%	24%	23%
Calculations	10%	6%	13%
Total number of items	30	35	40

**Note: the percentages represent the average percentage between the pretest and the posttest*

All items were edited to follow test-development standards (such as alphabetizing answer choices) and to ensure that they were appropriately aligned to the cognitive abilities of the students at each grade level.

Items were selected using a stratified random sampling approach. That is, the calculated numbers of items were randomly selected from each of the four areas. After the first selection, a handful of items were removed because of extensive similarity in wording among selected items, and replacements were randomly selected from the remaining unselected items. Approximately half the items used in the posttests were identical to those used on the pretests, and the other half consisted of new items drawn from the original item banks.

Student Surveys

Student enjoyment of and reactions to The Stock Market Game were measured using one of two versions of a newly developed survey. Because of developmental and intellectual differences between students of different ages, two versions of the survey were created. One version was for students in Grades 4–6; the other was for students in Grades 7–10. Each survey consisted of approximately 25 items, the version for the older students being slightly longer.

The survey items were written specifically for this study, using guidance from the SIFMA Foundation to identify areas of particular relevance to The Stock Market Game, such as

interaction with team members. The final survey measured four constructs of interest: engagement with the game; interaction with others; financial life skills,[10] and beyond the classroom, as follows:

*Engagement with the game***.** This construct measured how much students enjoyed playing The Stock Market Game overall. For this construct, students were asked questions related to how much they enjoyed various aspects of the game, such as lessons or working on the computer, and how much students thought they learned from various aspects of the game.

*Interaction with others***.** This construct measured how much students enjoyed interacting with others while playing The Stock Market Game and whether they felt they developed their interpersonal skills through those interactions. Students shared their opinions on several topics, including whether they liked working on a team, whether they liked competing against others, and how much they developed skills such as communication, compromise, and conflict resolution while working with their team.

*Financial life skills***.** This construct measured students' consideration of topics and development of financial skills traditionally needed in adulthood. Students reflected on how much The Stock Market Game encouraged them to think about and develop skills such as budgeting, careful spending, and making presentations, as well as future plans to invest in the stock market.

*Beyond the classroom***.** This construct measured how much students thought about the game concepts outside class. Students reported on game-related activities when not in class or at school, such as talking about the stock market with their parents, thinking about the stock market outside the classroom, and accessing financial media (such as newspapers and finance-related television programs) while at home.

The distribution of survey items across the four constructs for both surveys is presented in Table 6.

[10] The survey for the younger students did not contain enough questions for the measurement of a financial life skills construct. Reporting for this trait is reported at the item level.

Table 6. Distribution of Items Across Constructs for the Student Surveys

Construct	Student Survey Grades 4–6)	Student Survey (Grades 7–10)
Engagement with the game	30.8%	33.3%
Interaction with others	34.6%	25.9%
Financial skills	11.5%	14.8%
Beyond the classroom	23.1%	25.9%
Total number of items	*26*	*27*

The language and content of items differed between the two versions. For example, the survey questions for younger students on the effect of The Stock Market Game on leadership ability were worded to ask about the *use* of that skill *during* the game whereas in the survey for older students, questions were worded to ask about the *development* of that skill *as a result* of playing the game.

The language of the response options also varied with the age of the students. In order to assist younger students in the use of an agreement rating scale, the wording of the response options was simplified. Table 7 compares the response options that were given to the two groups of students.

Table 7. Response Options on Student Surveys

Grade 4–6	Grade 7–10
Really agree	Strongly agree
Agree	Agree
Disagree	Disagree
Really disagree	Strongly disagree

Items were grouped by topic to ease students' thought processes while answering. For example, items on competition were grouped together so that students would be contemplating the idea of competition only once while taking the survey.

Finally, demographic items were included to capture student characteristics that might affect enjoyment of the game or academic performance. Examples include gender and whether the student had played The Stock Market Game before.

Teacher Survey

The teacher survey was organized into two sections: (1) Implementation of The Stock Market Game and (2) Program Effect on Financial Practices. Descriptions follow.

Two versions of the teacher survey were created because there were two groups completing the survey: (1) teachers participating in the RCT and (2) teachers not participating in the

RCT who had taught The Stock Market Game in the previous year. Of the 83 possible items, teachers in the two groups answered 75 identical items. RCT teachers responded to an additional six items used to capture implementation issues and non-RCT teachers answered two additional screening items to determine their eligibility to complete the survey.

The survey also included demographic items to capture teacher, classroom, and school characteristics that may affect implementation or investment practices. The demographic questions were the following:

- *Class subject*—for example, business, nonbusiness
- *Experience with the program*—first time teaching, taught 2–5 times, taught 6 times or more
- *Years of experience teaching*—1–2 years, 3–5 years, 6 or more years
- *Locale*—rural, urban, suburban
- *Grade level*—elementary (Grades 4–5), middle (Grades 7–8), and high (Grades 9–10)

Implementation of The Stock Market Game

SIFMA Foundation curriculum experts created a list of possible implementation practices of teachers using The Stock Market Game. To capture the wide variation in program implementation, these practices fell into the following three categories:

- *Must-haves:* practices any teacher must do in order to implement the program, such as provide access to computers
- *Should-haves:* practices teachers should do to implement the program well, such as use the core lessons provided by the program
- *Extras:* practices teachers would do to go above and beyond the expected implementation, such as take students on program-related field trips

Through conversations with SIFMA Foundation representatives and exploration of The Stock Market Game curriculum, implementation practices were further refined for development into survey items. Three constructs of interest were identified: activities in the classroom, materials created by The Stock Market Game, and connections to outside resources, as follows:

Activities in the Classroom. This construct measured the use of teaching practices and activities to teach The Stock Market Game, such as teaching specific concepts, developing their own assessments, assigning students grades for program activities, and encouraging or requiring student participation in InvestWrite.[11]

[11] InvestWrite is a writing program teachers may use to complement and reinforce the concepts taught in The Stock Market Game. In the program, students use their knowledge about the financial sector and their critical thinking skills to compose essays addressing various topics. The essay assignments are tied to several lessons for The Stock

Materials Created by The Stock Market Game. This construct measured the use and helpfulness of specific resources created by The Stock Market Game for implementing the program, such as lessons, worksheets, publications, and projects.

Connections to Outside Resources. This construct measured the use of practices to connect the game to people and activities outside the classroom, such as connecting the program to current events, discussing careers in the stock market and the financial sector, organizing field trips, and arranging for guest speakers.

Each of these three constructs measured three different types of implementation, and combining the items from the three constructs formed an overall measure of implementation. In total, 37 survey items were created to measure implementation. The final distributions across the constructs are detailed in Table 8.

Table 8. Distribution of Survey Items Across Implementation Constructs

Implementation Constructs	Percentage of Items
Materials Created by SIFMA Fdn.	37.8%
Activities in the classroom.	35.1%
Connections to outside resources	27.0%
Total number of items	*37*

Response options for the teacher survey fell into one of three types. Some items had a yes/no scale to indicate use of various teaching practices. Of these items, two related to the use of teams and also included the option, "*My students did not play on teams*." Other items had a four-point scale for teachers to indicate the frequency of their use of materials and practices, including the following:

- Almost all of the time
- Regularly, but not all of the time
- Some of the time
- Not at all

Finally, some items (most of those pertaining to lessons and materials created by The Stock Market Game) had a five-point scale for teachers to indicate use and rate helpfulness, including the following:

- Did not use

Market Game and can be used as in-class activities as well as homework assignments. Teachers and students can also enter essays in a national competition, in which entrants compete for various prizes, including gift certificates, laptop computers, and trips to Disneyworld. Source; Securities Industry and Financial Markets Association. (2004–2009). *Learn About InvestWrite.* Retrieved July 21, 2009, from http://www.investwrite.info/about.aspx

- Used and was not helpful
- Used and was minimally helpful
- Used and was moderately helpful
- Used and was very helpful

The implementation section also included 10 items to capture information on game-setup and classroom logistics, such as the use of teams and access to computers.

Program Effect on Financial Practices

Although The Stock Market Game is intended to affect students, there was some interest in finding out whether teaching the game would affect teachers as well. SIFMA Foundation representatives provided a list of financial practices that teachers may begin using or change as a result of teaching The Stock Market Game. Practices addressed a wide array of behaviors, such as developing a personal budget or opening an investment account. Items were developed to address each of the behaviors and were grouped into three constructs, as follows:

*Engaging in Financial Planning***.** This construct measured actions teachers may take to control their finances and prepare for the future, such as setting financial goals, developing a household/personal budget, and establishing a plan to increase savings.

Conducting Financial Research. This construct measured actions teachers may take to expand their knowledge about financial planning and products, including reading the business section of the newspaper (online or in print), watching financial shows (television or Internet), and participating in financial courses or workshops.

Using Investment Products and Services. This construct measured actions related to specific products or services teachers may use for their financial planning, such as joining a credit union, opening an investment account, and participating in a pension program.

In total, 20 items were created for this section of the survey. The distribution of items across constructs is detailed in Table 9.

Table 9. Distribution of Teacher Survey Items Across Teacher Financial Practices Constructs

Construct	Percentage of Items
Financial planning	40%
Financial research	20%
Investment products/services	40%
Total number of items	*20*

Study Attrition

The research team examined the available data to determine whether study attrition led to differences between treatment and control groups. That is, we examined the extent to which the treatment and control groups were equivalent on observable characteristics and the extent to which classrooms in the sample might represent a broad range of classrooms. This section of the report describes the characteristics of the treatment and control groups along these dimensions.

Equivalence of Treatment and Control Groups

The interpretation of the results of random assignment studies is based on the assumption that the control and treatment groups are equivalent on both observed and unobserved characteristics. In this way, the control group serves as a model for what would have happened to members of the treatment group had they not been exposed to an intervention. Even when there is randomization, however, there is a chance that the groups are different in some way. To check this, Learning Point Associates compared the treatment and control groups on all characteristics for which there were data.[12]

In this study, the treatment and control groups did not differ significantly on any of the characteristics for which we had data. Specifically, the treatment and control groups were not different in terms of the following characteristics:

- Years of classroom teaching experience
- Years of experience teaching The Stock Market Game
- Grade level taught
- Number of classes in which teachers planned to teach The Stock Market Game during the fall of 2008, prior to assignment to treatment or control condition
- Locale (urban, suburban, or rural)
- Region of the country

[12] Appendix A details the demographic makeup of each group.

- Percentage of minority students in the school
- Percentage of students who qualify for free and reduced-price lunch in the school

A comparison of the treatment and control groups at randomization are in Appendix A.

Since not all teachers assigned to the treatment condition submitted data from the investor knowledge and mathematics assessments, researchers tested to see whether those who did not provide data were different across treatment and control groups. If the types of teachers who leave the study are different across treatment and control groups, then the equivalence of the groups can be compromised. If this occurs, it is plausible that the treatment and control groups would be different in some way other than exposure to The Stock Market Game, which could, in turn, bias estimates of the impact of the game.

Treatment and control classrooms for which assessment data were not received were not different in terms of any of these characteristics except for one—the number of classes in which teachers planned to teach The Stock Market Game. This finding suggests that attrition did not generally compromise the equivalence of the treatment and control groups. A comparison of the characteristics of classrooms for which data were not received are in Appendix A.

Table 10 shows the distribution across the number of classes teachers expected to teach in the fall of 2008. This distribution varied by treatment and control among classrooms that did not submit investor knowledge assessment data ($\chi^2 = 8.621$, $p = .035$) and among classrooms that did not submit mathematics assessment data ($\chi^2 = 9.227$, $p = .026$). Post hoc analyses revealed that control classrooms that did not participate with either test were more likely to report planning to teach The Stock Market Game in six or more classes (*p*-values). Although any differential attrition is not ideal, the research team could not think of an a priori reason for why the number of classes during which a teacher planned to teach The Stock Market Game in the upcoming year would influence student posttest scores. Therefore, we do not believe that this difference across the two groups would bias the estimates of program impact.

Table 10. Percentage of Classes Teachers Planned to Teach by Test Type and Treatment and Control Status

Assessment	Group	Number of classrooms teachers planned to teach			
		1 Class	2 to 3 Classes	4 to 5 Classes	6 or More Classes
Classrooms without mathematics assessments	Treatment (*n* = 138)	34.8%	46.4%	17.4%	1.4%
	Control (*n* = 166)	31.9%	44.0%	14.5%	9.6%
Classrooms without investor knowledge assessments	Treatment (*n* = 132)	31.8%	52.3%	13.6%	2.3%
	Control (*n* = 158)	32.9%	41.8%	15.2%	10.1%

A final check of the equivalence of the treatment and control groups compared the two groups on pretest scores of mathematics and investor knowledge. Study logistics made it impossible to administer the pretest prior to assignment to treatment and control conditions, so the pretest is not considered a pure baseline measure (Gelman & Hill, 2007). Teachers were, however, asked to administer the pretest prior to implementing the game, so the pretest scores are used as a proxy for prior ability in mathematics and investor knowledge.

Table 11 contains the mean pretest scores for the treatment and control classrooms. At pretest, treatment classrooms scored higher than control classrooms on the mathematics assessment for Grades 4–6 ($t = 3.002$, $p = .003$). The difference between the treatment and the control classroom pretest scores on the elementary school investor knowledge test approached significance ($t = 1.912$, $p = .058$). Pretest scores in the treatment and control classrooms did not differ significantly on any of the other assessments. To account for the differences at pretest, student pretest scores were included as a covariate in modeling the effect of the program.

Table 11. Mean Classroom Pretest Scores by Treatment and Control Condition

Test and number of classrooms	Treatment	Control
Investor knowledge elementary school ($n = 176$)	470.7	449.7
Investor knowledge middle school ($n = 232$)	480.7	474.9
Investor knowledge high school ($n = 181$)	502.3	496.7
Mathematics grades 4–6 ($n = 255$)*	489.8	455.7
Mathematics grades 7–10 ($n = 322$)	500.5	484.7

**Difference in means is significant at the* p = *.05 level.*

Generalizability of the Study Sample

Generalizability is concerned with whether the results from a particular study would hold for participants and settings outside the study. In this study, we ask whether we would find the same impact of playing The Stock Market Game in different classrooms in different parts of the country serving different students. In an ideal situation, generalizability could be assured by first randomly sampling individuals from the population of interest and then randomly assigning them to treatment or control conditions. In practice, however, this is rarely feasible because randomly assigned individuals often do not comply with assignment. That is, those assigned to receive the treatment may not receive treatment and conversely those assigned to participate as control may actually receive treatment. Instead, arguments for generalizability can be based on the extent to which the study sample resembles the population of interest (proximal similarity) and the extent to which the program effect holds over a diverse groups of participants and settings (heterogeneous irrelevancy) (Cook, 1990).

The research team recruited widely to ensure that the study sample reflected the broad array of classrooms in which The Stock Market Game is played. The study sample

included rural, urban, and suburban classrooms, as well as classrooms from all regions of the country. Teachers in these classrooms vary in terms of how long they have been teaching, their level of experience teaching The Stock Market Game, and the number of classes in which they planned to teach The Stock Market Game in the fall of 2008. The schools in which these classrooms were located ranged from those in which no student qualified for free and reduced-price lunch to those in which nearly all students qualified. The racial and ethnic makeup of the schools varied as well.

Study attrition can reduce generalizability if certain types of classrooms are more likely to drop out of the study. For example, if all rural classrooms dropped out of the study, the study would no longer be able to provide information about whether The Stock Market Game has an effect in rural classrooms. The research team examined the demographics of the classrooms that did not submit data to determine the extent to which they were systematically different from those that did.

The group of classrooms that did not provide assessment data was more likely than those that did submit data to have a teacher with zero to three years of teaching experience, to be in the Northeast, and to be in a high school. In addition, classrooms that did not provide data for the mathematics assessment were more likely than those that did submit data to have a teacher who had taught The Stock Market Game for one to three semesters before agreeing to be in the study. On all other measured characteristics, classrooms that did not provide data were similar to classrooms that did provide data. A complete description of the demographic makeup of the classrooms that provided data compared with the makeup of all classrooms is in Appendix A.

FINDINGS

Psychometric Analysis of Instruments

Psychometric analyses using the Rasch model (Rasch, 1980; Wright & Masters, 1982) were conducted on a sample of student test and survey data collected prior to conducting the RCT. These analyses were used to examine the reliability and validity of the instruments and to facilitate revisions designed to increase their overall utility. After the data were collected during the RCT phase of the study, the final study instruments were again analyzed to examine the reliability and validity of the scores produced by the instruments. In addition, the pretests and posttests were equated to one another and scale scores were developed for use in the statistical models of student and teacher outcomes.

Scaling and Equating Procedures

To generate scores for the tests and surveys, it was first necessary to transform the response data into ordinal categories that could be input to the Rasch model. For the tests, this process simply involved scoring correct responses as 1 and incorrect responses as 0. For the surveys, a polytomous scoring model was used to assign ordinally increasing numbers to each consecutive category. For example, the teacher survey contained the following response options (*Strongly Disagree, Disagree, Agree, Strongly Agree*), which were mapped to the numbers 0, 1, 2, and 3, respectively.

Traditional test and survey analysis typically sums the score for each test item (or the items for a particular construct on a survey) into an overall raw score. For the tests, the ability of the student would be measured as the total number correct on the test. Raw scores, however, account for neither test length nor the difficulty of the test items on one form versus another (e.g., the pretest and posttest, which contain different test items). In addition, raw scores do not represent an interval scale—that is, an increase of 1 point does not equal the same amount of learning at different raw scores. For instance, a change score of 2 in a change from 1 correct to 3 correct has a different meaning from a change score of 2 in a change from 20 correct to 22 correct. Rigorous statistical inference requires that differences in scores have constant value across the scoring metric. Therefore, converting raw scores from an ordinal scale to an interval scale (which has a stable unit over the entire scale) is necessary for quality inference. Scale scores produced by a scaling model such as the Rasch model account for the noninterval nature of the raw scores (when data fit the model).

Scaling is a process that involves transforming raw response data on the tests and surveys into a scale score using the Rasch model (or another similar item-response theory model). The scale scores produced through this type of psychometric analysis serve as summaries of the responses across many items. When the items are test items, the scale score represents student ability. For the surveys, the scale score represents the extent to which a respondent endorses a particular construct (such as engagement with the game). Higher scores represent more ability or endorsement, and lower scores represent less ability or

endorsement. When the data adequately fit the scaling model, the scale scores approximate interval level measures and are thus ideal for use in the statistical modeling of the impact of a program.

In addition to converting the raw scores to scale scores, the Rasch model was also used to equate the scores from the pretest and posttest version of each of the tests. Equating refers to the process of mapping the scores from multiple forms of an assessment onto the same scale. Equating these scores was a necessary step to ensure that comparisons could be made between scores from the pretest and scores from the posttest. With equated scores, a student who achieved a higher score on the posttest than the pretest could be said to have learned some of the material tested by the tests, regardless of the difficulty of either test. To equate the test scores from the pretest to the posttest, a linking constant approach (Wright & Stone, 1979) was derived from the difficulties of the items common to both the pretest and posttest. All five tests were successfully equated, that is pretests scores were placed onto the same scoring scale as posttest scores.

Once the Rasch scaled scores from the surveys were calculated and the pretest and posttest versions of the tests were equated to one another, the scores were mapped onto a final scale to provide a common meaning to the scale scores. For the tests, the average score for students in both the treatment and control groups was set to 500, and the standard deviation was set to 100. Therefore, for the posttests, following a normal distribution, roughly 68 percent of scores were between 400 and 600, roughly 95 percent of scores were between 300 and 700, and roughly 99 percent of scores were between 200 and 800. For the teacher and student surveys, the average score for each of the constructs was set to 50, and the standard deviation was set to 10. (See Appendix B for full details of Rasch analysis.)

Impact on Student Achievement

As noted, the impact of playing The Stock Market Game on student achievement was measured using newly developed assessments. The assessments were electronically administered to both treatment and control students before and after the game sessions were played. Analytic methodology is discussed first followed by the results for each of the tests. Full details for each of the analyses are in Appendix C.

Data Collection

Pretests and posttests were made available through a Web-based environment to students in both the treatment and the control groups. Teachers were given unique student IDs and asked to give each student only one ID. Student IDs were linked to teacher IDs; there was no way, however, to ascertain whether teachers assigned only one student ID to each student for both the pretest and the posttest. Therefore, data collected on student (self-reported) birth date and gender were checked for consistency at both test administrations. That is, if the information submitted for these variables was the same for the pretest and the posttest, then the tests were considered to have come from one student.

Analytic Methods

The analytic methodology used to analyze each of tests was the same. There were nine estimates calculated for each assessment, which were categorized according to two analytic approaches: intent-to-treat (ITT) and treatment-on-the-treated (ToT). This section briefly describes these analytic approaches.

Intent-to-Treat Analysis (ITT)

Each classroom participating in this study was randomly assigned to either play or not play The Stock Market Game. The standard approach to analyzing data from a randomized controlled trial is to compare the outcomes for the control and treatment groups, regardless of whether participants actually received the treatment. This estimate is commonly referred to as an Intent-to-Treat (ITT) estimate and can be interpreted as the effect of being assigned to a treatment condition. In this case, the ITT estimates provide the likely impact on student achievement for students who are assigned to play The Stock Market Game.

Treatment-on-the-Treated (ToT)

In reality, compliance with random assignment is never perfect. For many reasons, individuals, or groups of individuals, sometimes do not receive treatment, even if assigned to the treatment group. In this study there may have been some classes assigned to play the game that did not play, and some classes that were assigned not to play but actually did play. In a ToT approach, data are analyzed according to what participants actually did, not what they were assigned to do. Students at the end of the posttest were asked whether they had played The Stock Market Game in their class. If at least 70 percent of students confirmed playing, then the class was considered to have participated in the game.

An instrumental variables approach was used to calculate the ToT estimates. For these analyses, the outcome of random assignment was used to predict whether students were in a class that played the game. The impact models were then weighted by the inverse of these predicted values. That is, the analyses were conducted in two stages: the first model established the likelihood (i.e., predicted values) of playing the game and the second weighted the estimates by those values.

Missing Data

Among the classrooms that submitted data, pretest and posttest data were not submitted for all students. That is, some students completed only the pretest whereas others completed only the posttest. To ensure that the missing data did not bias the impact estimates, two versions of the ITT analysis were carried out.

One approach used the method of multiple imputation to estimate values for missing data and the other used only those cases with complete data. Ten data sets were imputed, including all covariates for which there were missing data. (Since there was no information gathered on students who were not tested, only students who completed either the pretest or the posttest were included in this analysis. In addition, pretests were removed from those cases in which the birth date and gender measures were not the same at time of pretest and posttest. Matching on these demographic variables tended to be better for the students in

the higher grades; but even removing the nonmatching pretest scores did not change overall mean scores substantially.

The other ITT analysis (complete case) included only students who submitted both pretest and posttest data and whose demographic data matched between pretest and posttest. Because the analyses yielded similar estimates, only the complete case approach was used to model the ToT impact estimates.

COVARIATES

If there are differences between treatment and control groups, the inclusion of covariates can statistically control for these differences, thereby increasing the precision of the impact estimates. To test this, the following five student-level covariates were examined:

- Pretest scale score
- Indication of a completed pretest (i.e., response provided for each item)
- Indication of a completed posttest (i.e., response provided for each item)
- Gender
- Self report on whether the student had played The Stock Market Game in another class

MODELS

Several models were fit for each of the above approaches (ITT and ToT). Student achievement was first modeled using only on the treatment indicator (i.e., treatment and control status). In order to account for possible differences between treatment and control group in preprogram abilities, another set of models assessed achievement by fitting the data with two variables: the treatment indicator and the student's individual pretest score. Finally, in an effort to further increase precision of the impact estimates, student achievement was modeled using the treatment indicator, the student's pretest score, and four student-level covariates.

Each model was fit with a random coefficients mixed model with student scores nested within classrooms.

Interpretation of Estimates

Differences in achievement are presented in terms of the Rasch scale scores and further quantified in terms of effect sizes and confidence intervals. In a recent paper examining effect-size change for a number of standardized tests, Hill, Bloom, Black, and Lipsey (2007), derive empirical average effect sizes for students in Grades K–12 over the course of a year. Hill et al. further provide average effect sizes from the results of more than 60 randomized controlled trials that are categorized according to student grade level and the specificity of the test. The empirical benchmarks from this recent report are used to interpret the magnitude, and meaning, of the effect size estimates for the impact of playing The Stock Market Game.

Impact estimates are presented for all models, and for all but one test (mathematics 7–10), the results are similar across different statistical scenarios. For ease of interpretation, however, interpretation of the results is discussed for only one model—the ToT model that includes the treatment indicator variable and the student-level pretest score as a covariate. We chose this estimate because the ToT method provides an estimate of treatment effect for those students who actually played The Stock Market Game. We include the pretest score because in some cases the treatment and control groups were shown to be different on this measure and this difference would likely influence outcome estimates.

Mathematics Findings

As noted, there were two assessments developed to test mathematics learning, each with a pretest and posttest—one for students in Grades 4–6 and one for students in Grades 7–10. If students reported being in Grades 11 or 12, their scores were not used in these analyses.

Impact on Mathematics for Students in Grades 4–6

Playing The Stock Market Game had a positive impact on student learning. Students in the treatment group outperformed students in the control group. Although the impact estimates from each of the models varied in magnitude, all were statistically significant. Table 12 shows the impact estimates in terms of scale score differences and their significance levels for each of the nine models. These estimates range approximately from 18 to 41 scale-score points. Data from 4,358 students were collected for these analyses.

Table 12. Mathematics Grades 4–6: Impact Estimates Using Scale Scores

	Approach		
	ITT		ToT
Model	Multiple Imputation	Complete Case	Instrumental Variables
Treatment Indicator	35.98***	41.61***	37.21***
Treatment Indicator + Pretest	18.20***	23.16***	26.88***
Treatment Indicator + Pretest + Other Covariates	18.29***	23.43***	23.96**

***Significant at the p<.01 level.*
****Significant at the p<.001 level.*

Estimating the impact using effect sizes and confidence intervals provides another opportunity to see how the data perform under the various statistical scenarios. Table 13 shows the effect sizes and confidence intervals for each of the models.

Table 13. Mathematics Grades 4–6:
Impact Estimates in Terms of Effect Sizes and Confidence Intervals

Model	Approach		
	ITT		ToT
	Multiple Imputation	Complete Case	Instrumental Variables
Treatment Indicator	0.25 (0.13–0.37)	0.28 (0.15–0.41)	0.23 (0.10–0.36)
Treatment Indicator + Pretest	0.28 (0.13–0.43)	0.26 (0.11–0.41)	***0.25 (0.11–0.40)***
Treatment Indicator + Pretest + Other Covariates	0.28 (0.13–0.43)	0.27 (0.12–0.41)	0.25 (0.10–0.39)

We focus the interpretation of findings on one model: the ToT model that includes the student-level pretest score as a covariate (bold and italicized in Table 13). The effect size for the ToT model is 0.25, with a confidence interval ranging from 0.11 to 0.40. In the absence of an intervention, during the course of one full year, students in these grades might demonstrate an effect-size change in mathematics between 0.30 and 0.56 (Hill et al., 2007). Therefore, a difference of 0.25 standardized units after only a 15-week period could be considered substantial.[13]

Another interpretation of this effect size comes from a comparison with other randomized studies. Hill et al. (2007) details the report of effect sizes for randomized studies according to three types of tests for elementary students: standardized test (broad), standardized test (narrow), and specialized topic/test. We consider the mathematics test to fall into the category of standardized test (narrow). We consider the investor knowledge test to be a specialized topic/test.

Hill et al. (2007) report that for students in elementary schools who are tested with a standardized test that has a narrow focus, the average effect size for the intervention is 0.23. Therefore, playing The Stock Market Game could be considered to have an effect similar to that of other targeted interventions.

Impact on Mathematics for Students in Grades 7–10

The findings for the impact of playing The Stock Market Game on student achievement in Grades 7–10 were inconsistent across the various statistical modeling approaches. Four of the nine models yielded significant impact estimates. In these four models, students in the treatment group outperformed students in the control group. The multiple imputation approach did not yield significant estimates, nor did the ITT complete case model, nor the ToT model when no covariates were included.

[13]It is important to note that the Hill et al. report based growth on nationally normed standardized tests. The explanation of the effect size finding for the mathematics tests used in this study does not imply growth on a standardized test.

Table 14 shows the impact estimates in terms of scale score differences and their significance levels for each of the models. These estimates range approximately from 5 points to 17 scale-score points. Data from 4,500 students were collected for these analyses.

Table 14. Mathematics Grades 7–10: Impact Estimates Using Scale Scores

Model	Approach		
	ITT		ToT
	Multiple Imputation	Complete Case	Instrumental Variables
Treatment Indicator	10.98	13.91	15.26
Treatment Indicator + Pretest	5.34	12.33*	14.52*
Treatment Indicator + Pretest + Other Covariates	7.25	15.03**	17.47**

**Significant a the p<.05 level.*
***Significant at the p<.01 level.*

Estimating the impact using effect sizes and confidence intervals provides another opportunity to see how the data perform under the various statistical scenarios. Table 15 shows the effect sizes and confidence intervals for each of the models.

Table 15. Mathematics Grades 7–10:
Impact Estimates in Terms of Effect Sizes and Confidence Intervals

Model	Approach		
	ITT		ToT
	Multiple Imputation	Complete Case	Instrumental Variables
Treatment Indicator	0.09 (¯0.03–0.21)	0.10 (¯0.03–0.23)	0.11 (¯0.02–0.24)
Treatment Indicator + Pretest	0.10 (¯0.05–0.24)	0.16 (0.01–0.31)	***0.17 (0.02–0.32)***
Treatment Indicator + Pretest + Other Covariates	0.16 (¯0.01–0.32)	0.21 (0.06–0.36)	0.22 (0.07–0.37)

Models that yield confidence intervals crossing zero indicate that the differences between the treatment and control groups could actually be zero. In other words, the five models in Table 15 that show negative values do not support the finding of a program effect. The other four models do, however, indicate that the program positively affects student

achievement. The one cautionary note here, even for those models that are significant, is that the estimate of the difference between the two groups could be as low as an effect size of 0.01 (ITT complete case, with pretest). The estimate also could be as high as a difference of a 0.37 effect size (ToT, with pretest and other covariates).

To provide context to these findings, we discuss them in terms of one model: the ToT model that includes the student-level pretest score as a covariate (bold and italicized in Table 15). Again, this approach takes into account students starting skill level as well as adjusting for whether students actually participated in playing the game.

The effect size for this ToT model is 0.17 with a confidence interval that ranges from 0.02 to 0.32. In the absence of an intervention, during the course of one full year, students in these grades might demonstrate an effect-size change in mathematics between 0.14 and 0.32. Therefore, after a 15-week intervention, a difference between groups equal to an effect size of 0.17 could be considered substantial. This effect size, however, is slightly lower than that from other interventions for high school students, which report an average effect size of 0.28 (Hill et al., 2007). Again, however, these effect-size estimates should be regarded with caution because they were not consistently demonstrated under all statistical approaches.

Investor Knowledge Findings

There were three assessments developed to test student learning of concepts related to savings and investing, each with a pretest and a posttest. One was administered to students in Grades 4 and 5 and is referred to as the elementary school test. Another was administered to students in Grades 6 through 8 (middle school test) and one other was administered to students in Grades 9 and 10 (high school tests). Students who reported that they were in Grade 11 or 12 were not included in the analysis.

Impact on Investor Knowledge for Elementary School Students

Playing the Stock Market Game had a positive impact on elementary student learning of concepts related to saving and investing. Students in the treatment group outperformed students in the control group. Although the impact estimates from each of the nine models varied in magnitude, all were statistically significant. Table 16 shows the impact estimates in terms of scale score differences and their significance levels for each of the models. These estimates range from approximately 31 points to more than 69 points. Data from 2,616 students were collected for these analyses. Details are in Appendix C.

Table 16. Investor Knowledge, Elementary School Test
Impact Estimates Using Scale Scores

Model	Approach		
	ITT		ToT
	Multiple Imputation	Complete Case	Instrumental Variables
Treatment Indicator	44.21***	55.23***	52.93***
Treatment Indicator + Pretest	33.36***	55.77***	61.51***
Treatment Indicator + Pretest + Other Covariates	31.68***	54.47***	69.05***

****Significant at the p<.001 level.*

Table 17 shows the estimates in terms of effect sizes and confidence intervals, again demonstrating the performance of the data using different modeling approaches.

Table 17. Investor Knowledge, Elementary School Test:
Impact Estimates in Terms of Effect Sizes and Confidence Intervals

Model	Approach		
	ITT		ToT
	Multiple Imputation	Complete Case	Instrumental Variables
Treatment Indicator	0.30 (0.14–0.45)	0.34 (0.18–0.50)	0.29 (0.13–0.45)
Treatment Indicator + Pretest	0.32 (0.15–0.49)	0.42 (0.24–0.60)	***0.43 (0.24–0.61)***
Treatment Indicator + Pretest + Other Covariates	0.30 (0.13–0.46)	0.42 (0.23–0.60)	0.43 (0.25–0.61)

We focus the interpretation of findings on one model—the ToT model that includes the student-level pretest score as a covariate (bold and italicized in Table 17). The effect size for the ToT model is 0.43, with a confidence interval ranging from 0.24 to 0.61.

After a full year of schooling without an intervention, elementary students in Grades 4 and 5 might demonstrate an effect-size change in mathematics between 0.41 and 0.56 (Hill et al., 2007). Therefore, a difference of 0.43 standardized units after a 15-week period could be considered substantial. In comparison with other randomized studies using a specialized test, the average effect size for elementary school students is 0.44. Therefore, playing The Stock Market Game could be considered to have an effect similar to that of other targeted interventions.

IMPACT ON INVESTOR KNOWLEDGE FOR MIDDLE SCHOOL STUDENTS

Playing The Stock Market Game had a positive impact on middle school student learning of concepts related to savings and investing. Although the estimates varied, each of the models yielded significant estimates of program impact. Table 18 shows these estimates, which range from 29 to 58 points. Data from 4,275 students were collected for these analyses.

Table 18. Investor Knowledge, Middle School Test: Impact Estimates in Terms of Scale Scores

Model	Approach		
	ITT		ToT
	Multiple Imputation	Complete Case	Instrumental Variables
Treatment Indicator	41.44***	57.74***	51.43***
Treatment Indicator + Pretest	30.15***	41.07***	42.75***
Treatment Indicator + Pretest + Other Covariates	29.30***	42.33***	44.70***

****Significant at the p<.001 level.*

Table 19 shows the effect sizes and confidence intervals of the impact estimates for each of the models.

Table 19. Investor Knowledge, Middle School Test: Impact Estimates in Terms of Effect Sizes and Confidence Intervals

Model	Approach		
	ITT		ToT
	Multiple Imputation	Complete Case	Instrumental Variables
Treatment Indicator	0.39 (0.24–0.54)	0.42 (0.29–0.55)	0.40 (0.24–0.55)
Treatment Indicator + Pretest	0.49 (0.31–0.68)	0.45 (0.29–0.61)	***0.45 (0.29–0.60)***
Treatment Indicator + Pretest + Other Covariates	0.51 (0.33–0.70)	0.50 (0.34–0.65)	0.49 (0.33–0.64)

We again focus the interpretation of findings on the ToT model that includes the student-level pretest score as a covariate (bold and italicized in Table 19). The effect size for the ToT model is 0.45, with a confidence interval ranging from 0.29 to 0.60.

In the absence of an intervention, during the course of one full year, students in Grades 6 and 7 might demonstrate an effect-size change in mathematics anywhere between 0.22 and 0.41 (Hill et al., 2007). Therefore, a difference of 0.45 standardized units after a 15-week period could be considered substantial. This effect size is slightly lower, however, than that

from other interventions for middle school students, which report an average effect size of 0.51 (Hill et al., 2007).

Impact on Investor Knowledge for High School Students

Playing The Stock Market Game had a positive effect on high school student learning of concepts related to savings and investing. Although the magnitude of the estimates depended on the model used to fit the outcome data, every model yielded significant impact estimates. Table 20 shows the estimate for the nine models. Data from 1,703 students were collected for these analyses.

Table 20. Investor Knowledge, High School Test: Impact Estimates Using Scale Scores

Model	Approach		
	ITT		ToT
	Multiple Imputation	Complete Case	Instrumental Variables
Treatment Indicator	26.79**	34.37***	29.47*
Treatment Indicator + Pretest	17.69*	31.69***	36.12**
Treatment Indicator + Pretest + Other Covariates	14.04*	29.65***	31.53**

****Significant at the p<.001 level.*
***Significant at the p<.01 level.*
**Significant at the p<.05 level.*

Table 21 shows the effect sizes and confidence intervals of the impact estimates for each of the models.

Table 21. Investor Knowledge, High School Test: Impact Estimates in Terms of Effect Sizes and Confidence Intervals

Model	Approach		
	ITT		ToT
	Multiple Imputation	Complete Case	Instrumental Variables
Treatment Indicator	0.24 (0.06–0.42)	0.26 (0.07–0.46)	0.22 (0.03–0.41)
Treatment Indicator + Pretest	0.26 (0.05–0.47)	0.36 (0.13–0.58)	***0.39 (0.16–0.62)***
Treatment Indicator + Pretest + Other Covariates	0.24 (0.03–0.45)	0.38 (0.15–0.61)	0.37 (0.14–0.59)

We focus the interpretation of findings on one model: the ToT model that includes the student-level pretest score as a covariate (bold and italicized in Table 21). The effect size for the ToT model is 0.39 with a confidence interval that ranges from 0.16 to 0.62.

In the absence of an intervention, during the course of one full year, students in Grades 9 and 10 might demonstrate an effect-size change in mathematics anywhere between 0.14 and 0.25 (Hill et al., 2007). Therefore, a difference of 0.39 standardized units after a 15-week period could be considered substantial. In other randomized studies, using a specialized test, the average effect size for high school students is 0.27. Therefore, the effect of playing The Stock Market Game could be considered to have a stronger effect on high school students than other targeted interventions.

Summary of Impact on Student Achievement

Overall, students who played The Stock Market Game outperformed those who did not play the game in tests of both mathematics and investor knowledge. There is, however, one cautionary note. For achievement as measured by the mathematics test for students in Grades 7–10, there were some statistical models that yielded nonsignificant results. These nonsignificant results were found in the multiple imputation models as well as those models that did not model initial student skill level (i.e., the models without covariates). When initial skill level is taken into account, the complete case analyses (using either ITT or ToT approach) yielded significant results.

Table 22 provides an overall summary of the student achievement findings using the ToT approach, including the student-level pretest score as a covariate.

Table 22. Summary of ToT Impact Findings for Mathematics Achievement and Investor Knowledge

Mathematics	**Grades 4–6**	**Grades 7–10**	
Effect size	0.25	0.17	
Confidence interval	0.11 to 0.40	0.02 to 0.32	
Magnitude of change	Substantial	Substantial	
Comparison with other RCT intervention studies	Similar	Slightly lower	
Investor Knowledge	**Grades 4–5**	**Grades 6–8**	**Grades 9–10**
Effect size	0.43	0.45	0.39
Confidence interval	0.24 to 0.61	0.29 to 0.60	0.16 to 0.62
Magnitude of change	Substantial	Substantial	Substantial
Comparison with other RCT intervention studies	Similar	Slightly lower	Stronger

Note: Results represent the Treatment on Treated (ToT) approach with pretest as covariate.

Teacher Implementation of The Stock Market Game

To examine teacher implementation of The Stock Market Game, a survey was administered nationwide to teachers of The Stock Market Game. The items on the survey were designed specifically to measure the practices teachers use when they teach the game in their classrooms. Items were developed using information gathered from The Stock Market Game online Teacher Center, an online repository of resources and materials for teaching the program, with guidance as well from the SIFMA Foundation, to identify practices of particular relevance. The final survey contained 47 items that measured implementation on three constructs:

- Use of The Stock Market Game in the classroom (*activities in the classroom*)
- Lessons and materials created by The Stock Market Game (*lessons and materials*)
- Linking The Stock Market Game to outside resources (*connections to outside resources*)

The survey also included items to capture game setup and logistics as well as demographic items to capture teacher or class characteristics that might affect implementation or student academic performance.

Data Collection

Teachers across the country were invited to complete the survey if they had taught the game in the fall of 2008, summer of 2008, or at any time in the previous school year (2007–08). Teachers participating in the RCT were also asked to complete the survey at the end of the fall 2008 game sessions. The survey was administered electronically through a secure website created by Learning Point Associates. Two versions of the survey were developed, one for RCT teachers and one for non-RCT teachers. The items on investment practices were identical except for six additional items for RCT teachers used to capture implementation issues that might have been important for the effect analysis. Teachers were asked to input a teacher identification number assigned by Learning Point Associates, which was linked to the teachers' group for the study (RCT vs. non-RCT). This identification number directed teachers to the correct survey.

Analytic Methods

The Stock Market Game teacher surveys were analyzed in two ways: examination of item-level frequencies, and Analysis of Variance (ANOVA) of the Rasch-derived scale scores.

Survey items were designed to allow exploration of constructs related to implementation: *overall implementation, activities in the classroom, lessons and materials, and connections to outside resources*. These items were analyzed individually, to provide a nuanced view of particular investment practices that teachers use and of their perceptions of the influence of

The Stock Market Game on those practices. Discussion of the descriptive information for an overall measurement of the use of practices, as well as program influence, is based on the following percentage categories of teachers who selected each rating:

- Few (0 to 24 percent)
- Some (25 to 49 percent)
- Majority (50 to 74 percent)
- Most (75 to 100 percent)

The individual survey items were also fit with the Rasch model to create overall scale scores for each of the three constructs. The higher the scale score, the greater the influence of the program on teachers' practices in that area. More detailed and technical results related to the Rasch analysis of the teacher survey are in Appendix B. The Rasch scale scores were used to explore the relationship between the three constructs measuring teacher investment practices and six teacher characteristics as follows:

- *Class subject:* business, nonbusiness
- *Experience with the program:* first time teaching, taught 2–5 times, taught 6 times or more
- *Years experience teaching:* 1–2 years, 3–5 years, 6 or more years
- *Locale:* rural, urban, suburban
- *Grade level:* elementary school (Grades 4–5), middle school (Grades 7–8), and high school (Grades 9–10)

Participants

Learning Point Associates invited 12,381 teachers to take the survey, and of those, 4,804 completed the survey, for a response rate of 39 percent. Of those, 113 teachers had not taught the game since the fall of 2007 or earlier and were automatically excluded, leaving a total of 4,691 teacher surveys for analysis. In the final pool, approximately 91 percent were non-RCT teachers and 9 percent were RCT teachers. Of the RCT teachers, 48 percent were in the control and 52 percent were in the treatment condition.

Teachers primarily taught in a suburban locale (49 percent) and were located in the South (36 percent) (see Tables 23 and 24) with the majority of respondents, 59 percent, indicating they have been teaching 11 years or more (see Table 25). Teachers also reported the number of times they had taught The Stock Market Game. The highest percentage of teachers, 47 percent, reported having taught the game two to five times (see Table 26).

Note: Sample sizes in the following tables are different because not all teachers responded to all questions.

Table 23. Locale of Teachers

Locale	N	Percentage
Suburban	2,064	49%
Rural	1,201	28%
Urban	975	23%
Total	4,240	

Table 24. Region of Teachers

Region	N	Percentage
South	1,524	36%
Northeast	1,092	26%
Midwest	970	23%
West	645	15%
Total	4,231	

Table 25. Teacher-Reported Years of Experience Teaching

Years of Teaching	N	Percentage
First year	80	1.9%
2	132	3.2%
3	192	4.6%
4–5	402	9.6%
6–10	902	21.6%
11 or more	2,469	59.1%
Total	4,177	

Note: Includes 2008–09 school year

Table 26. Teacher-Reported Times Teaching The Stock Market Game

Number of Times Teaching The Stock Market Game	N	Percentage
First time	991	23.9%
2–5	1,959	47.3%
6–10	717	17.3%
11 or more	474	11.4%
Total	4,174	

Note: Includes current session

Teachers indicated all the grade levels of students to whom they taught The Stock Market Game (see Table 27).The majority of survey respondents taught high school students in Grades 9–12, with the greatest percentage indicating that they taught The Stock Market Game to their Grade 12 students (42 percent). These percentages represent the number of responses from 4,691 teachers. For example, 323 (of the 4,691 teachers) reported teaching students The Stock Market Game to their fourth-grade class. Because teachers could select more than one category, the percentages do not add up to 100.

Table 27. Teacher-Reported Grades of Students Participating in The Stock Market Game

Grade	N	Percentage
4	323	6.9%
5	728	15.5%
6	637	13.6%
7	654	13.9%
8	767	16.4%
9	599	12.8%
10	972	20.7%
11	1,425	30.4%
12	1,952	41.6%

Teachers also reported on the subject of the class(es) in which they teach The Stock Market Game. The majority of teachers, 67 percent, reported teaching the program in a business-related course, including business, economics, and finance. Other common subjects included mathematics (22 percent) and social studies (16 percent).

It was not expected that responses between the national sample and the RCT teachers would be identical, since the RCT teachers were recruited to include only teachers with students in Grades 4 through 10 (which can affect several characteristics). Nonetheless, we examined possible differences between the two groups and found only minor differences. In particular, the teachers nationwide were more likely to teach high school students and more likely to conduct the course in business classes (for more information, see Appendix D).

Game Setup

Teachers were asked about a number of details on how they set up the program for their classroom, including logistical issues, such as where students accessed computers and whether they assigned team member roles. For all items pertaining to game setup and implementation, teachers were ask to reflect upon the most recent game in which they had their students participate. The majority of teachers (65 percent) referred to a game session in fall of 2008, some to a winter or spring 2008 session (32 percent), and very few referred

to the summer 2008 session (less than 1 percent) or the full year session of 2007–08 (2 percent). The majority of the sessions reflected upon were 10 weeks long (73 percent), some were 15 weeks long (22 percent), and few were full year sessions (5 percent). Most teachers, 95 percent, reported that they were not required to use the program (by their principal, school board, superintendant, or others) and elected to do so on their own.

A majority of teachers reported teaching the program one day a week (55 percent), and some reported teaching it two to three days a week (38 percent). Students most often used computers for The Stock Market Game two or three days a week (43 percent) or one day a week (41 percent). Students accessed computers in a computer lab (reported by 45 percent of teachers) or through computers located permanently within the classroom (36 percent). Teachers typically offered students more than 20 minutes of computer time (51 percent) for each session of The Stock Market Game, although some teachers (40 percent) offered computers for 10 to 20 minutes per session.

Teachers reported that student teams for The Stock Market Game were most often composed of three (28 percent) or four (32 percent) members. Teachers were split on assigning teams themselves (49 percent) versus letting students make their own teams (51 percent). The curriculum for The Stock Market Game, available online at The Teacher Center, recommends teachers assign team member roles, such as captain/director or record keeper, but only 24 percent of teachers reported doing so. The program also recommends doing team-building activities, such as establishing team goals and norms for group behavior; just under half the teachers (46 percent) reported doing so.

Teacher Survey Findings

Findings from the analysis of the teacher surveys are discussed in terms of the items related to setting up the game, an overall measure of implementation, and three implementation constructs: *activities in the classroom*, *lessons and materials created by The Stock Market Game*, and *connections to outside resources*.

Overall Implementation

In interpreting the results, it was useful to recategorize the survey items (originally defined as must haves, should haves, and extras) into two new categories: basic and advanced. The original categories defined implementation in terms of the program design and how program administrators at the SIFMA Foundation expected teachers to teach the program, but the analysis captured a different pattern, showing how teachers actually chose to use the program. Thus, the items were recategorized as basic or advanced. Basic practices are those that teachers are familiar with and commonly use in teaching. Basic practices are what we might expect from teachers in implementing The Stock Market Game. Advanced practices are those that require either a new approach or greater teacher involvement. For each of the three constructs—*activities in the classroom, lessons and materials,* and *connections to outside resources*—we define *basic* and *advanced* to include the activities displayed in Table 28.

Table 28. Descriptions of Levels of Implementation of The Stock Market Game

Construct	Basic Typical methods of teaching or involving students in the program that teachers are more familiar with	Advanced Methods of teaching or involving students that go beyond typical classroom activities
Activities in the Classroom	Teaching definitions of stock/company/ticker, posting rankings	Playing the game with students, encouraging/requiring InvestWrite
Lessons and Materials Created by The Stock Market Game	Using core materials for implementing the program (lessons, worksheets)	Using unessential materials (projects, noncore lessons, postgame follow-through)
Connections to Outside Resources	Linking the program to easily accessible people/events outside the classroom (current events, careers, notifying parents)	Linking the program to people/things more difficult to access (guest speakers, field trips, involving parents in the program)

As previously discussed, descriptive, item-level analysis provides a picture of practices and materials commonly used by teachers to implement The Stock Market Game.

This analysis revealed that overall teachers reported using basic-level *activities, materials,* and *connections* in teaching The Stock Market Game. More advanced practices were less commonly used, though a substantial percentage reported using several of those practices.

In addition to item-level analysis, a one-way ANOVA analysis was conducted using Rasch-derived scale scores for overall implementation to explore the data for any significant differences in implementation across teacher groups based on *grade level*, *experience teaching*, *experience with the program*, *subject*, *locale,* or *session length.* Statistically significant differences in overall implementation were found for five characteristics:

Grade Level. Teachers of elementary school students (Grades 4–5) had significantly higher implementation scores than teachers of students in middle school (Grades 6–8).[14]

Experience With the Program. Teachers who were teaching The Stock Market Game for the first time had significantly lower implementation scores than did teachers who had taught the program two to five times[15] and lower than teachers who had taught the program six times or more.[16]

[14] Tukey's HSD Mean Difference = 1.505, $p = .005$.

[15] Tukey's HSD Mean Difference = -1.294, $p = .002$.

[16] Tukey's HSD Mean Difference = -1.7.5, $p < .001$.

Subject. Business teachers had significantly higher implementation scores than nonbusiness teachers.[17]

Session Length. Teachers of sessions approximately 15 weeks long had significantly higher implementation scores than teachers of sessions approximately 10 weeks long[18] and teachers of full-year sessions.[19]

Locale. Teachers in urban schools had significantly higher implementation scores than did teachers in rural[20] or suburban schools.[21] Teachers in rural schools had significantly higher implementation scores than teachers in suburban schools did.[22]

ACTIVITIES IN THE CLASSROOM

The majority of teachers indicated that they employed basic, familiar activities for teaching the program; less than half reported using more advanced teaching activities.

The construct *activities in the classroom* is composed of 13 survey questions related to (1) the use and (2) the frequency of use of activities to teach the program. These items were of two different types. Some items asked teachers "In the most recent session that you taught The Stock Market Game, did you…" and included the response options of yes and no. Other items asked teachers "In the most recent session that you taught The Stock Market Game, how often did you…" and included the response options of *most of the time*; *regularly, but not all the time; some of the time; and not at all*.

For the item-level analysis, items were categorized so as to compare percentages of teachers who engaged in the teaching activities with those who did not engage in those activities. Therefore, the frequency scales responses were combined to compare any use (*most of the time; regularly, but not all the time; some of the time*) with no use at all.

Analysis revealed that higher percentages of teachers reported using *basic* activities than reported using *advanced* activities. Basic activities are those types of teaching that teachers may be more familiar with or that require less participation on a student's part. These are the types of activities that one would expect be used to implement a supplemental educational program. For example, most teachers reported teaching students the foundational concepts of stock, company, and ticker (98, 91, and 78 percent, respectively), and the majority indicated they assigned students grades and developed their own projects for the program (64 percent and 56 percent, respectively). These are activities that teachers

[17] $F_{(1,4391)} = 20.847$, $p < .001$.

[18] Tukey's HSD Mean Difference = 2.477, $p < .001$.

[19] Tukey's HSD Mean Difference = 2.244, $p = .007$.

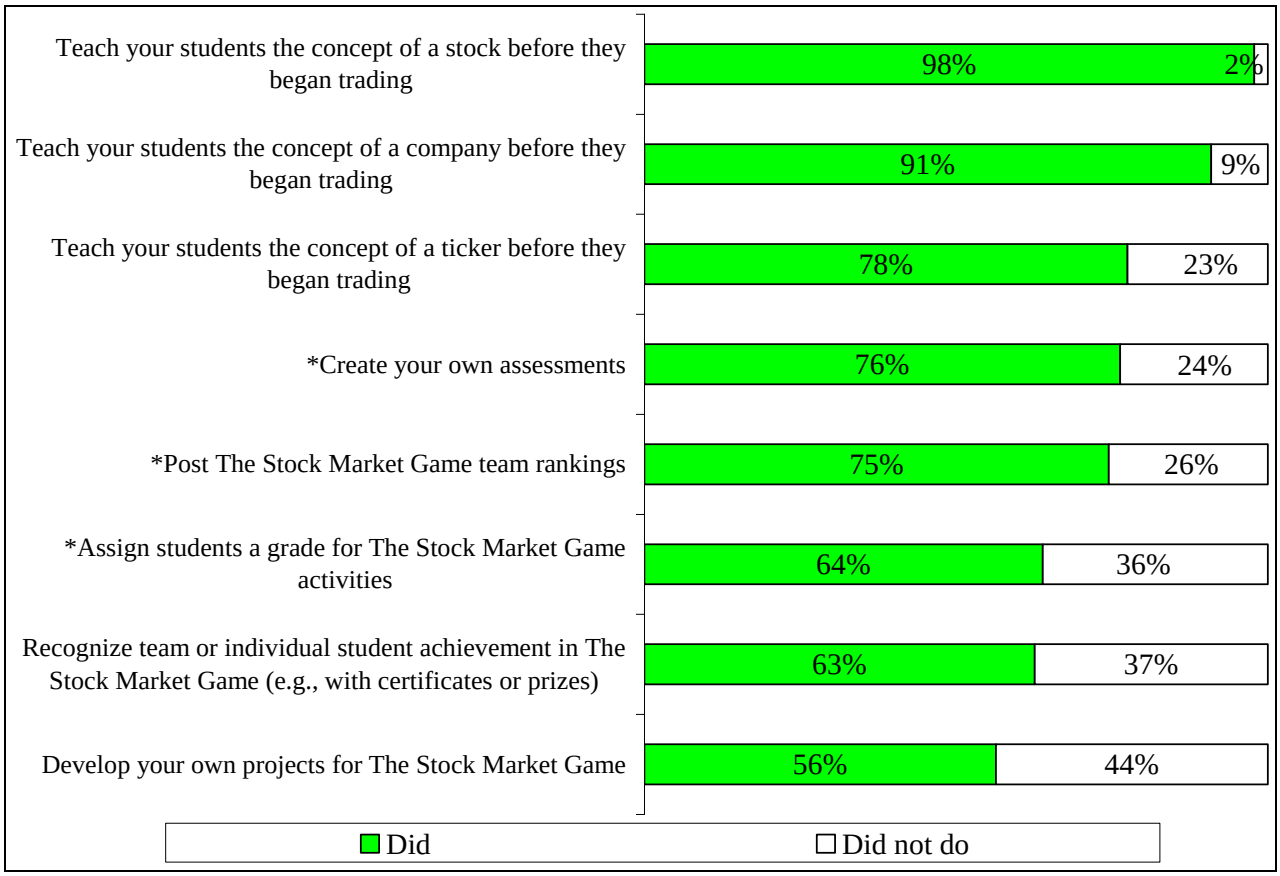
[20] Tukey's HSD Mean Difference = 1.242, $p = .010$.

[21] Tukey's HSD Mean Difference = 2.146, $p < .001$.

[22] Tukey's HSD Mean Difference = .905, $p = .029$.

typically use in the course of instruction on any topic. Figure 3 details teachers' responses on activities that were most commonly used.

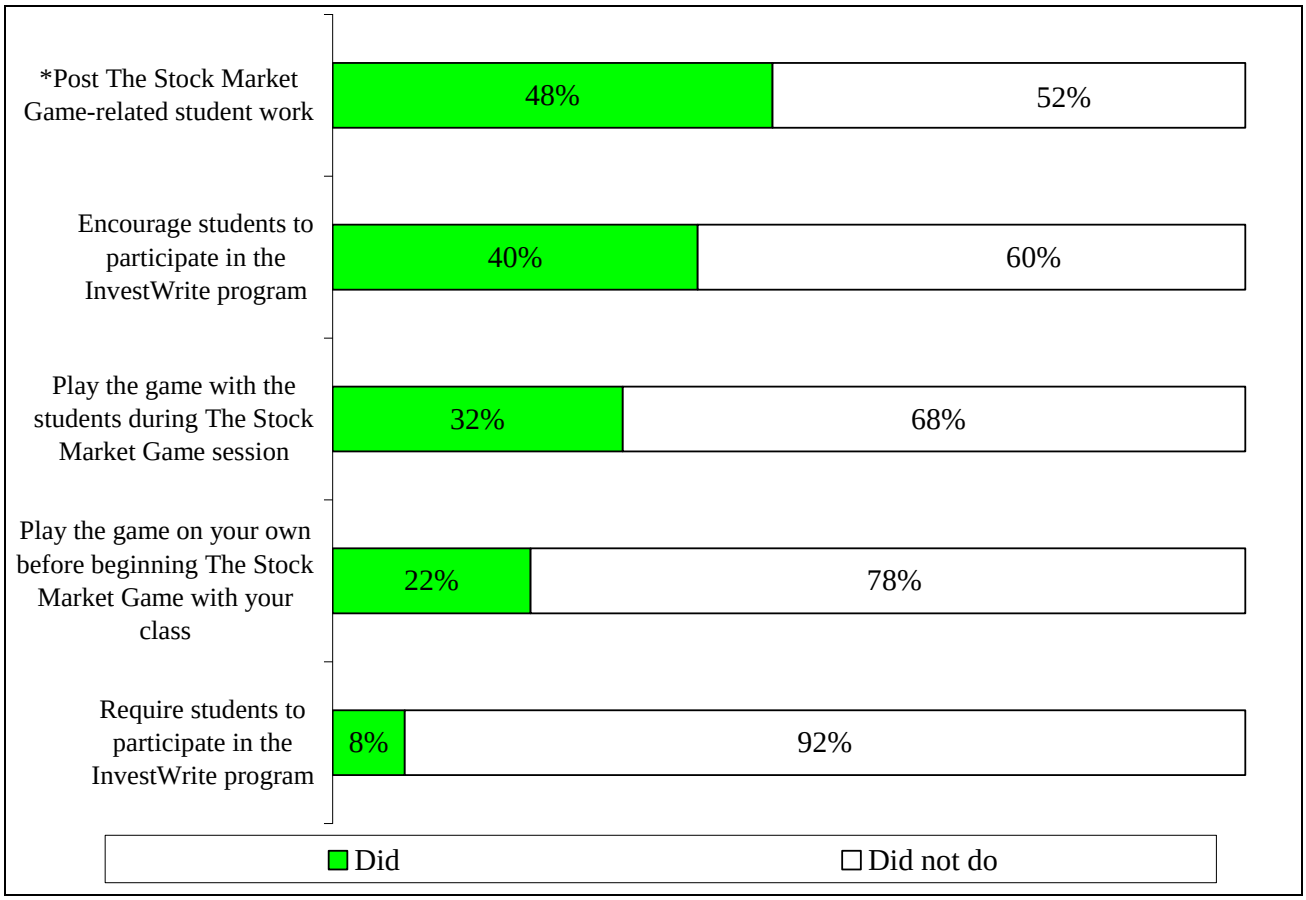
Figure 3. Percentages of Teachers Indicating Use of Basic Activities (Used by More Than Half the Teachers)



**These items had frequency response options. All others had yes/no response options.*

Less than half the teachers reported using more *advanced* activities to engage and teach students. These types of activities are less a part of typical teacher practice or ask more of the student. For example, some teachers reported encouraging students to participate in InvestWrite (40 percent) and playing the game with students during the session (32 percent), and few teachers reported requiring students to participate in InvestWrite (8 percent). In general, these activities go outside the realm of common activities or require more student participation than more common teaching activities. Figure 4 details teachers' responses on activities for which less than half the teachers reported their use.

Figure 4. Percentages of Teachers Indicating Use of Advanced Activities (Used by Less Than Half the Teachers)



**This item had frequency response options. All others had yes/no response options.*

With regard to frequency of use (indicated with an asterisk in Figures 3 and 4) overall, teachers indicated more frequent use of teaching activities that are easier to incorporate. For example, the greatest percentage of teachers indicated they used two practices *almost all the time*: assigning students a grade (41 percent) and posting team rankings (48 percent). In contrast, when reporting the frequency of creating their own assessments, about half the teachers (51 percent) reported creating their own assessments only *some of the time*. A final item, posting student work, could be used more frequently but would be dependent upon the teacher's own use of the program (e.g., those teachers who use worksheets and projects would have more to post than teachers who do not use those activities). More than half the teachers (55 percent) indicated they posted student work only *some of the time*.

Table 29. Frequency of Use of Specific Activities to Teach The Stock Market Game

In the most recent session that you taught The Stock Market Game, how often did you…	N	Some of the time	Regularly, but not all of the time	Almost all of the time
Create your own assessments?	3,297	50.6%	27.3%	22.1%
Post The Stock Market Game team rankings?	3,217	27.9%	24.2%	47.9%
Assign students a grade for The Stock Market Game activities?	2,759	31.9%	27.5%	40.5%
Post The Stock Market Game–related student work?	2,077	54.5%	25.5%	20.1%

Finally, the items in this construct were analyzed to create an implementation score indicating the overall use of *activities*. These scale scores were analyzed using a one-way ANOVA method to detect any significant differences in implementation across teacher groups based on teacher, classroom, and school characteristics. Significant differences were found within five of these characteristics:

Grade Level. Teachers of high school students (Grades 9–12) had significantly higher implementation scores for *activities* than did teachers of students in middle school (Grades 6–8)[23] and elementary school (Grades 4–5).[24]

Experience With the Program. The more times teachers had taught The Stock Market Game, the higher their *activities* implementation scores. Teachers who had taught the game six times or more had higher implementation scores than teachers who taught two to five times[25] and higher than those who were teaching the game for the first time during this study.[26] Teachers who taught the program two to five times had higher implementation scores than teachers who were teaching the program for the first time during this study.[27]

[23] Tukey's HSD Mean Difference = 3.612, $p < .001$.

[24] Tukey's HSD Mean Difference = 4.529, $p < .001$.

[25] Tukey's HSD Mean Difference = 2.439, $p < .001$.

[26] Tukey's HSD Mean Difference = 5.768, $p = .000$.

[27] Tukey's HSD Mean Difference = 3.329, $p < .001$.

Subject. Business teachers had significantly higher *activities* implementation scores than nonbusiness teachers.[28]

Session Length. Teachers of the 15-week game sessions had significantly higher *activities* scores than teachers of the 10-week sessions[29] and teachers of the full-year sessions.[30]

Locale. Teachers in urban schools had significantly higher *activities* scores than teachers in rural[31] or suburban schools.[32]

LESSONS AND MATERIALS CREATED BY THE STOCK MARKET GAME

The construct measuring the use of *materials created by the stock market game* is composed of 14 items related to (1) the use and (2) the frequency of use of program-created materials for teaching The Stock Market Game. These items referred to materials created by program staff to assist teachers in implementation, such as lessons, worksheets, projects, and assessments. The findings for this construct are reported in two categories—use and helpfulness.

Use of Lessons and Materials

The majority of teachers reported using the *basic* program-created materials to teach The Stock Market Game; less than half reported using more *advanced* program-created materials.

Analysis revealed that higher percentages of teachers reported using *basic* materials. Basic materials refer to those that teachers tend to use in the teaching of any subject. For example, most teachers reported integrating The Stock Market Game publications with classroom activities (88 percent) and using lessons in general (75 percent). Other commonly used materials included lessons for foundational concepts of stock and company (67 and 55 percent, respectively), worksheets (66 percent), and the standards map (63 percent), a document identifying state standards covered by lessons for The Stock Market Game. Figure 5 details teachers' responses on the most commonly used program-created materials.

[28] $F_{(1,4391)} = 171.396$, $p < .001$.

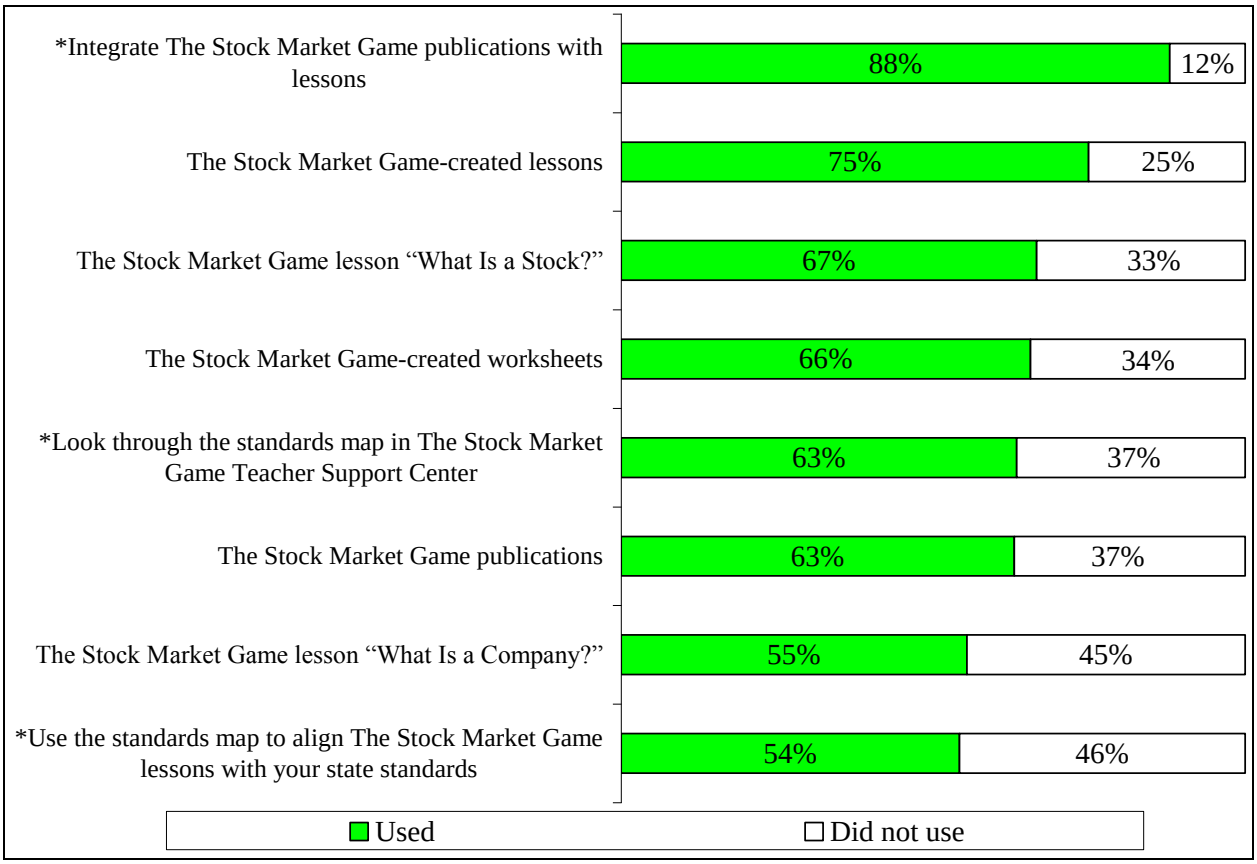
[29] Tukey's HSD Mean Difference = 3.103, $p < .001$.

[30] Tukey's HSD Mean Difference = 4.380, $p < .001$.

[31] Tukey's HSD Mean Difference = 2.152, $p < .001$.

[32] Tukey's HSD Mean Difference = 2.598, $p < .001$.

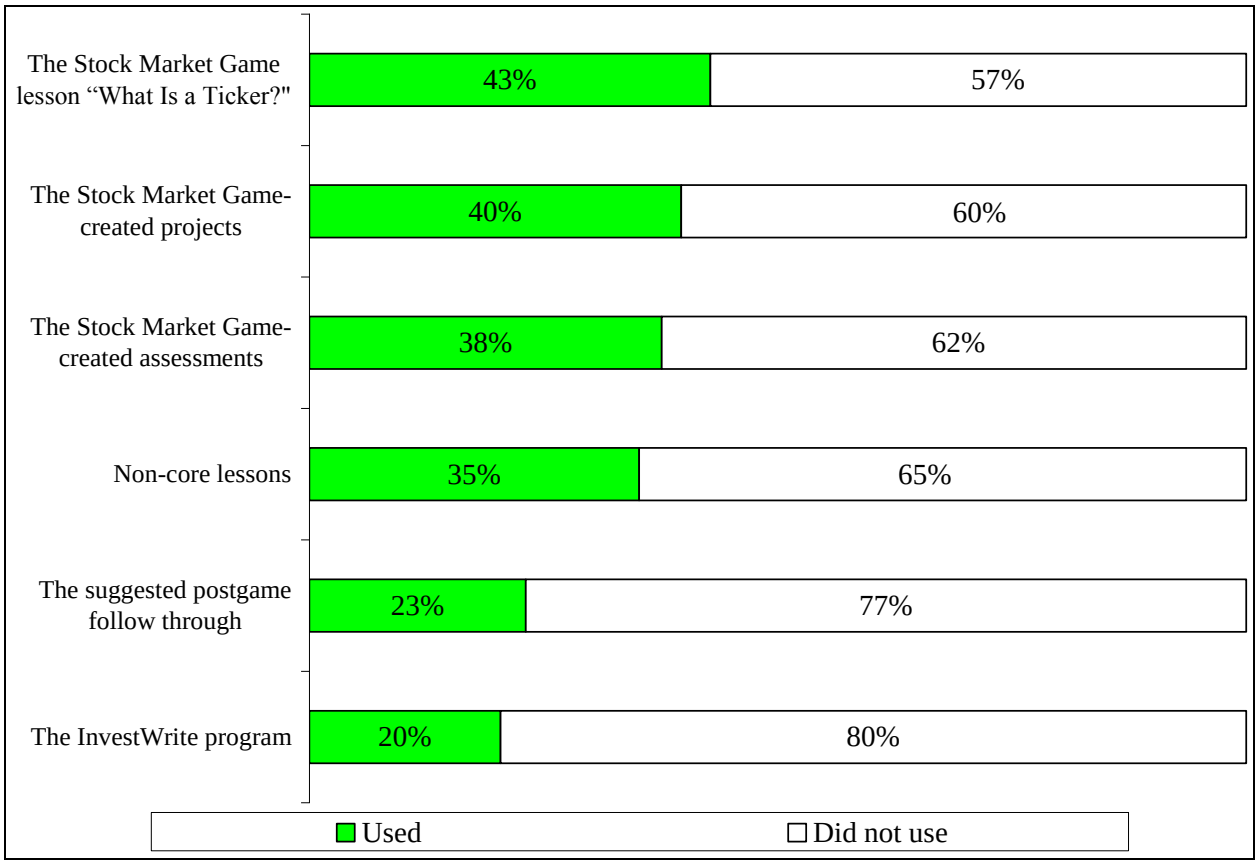
Figure 5. Percentages of Teachers Indicating Use of Basic Program-Created Materials (Used by More Than Half the Teachers)



**These items had frequency response options. All others had yes/no response options.*

The majority of teachers did not use the more advanced program-created materials, but a substantial minority are. For example, some teachers reported using projects (40 percent) and noncore lessons (35 percent), and a few reported using the postgame follow through (23 percent) and the InvestWrite program (20 percent). Although the less-used practices were generally the more advanced, one exception was the program-created lesson for the foundational concept of ticker, for which only 43 percent of teachers reported its use. Although this represents a more typical classroom activity and is a basic element of the program, it appears teachers either elected to skip this lesson or teach this concept using their own materials, rather than the program-created approach. Figure 6 details teachers' responses on the use of more advanced program-created materials.

Figure 6. Percentages of Teachers Indicating Use of Advanced Program-Created Materials (Used by Less Than Half the Teachers)



For those items that asked about frequency of using program-created materials to teach The Stock Market Game (indicated with an asterisk in Figures 5 and 6) the percentages of responses are detailed in Table 30. Of those teachers who used these materials, the majority reported doing so *some of the time*. Two items investigated specific uses of the standards map. The first asked teachers how often they conducted a basic review of the standards map; the second asked how often teachers used that resource to align lessons with state standards. For both these items, the majority of teachers indicated doing so *some of the time* (64 and 59 percent, respectively). A third item asked about using publications in lessons; again, the majority of teachers (63 percent) reported doing so *some of the time*.

Table 30. Frequency of Use of Materials Created by The Stock Market Game

In the most recent session that you taught The Stock Market Game, how often did you…	N	Some of the time	Regularly, but not all the time	Almost all the time
Integrate The Stock Market Game publications with lessons?	3,297	63.1%	27.4%	9.5%
Look through the standards map in The Stock Market Game Teacher Support Center?	2,759	63.6%	25.6%	10.9%
Use the standards map to align The Stock Market Game lessons with your state standards?	3,217	59.0%	27.2%	13.9%

The items in this construct were also analyzed to create implementation scale scores indicating the overall use of materials created by The Stock Market Game. These scale scores were analyzed using a one-way ANOVA to detect any significant differences in implementation across teacher groups based on teacher, classroom, and school characteristics. Statistically significant differences were found within the following five characteristics:

Grade Level. Teachers of elementary school students (Grades 4–5) had significantly higher scores for use of program-created materials than both teachers of middle school students (Grades 6–8)[33] and high school students (Grades 9–12).[34]

Experience With Program. Teachers who had taught the program six times or more had significantly lower scores for use of program-created materials than teachers who had taught the program two to five times[35] or teachers who were teaching the game for the first time during this study.[36]

Session Length. Teachers of 15-week sessions had significantly higher scores for use of program-created materials than teachers of 10-week sessions.[37]

Locale. Teachers in suburban schools had significantly lower scores for use of program-created materials than teachers in rural[38] or urban schools.[39]

[33] Tukey's HSD Mean Difference = 4.814, $p < .001$.

[34] Tukey's HSD Mean Difference = 5.281, $p < .001$.

[35] Tukey's HSD Mean Difference = -3.007, $p < .001$.

[36] Tukey's HSD Mean Difference = -3.958, $p < .001$.

[37] Tukey's HSD Mean Difference = 4.268, $p < .001$.

[38] Tukey's HSD Mean Difference = -3.277, $p < .001$.

[39] Tukey's HSD Mean Difference = -4.500, $p < .001$.

Helpfulness of Lessons and Materials

Although not all teachers used the materials, the majority of teachers who did use them reported that they were *moderately* or *very helpful*.

The construct that measured *use of materials created by the stock market game* also measured the helpfulness of these materials. For 11 of the 14 items, teachers who used materials also rated how helpful that material was for teaching The Stock Market Game. As previously mentioned, items asked teachers "In the most recent session that you taught The Stock Market Game, how helpful was/were…" and included the response options of *used and was vary helpful*, *used and was moderately helpful*, *used and was minimally helpful*, *used and was not helpful*, and *did not use*.

Overall, teachers who used materials reported that they were *moderately* or *very helpful*. Percentages ranged from 60 percent (for the InvestWrite program) to 90 percent (for the program-created lesson "What Is a Stock?").

Some of the most helpful materials, with at least three quarters indicating *moderately* or *very helpful*, were the foundational lessons of stock, company, and ticker (more than 85 percent), and lessons (83 percent). Notably, even for those items not used by most teachers, such as the noncore lessons, the postgame follow-through, and InvestWrite, the majority of teachers who used them found them helpful (83, 83, and 60 percent, respectively). Figure 7 details teachers' ratings of the helpfulness of program-created materials for those who reported their use.

CONNECTIONS TO OUTSIDE RESOURCES

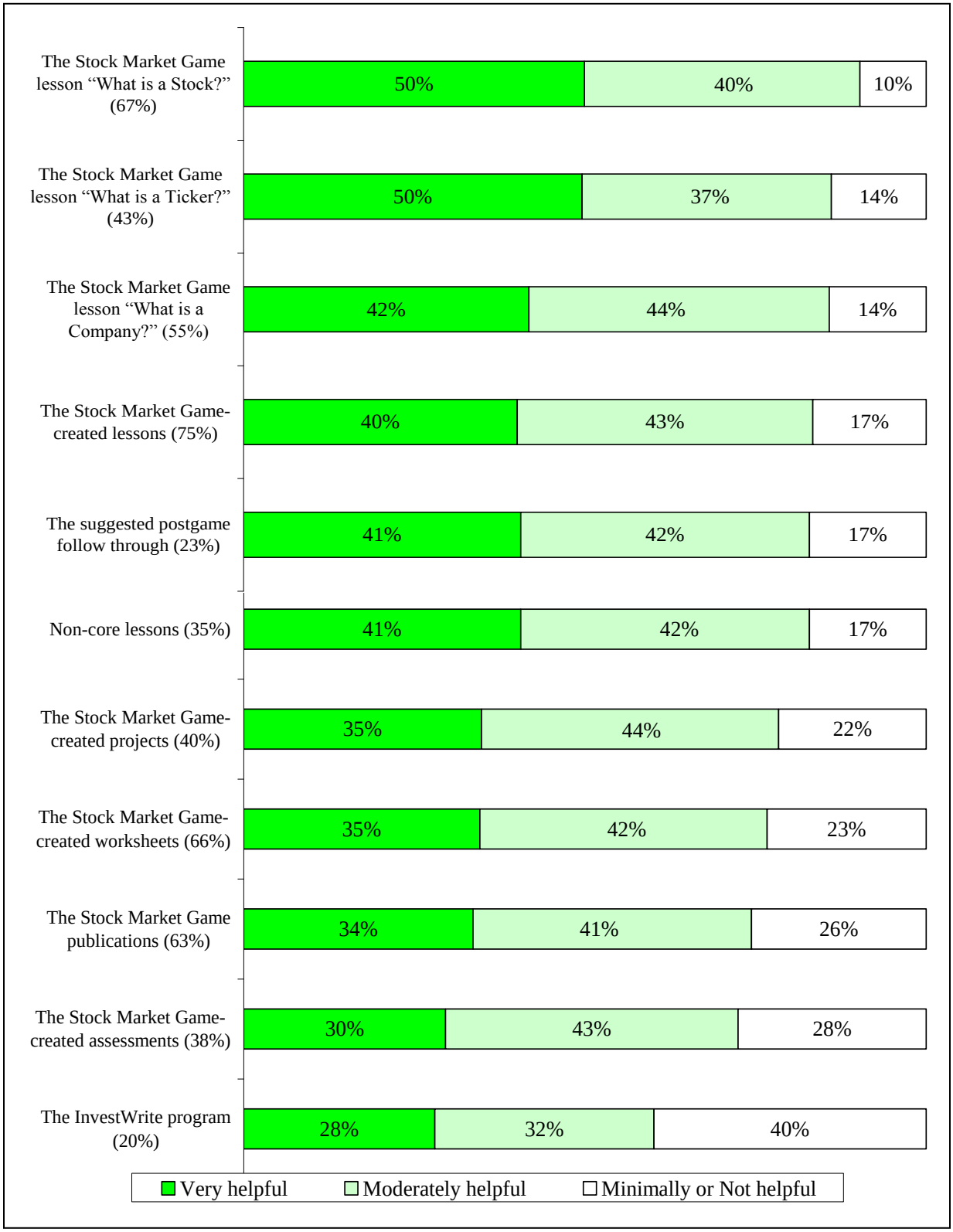
The majority of teachers reported that they connect the program to resources outside the classroom that are easy to access. Less than half made use resources that are more difficult to access.

The construct measuring *connections to outside resources* is composed of ten survey questions related to (1) use and (2) frequency of practices to connect The Stock Market Game to people and events outside the classroom.

Percentages indicating the use of these practices varied widely, ranging from 8 percent (using related field trips) to 97 percent (connecting The Stock Market Game to current events).

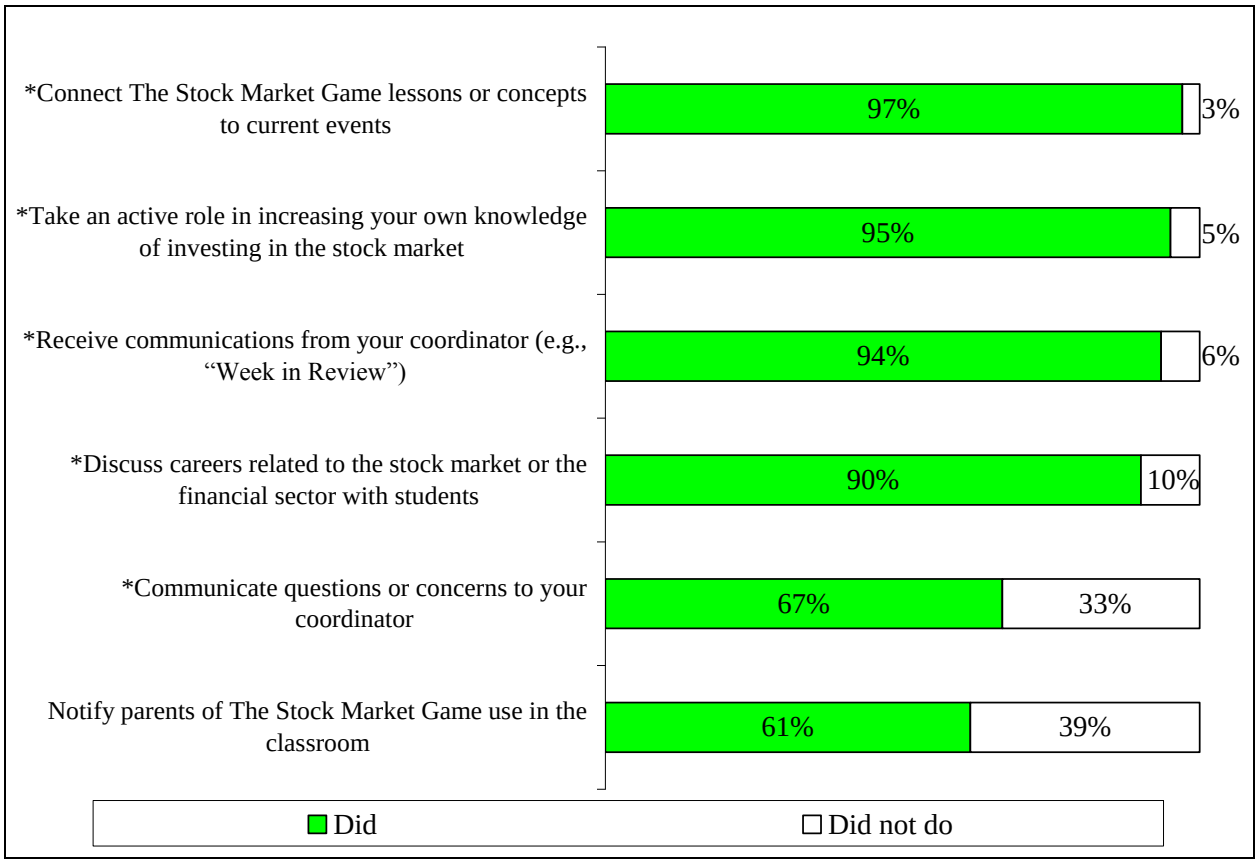
Higher percentages of teachers reported making connections to *basic* resources that are easy to access. For example, most teachers reported connecting the program to current events (97 percent) and discussing careers related to the stock market or financial sector (90 percent). Other common activities included communicating questions to the local coordinator of The Stock Market Game (67 percent) and notifying parents of the use of the program (61 percent). Figure 8 details teachers' responses on practices within the *connections* construct for which at least half the teachers reported their use.

Figure 7. Helpfulness of Materials as Rated by Teachers*



**Percentages of teachers indicating use of materials included in parentheses*

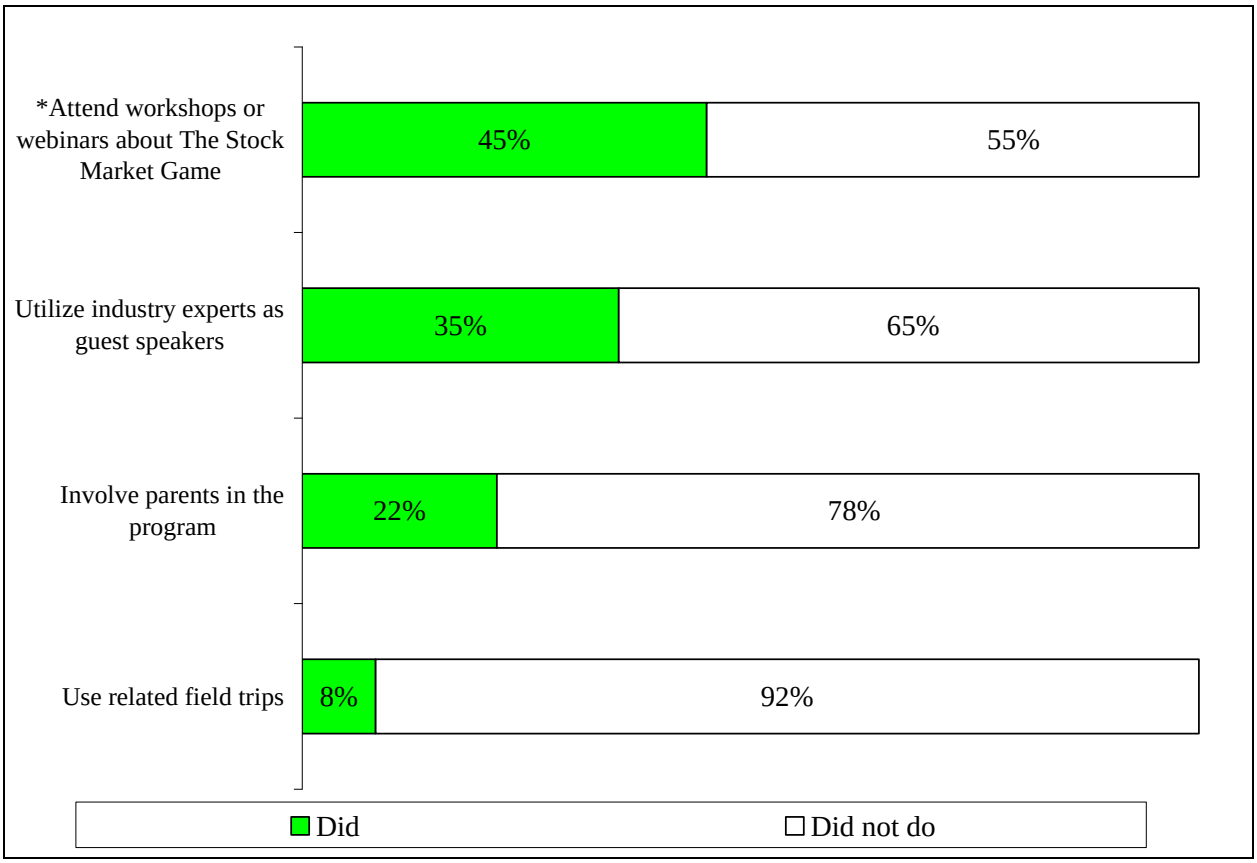
Figure 8. Percentages of Teachers Indicating Use of Basic Practices Related to Connections With Outside Resources (Used by More Than Half the Teachers)



**These items had frequency response options. The other had a yes/no response option.*

The majority of teachers did not use more advanced practices to make connections with outside resources. Nonetheless, a substantial minority did make such connections. Some teachers attended workshops or webinars about The Stock Market Game (45 percent), coordinated guest speakers (35 percent), and involved parents in the program (22 percent); few teachers reported using related field trips (8 percent). Connections like these involve events outside the classroom or people not involved in typical classroom activities and require more effort to include them. Figure 9 details teachers' responses on practices measured by the *connections* construct for which less than half the teachers reported their use.

Figure 9. Percentages of Teachers Indicating Use of Advanced Practices Related to *Connections to Outside Resources* (Used by Less Than Half the Teachers)



**This item had frequency response options. All others had yes/no response options.*

For those items that asked about frequency of use (indicated with an asterisk in Figures 8 and 9) the percentages of responses are detailed in Table 31. As noted, teachers who engaged in these practices reported more frequent use of the *basic* methods to connect the program to outside resources. For example, the practice of connecting lessons to current events and receiving communications were done *almost all the time* (47 and 65 percent, respectively). About 38 percent of teachers reported increasing their own knowledge about the stock market *regularly, but not all the time*. Teachers were more likely to report using the *advanced* activities (discussing careers, communicating with coordinator, and attending program workshops or webinars) only *some of the time* (39, 54, and 57 percent, respectively).

Table 31. Frequency of Use of Specific Practices Related to Connection to Outside Resources

In the most recent session that you taught The Stock Market Game, how often did you…	N	Some of the time	Regularly, but not all the time	Almost all the time
Connect The Stock Market Game lessons or concepts to current events?	4,185	17.8%	35.0%	47.2%
Take an active role in increasing your own knowledge of investing in the stock market?	4,104	27.9%	37.5%	34.6%
Receive communications from your coordinator (e.g., "Week in Review")?	4,032	12.5%	22.2%	65.2%
Discuss careers related to the stock market or the financial sector with students?	3,892	38.9%	35.4%	25.7%
Communicate questions or concerns to your coordinator?	2,866	53.6%	25.2%	21.2%
Attend workshops or webinars about The Stock Market Game?	1,942	57.2%	23.4%	19.4%

Finally, the items in this construct were analyzed to create implementation scale scores indicating an overall measure for making connections to outside resources. These scale scores were analyzed using a one-way ANOVA to detect any significant differences in implementation across teacher groups based on teacher, classroom, and school characteristics. Statistically significant differences were found on the following three characteristics:

Grade Level. Teachers of elementary school students (Grades 4–5) had significantly higher scores for use of connections to outside resources than both teachers of middle school (Grades 6–8)[40] and teachers of high school students (Grades 9–12).[41]

Experience With the Program. The more times teachers had taught The Stock Market Game, the higher their scores were for this construct. Teachers who had taught the game six times or more had higher *connections* scores than teachers who had taught the program two to five times[42] and higher than teachers who were teaching the game for the first time during this study.[43] Teachers who had taught the program two to five times had

[40] Tukey's HSD Mean Difference = 1.834, $p = .003$.

[41] Tukey's HSD Mean Difference = 2.251, $p < .001$.

[42] Tukey's HSD Mean Difference = 1.292, $p = .007$.

[43] Tukey's HSD Mean Difference = 2.788, $p < .001$.

significantly higher scores than teachers who were teaching the game for the first time during this study.[44]

Session Length. Teachers who taught the game during the 15-week sessions had significantly higher *connections* scores for this construct than teachers who taught during the 10-week sessions.[45] The result was not significant, however, once RCT teachers were removed from the pool.

Summary of Teacher Implementation

A summary of the findings for each construct—*activities in the classroom, lessons and materials,* and *connections to outside resources*—follows.

The majority of teachers indicated that they employed basic, familiar activities for teaching the program; fewer than half reported using more advanced teaching activities. Teachers were asked about a variety approaches to engage students in the program. More than half the teachers surveyed (56 to 98 percent) reported using basic activities, such as introducing the foundational concepts of stock, company, and ticker; posting team rankings; and recognizing student achievement. Fewer than half the teachers (8 to 48 percent) reported using more advanced activities to increase student engagement, such as posting student work, playing the game with the students, and requiring students to participate in the InvestWrite program (a writing competition in which students compose essays about financial topics).

Teachers indicated more frequent use of activities that are easier to incorporate. For example, the highest percentage of teachers reported assigning students a grade (41 percent) and posting team rankings (48 percent) *almost all of the time*, whereas for assessment, a practice which generally occurs less frequently, about half the teachers (51 percent) reported creating their own assessments *some of the time*.

Significant differences in the use of these practices were related to grade level, experience with the program, subject, session length, and locale.

The majority of teachers reported that they used the basic program-created materials to teach The Stock Market Game; less than half reported using more advanced materials. Teachers were asked about their use of materials created by The Stock Market Game, such as lessons, worksheets, projects, and assessments. Overall, more than half the teachers surveyed (54 to 88 percent) reported using basic materials, that is, those materials typically used to teach a course, such as lessons, publications, and worksheets. Fewer than half the teachers (20 to 40 percent) reported using materials that go beyond basic implementation of the program such as financial projects, postgame follow-up on investments, and InvestWrite.

[44] Tukey's HSD Mean Difference = 1.495, $p = .003$.

[45] Tukey's HSD Mean Difference = 1.083, $p = .032$.

For three items that asked about using program-created materials, the majority of teachers reported doing so *some of the time.* The majority of teachers reported integrating The Stock Market Game publications in lessons (63 percent), looking through the standards map (64 percent), and using the standards map to align lessons with state standards (59 percent).

Significant differences in the use of these practices were related to grade level, experience with the program, session length, and locale.

Although not all teachers used the materials, the majority of those who did reported that the materials were moderately or very helpful. Teachers who used materials created by The Stock Market Game rated the helpfulness of those resources for teaching the program. Overall, these teachers reported the materials to be helpful, with 60 to 90 percent rating each of the materials as *moderately* or *very helpful*. Teachers generally rated core materials (e.g., lessons for teaching the idea of a stock, company, and ticker), other general lessons, and worksheets for implementation as the most helpful. For those materials that only some teachers used (such as InvestWrite, financial projects, and postgame follow-through), those who used them found them *moderately* or *very helpful* (60 to 83 percent).

The majority of teachers reported that they connect the program to resources outside the classroom that are easy to access; fewer than half made use of less readily accessed resources. Teachers were asked about ways they might connect the game to people and events outside the classroom. More than half the teachers surveyed (61 to 97 percent) reported making connections that are easy to arrange and integrate, such as connecting The Stock Market Game to current events, discussing careers in the financial sector, and notifying parents that the program was being used in the classroom. Less than half, 8 to 45 percent, reported incorporating resources that are more difficult to arrange, such as hosting guest speakers, involving parents in the program, and coordinating field trips.

Teachers reported more frequent use of the more popular methods of connecting the program to outside resources. For the common activities of connecting lessons to current events and receiving communications, the highest percentages of teachers reported doing so *almost all the time* (47 and 65 percent, respectively). About 38 percent of teachers reported increasing their own knowledge about the stock market *regularly, but not all the time*. The highest percentage of teachers reported using less common activities (discussing careers, communicating with coordinator, and attending program workshops or webinars) *some of the time* (39, 54, and 57 percent, respectively). Significant differences in the use of these practices were related to grade level, experience with the program, and session length.

In summary, teachers appear to be using basic approaches to implement The Stock Market Game, but some are using more advanced approaches. Of those teachers using The Stock Market Game materials, most find them helpful. Finally, teachers connected the game to people and events in the outside world that are readily accessed.

Student Experiences of The Stock Market Game

To examine student opinions of The Stock Market Game, one of two versions of a newly developed survey was administered at the end of the fall 2008 game sessions. These student surveys had been pilot-tested the previous spring and were given to only those students participating in the treatment group of The Stock Market Game study. The surveys were administered electronically through a secure website created by Learning Point Associates.

Data Collection

As noted, two versions of the survey were developed, one for younger students, Grades 4–6, and one for older students, Grades 7–10, to appropriately address students at different developmental and intellectual stages. The student survey items were written specifically for the study, using guidance from the SIFMA Foundation to identify areas of particular relevance to The Stock Market Game. The final surveys consisted of 26 items that measured four constructs of interest: *engagement with the game, interaction with others, financial life skills*, and *extending the game beyond the classroom*. A number of demographic items were also included to capture student or class characteristics that might affect enjoyment of the game or academic performance. Students in the treatment condition of the RCT were asked to complete the surveys.

Analytic Methods

The findings from the student surveys were analyzed in two ways: examination of item-level frequencies, and ANOVA of the Rasch-derived scale scores.

Item-level analyses were conducted on all student responses on both student surveys. The frequency of responses produced a nuanced picture of how likely students were to agree or disagree with individual survey questions within a construct. The Rasch scale scores were used to conduct the statistical analyses of the four survey scale scores in terms of six student characteristics, which were as follows:

- *Gender* (male, female)
- *Locale* (rural, urban, suburban)
- *First time playing the game* (first time playing, played game before)
- *Playing on a team* (played game on a team, played game alone)
- *Grade category for survey of younger students*—Grades 4–5, Grade 6
- *Grade category for survey of older students*—Grades 7–8, Grades 9–10
- *Liked class* (a lot, a little)

Participants

A total of 3,111 student surveys were collected in fall 2008 for this study. Surveys with no responses or from students in Grades 11 and 12 were removed, resulting in 2,729 surveys available for analysis. Students were primarily from a suburban locale (51 percent), followed by urban (29 percent), and rural (20 percent). Students participated from all regions, located in the South (42 percent), the Midwest (22 percent), the Northeast (22 percent), and the West (14 percent). Further participant details follow.

Survey for Younger Students (Grades 4–6)

The younger student survey was taken by 1,332 students in Grades 4–6. From this survey data, 1,316 were used for the analysis. The younger student survey sample contained a majority of Grade 5 students (50 percent), followed by Grade 6 students (32 percent) and then Grade 4 students (18 percent) (see Table 32). Of the students who completed the younger student survey, there were equal numbers of male (50 percent) and female (50 percent) students.

Table 32. Number of Surveys Used in the Analysis

Grade	N	Percentage
4	234	18%
5	653	50%
6	429	32%
Total N	***1,316***	

Survey for Older Students (Grades 7–10)

The older student survey was taken by 1,779 students in Grades 7–12, but responses from students in Grades 11 and 12 were removed, because they were not part of the population targeted for this study. From the remaining student survey data, 1,413 student survey results were used for this analysis. This sample included mostly Grade 8 students (35 percent) and Grade 7 students (33 percent), followed by Grade 10 students (17 percent) and Grade 9 students (15 percent). Of the students who completed the older student survey, there were slightly more male students (53 percent) than female students (47 percent).

Table 33. Number of Surveys Used in the Analysis

Grade	N	Percentage
7	473	33%
8	492	35%
9	211	15%
10	237	17%
Total N	***1,413***	

Student Experience Findings

Findings from the student survey are discussed in terms of the four student constructs—*engagement with the game, interactions with others, financial life skills,* and *beyond the classroom*. Descriptive information for an overall level of agreement was determined based on the percentage of students who agreed or strongly agreed with each item within a construct: *most* (100 to 75 percent), *majority* (74 to 50 percent), *some* (49 to 25 percent), and *few* (24 to 0 percent). Because of the developmental differences between younger and older students, the frequencies are presented separately for the two groups.

ENGAGEMENT WITH THE GAME

Most students reported that they enjoyed, and learned from, playing The Stock Market Game.

The construct *engagement with the game* is composed of eight or nine survey questions[46] related to (1) whether The Stock Market Game was fun, interesting and exciting; (2) whether it was educational; and (3) whether students enjoyed using computers while playing the game. The item-level analysis presents the frequency of responses on the surveys completed by the younger and older students, followed by significant differences in the scale scores within various student characteristics.

Students in Grades 4–6 (Younger Students)

Most younger students reported that they enjoyed playing The Stock Market Game. More than 90 percent of students in Grades 4–6 either *agreed* or *really agreed* when responding to the statement *I liked playing The Stock Market Game*. Similarly, younger students also *agreed* or *really agreed* with statements that they enjoyed choosing their own stocks to buy (89 percent), trading stocks on the computer (84 percent), and checking their portfolios on the computer (79 percent). There was only one item for which there was not a majority in agreement—only 33 percent of students *agreed* or *really agreed* with the statement, *When I am not in class, I check my portfolio a lot.*

Table 34 presents the younger student responses to all questions related to engagement with the game.

[46] Eight items were on the survey designed for the younger students and nine were on the survey for the older students.

Table 34. Engagement With the Game—Student Surveys (Grades 4–6)

Decide how much you agree or disagree with the following statement.	N	Really Agree	Agree	Disagree	Really Disagree
I liked playing The Stock Market Game.	1,312	41.2%	49.0%	6.9%	2.8%
I enjoyed choosing which stocks to buy.	1,307	55.5%	33.8%	8.2%	2.4%
I enjoyed trading stocks on the computer.	1,307	41.5%	42.2%	11.8%	4.5%
I enjoyed checking my portfolio on the computer.	1,304	32.0%	46.7%	17.0%	4.3%
I liked figuring out how to make more money with my portfolio.	1,308	36.3%	40.4%	17.3%	6.0%
I enjoyed it when my teacher taught us about investing.	1,307	20.5%	55.7%	19.4%	4.4%
I liked playing The Stock Market Game more than activities we usually do in class.	1,312	23.6%	36.4%	32.8%	7.2%
When I am not in class, I check my portfolio a lot.	1,292	11.9%	21.1%	37.0%	30.0%

Several student characteristics were examined for significant differences in the Rasch-derived scale scores in terms of *gender*, *locale*, *grade category*, *playing on a team*, and *first time playing The Stock Market Game*. Statistically significant differences in the scale scores were found on the following three characteristics:

Gender. Younger males had significantly higher overall engagement scores than younger females.[47]

Playing on a Team. Younger students who played The Stock Market Game with a team had significantly higher overall engagement scores than those who played by themselves.[48]

First Time Playing. Younger students who had played The Stock Market Game before had significantly higher overall engagement scores than students who were playing for the first time.[49]

Students in Grades 7–10

A majority of older students reported that they enjoyed playing The Stock Market Game and that they learned while playing. Older students responded positively to the statement, *I*

[47] $F_{(1,1305)} = 10.28$, $p = .001$.

[48] $F_{(1,1307)} = 9.40$, $p = .002$.

[49] $F_{(1,1301)} = 7.74$, $p = .005$.

learned a lot when my teacher taught us about investing, with more than 78 percent of students in Grades 7–10 either agreeing or strongly agreeing with the statement. The majority of older students also tended to *agree* or *strongly agree* with the statements that they liked playing The Stock Market Game (76 percent) and they learned a lot when researching companies on the computer (75 percent). Like the younger students, the majority of students did not agree with the statement *When I am not in class, I check my portfolio a lot*—only 25 percent of older students *agreed* or *strongly agreed* with this statement.

Table 35 presents the older student responses to all questions related to engagement with the game.

Table 35. Engagement With the Game—Student Surveys (Grades 7–10)

Decide how much you agree or disagree with the following statement.	N	Strongly Agree	Agree	Disagree	Strongly Disagree
I learned a lot when my teacher taught us about investing.	1,408	22.1%	56.4%	15.9%	5.6%
I liked playing The Stock Market Game.	1,412	19.9%	56.4%	15.9%	7.7%
I learned a lot when researching companies on the computer.	1,403	22.2%	53.2%	19.4%	5.3%
I enjoyed researching companies on the computer.	1,404	24.0%	47.3%	20.5%	8.2%
I learned a lot while managing my portfolio.	1,401	15.3%	51.3%	25.9%	7.4%
I enjoyed when my teacher taught us about investing.	1,409	12.3%	51.7%	26.8%	9.2%
I liked playing The Stock Market Game more than activities we usually do in class.	1,411	25.4%	38.1%	28.3%	8.2%
I enjoyed managing my portfolio.	1,410	13.8%	42.7%	33.2%	10.3%
When I am not in class, I check my portfolio a lot.	1,409	6.6%	18.5%	38.5%	36.3%

Several student characteristics were examined for significant differences in the Rasch-derived scale scores. Statistically significant differences were found on the following three characteristics:

Gender. Older boys had significantly higher *engagement* scores than older girls.[50]

Playing on a Team. Older students who played The Stock Market Game with a team reported significantly higher overall engagement than those who played by themselves.[51]

Liked the Class. Older students who indicated they liked the class a lot reported significantly higher overall engagement than students who liked the class a little.[52]

Interactions With Others

Most students reported that playing on a team during The Stock Market Game was a positive experience and improved their interaction with others.

The construct *interaction with others* is composed of seven or nine survey questions[53] related to whether students who played The Stock Market Game (1) enjoyed working on a team, (2) liked competing against others, and (3) developed interpersonal skills such as communication, compromise, and conflict resolution. The item-level analysis presents the frequency of responses on the younger and older student surveys, followed by significant differences that were found in the scale scores between groups of students using ANOVA.

Students in Grades 4–6 (Younger Students)

Most younger students reported that playing on a team during The Stock Market Game was a positive experience and improved their interactions with others. The results from the item-level analysis showed that most younger students agreed with the survey items for this construct. The results from the younger student survey showed that close to 86 percent of students in Grades 4–6 who played on a team either agreed or really agreed with the statement, *I liked working with my team in The Stock Market Game*. Younger students also agreed or really agreed with the statements that they enjoyed playing against others (85 percent), they helped each other while playing the game (82 percent), and they shared responsibility for their portfolio (82 percent). A majority of younger students reported that they would like to be on a team if they were to play The Stock Market Game again (70 percent).

Table 36 presents the responses from the younger students for all questions related to interactions with others.

[50] $F_{(1,1405)} = 31.74$, $p < .00.1$

[51] $F_{(1,1408)} = 5.30$, $p = .021$.

[52] $F_{(1,1403)} = 198.77$, $p < .001$.

[53] The survey designed for the younger students had seven questions and the survey designed for the older students had nine items.

Table 36. Interactions With Others—Student Surveys (Grades 4–6)

Decide how much you agree or disagree with the following statement.	N	Really Agree	Agree	Disagree	Really Disagree
I liked working with my team in The Stock Market Game.	1,276[a]	46.7%	38.9%	8.6%	5.7%
I liked playing against others in The Stock Market Game.	1,303	54.6%	30.4%	9.0%	6.0%
My teammates helped each other while playing The Stock Market Game.	1,274[a]	40.0%	41.8%	12.7%	5.5%
My team shared responsibility for our portfolio.	1,263[a]	40.9%	41.5%	11.6%	6.0%
I learned how to make group decisions from playing The Stock Market Game.	1,302	36.0%	44.3%	15.0%	4.7%
I learned how to listen to other people's ideas from The Stock Market Game.	1,304	33.1%	46.4%	15.6%	5.0%
If I played The Stock Market Game again, I would like to play on a team instead of on my own.	1,299	44.9%	24.8%	13.6%	16.7%
I learned how to do a better job of telling people what I think from playing The Stock Market Game.	1,301	31.3%	40.6%	21.2%	6.9%
I learned how to solve arguments from playing The Stock Market Game.	1,306	20.9%	34.4%	32.2%	12.5%

Note: Results are displayed for students who indicated they played on a team.

Several student characteristics were examined for significant differences in the Rasch-derived scale scores. Statistically significant differences were found on the following two characteristics:

Playing on a Team. Younger students who played The Stock Market Game with a team had significantly higher *interactions* scores than those who played by themselves.[54]

Grade Category. Students at the elementary level (Grades 4–5) had significantly higher *interactions* scores than students at the middle level (Grade 6).[55]

[54] $F_{(1,1307)} = 25.51$, $p < .001$.

[55] $F_{(1,1314)} = 11.10$, $p = .001$.

Students in Grades 7–10 (Older Students)

A majority of the older students reported that playing on a team during The Stock Market Game was a positive experience and improved their interactions with others. The survey results showed that more than 82 percent of students in Grades 7–10 who played on a team either agreed or strongly agreed with the statement *I liked working with my team in The Stock Market Game.* Most older students also agreed or strongly agreed with the statements that they enjoyed competing against others (76 percent), and they learned how to make group decisions with their team (75 percent). Table 37 presents the older student responses related to interactions with others.

Table 37. Interactions With Others—Student Surveys (Grades 7–10)

Decide how much you agree or disagree with the following statement.	N	Strongly Agree	Agree	Disagree	Strongly Disagree
I liked working with my team in The Stock Market Game.	1,356[a]	34.0%	48.3%	10.6%	7.1%
I liked competing against others in The Stock Market Game.	1,407	35.6%	40.9%	15.4%	8.2%
Working with my team helped me learn how to make group decisions that everyone can agree to.	1,343[a]	23.8%	51.2%	17.0%	8.0%
If I played The Stock Market Game again, I would like to play in a team instead of on my own.	1,408	38.1%	32.5%	14.2%	15.1%
Working with my team helped me learn how to communicate my opinions to others.	1,338[a]	23.4%	50.1%	18.9%	7.5%
Working with my team helped me learn how to be a better leader.	1,353[a]	19.4%	44.9%	27.3%	8.4%
Working with my team helped me learn how to solve arguments or disagreements.	1,339[a]	16.4%	42.0%	32.0%	9.6%

Note: Results are displayed for students who indicated they played on a team.

Several student characteristics were examined for significant differences in the Rasch-derived scale scores. Statistically significant differences were found on the following two characteristics:

Playing on a Team. Older students who played The Stock Market Game with a team had significantly higher *interactions* scores than those who played by themselves.[56]

Liked the Class. Older students who indicated they liked the class a lot had significantly higher *interactions* scores than students who liked the class a little.[57]

FINANCIAL LIFE SKILLS

A majority of students reported that The Stock Market Game influenced their development of financial life skills needed in adulthood.

The construct *financial life skills* is composed of three to four survey questions[58] related to how The Stock Market Game affected the (1) development of life skills traditionally needed in adulthood, such as setting goals and making presentations, and (2) making sound financial decisions. The item-level analysis presents the frequency of responses on the younger and older student surveys, followed by significant differences that were found in the scale scores between groups of students using ANOVA.

Since there were only three items related to the development of financial life skills on the survey designed for the younger students, no scale scores could be calculated. Therefore, the ANOVAs were carried out only on the data from the survey of the older students.

Students in Grades 4–6 (Younger Students)

A majority of younger students reported that The Stock Market Game influenced their development of financial life skills needed in adulthood. The results from the younger student survey showed that most students in Grades 4–6, close to 87 percent, either *agreed* or *really agreed* with the statement *The Stock Market Game taught me to be more careful with my money*. A majority of younger students also reported that they are excited to invest in the stock market in the future because of the game (67 percent). In addition, the majority of students (67 percent) *agreed* or *really agreed* that they learned about making better presentations from playing the game.

Table 38 presents the younger students responses to all questions related to financial life skills.

[56] $F_{(1,1408)} = 8.94$, $p = .003$.

[57] $F_{(1,1404)} = 147.15$, $p < .001$.

[58] The survey designed for younger students contained three items and the survey designed for older students contained four items.

Table 38. Financial Life Skills—Student Surveys (Grades 4–6)

Decide how much you agree or disagree with the following statement.	N	Really Agree	Agree	Disagree	Really Disagree
The Stock Market Game taught me to be more careful with my money.	1,305	53.3%	33.3%	9.5%	3.9%
I am excited about investing in the stock market when I am older.	1,299	31.9%	35.0%	22.5%	10.5%
I learned how to make better presentations from playing The Stock Market Game.	1,310	23.2%	43.4%	26.9%	6.5%

Students in Grades 7–10 (Older Students)

The majority of older students reported that The Stock Market Game influenced their development of financial life skills needed in adulthood. The results from the survey showed that 67 percent of students in Grades 7–10 either *agreed* or *strongly agreed* with the statement *Because of The Stock Market Game, I am more careful about how I spend my money.* Older students *agreed* or *strongly agreed* with the statement that the game influenced their plans for making goals about their money for the future (63 percent). Some older students also reported that they planned to invest in the stock market in the future because of the game (48 percent) and some reported that playing the game helped to improve their presentation skills (43 percent).

Table 39 presents the older student responses to all questions related to financial life skills.

Table 39. Financial Life Skills—Student Surveys (Grades 7–10)

Decide how much you agree or disagree with the following statement.	N	Strongly Agree	Agree	Disagree	Strongly Disagree
Because of The Stock Market Game, I am more careful about how I spend my money.	1,405	24.8%	42.2%	23.1%	9.9%
Because of The Stock Market Game, I am making goals for my money in the future.	1,412	22.2%	41.1%	27.6%	9.1%
Because of The Stock Market Game, I plan to invest in the stock market in the future.	1,404	16.6%	31.5%	34.3%	17.7%
Playing The Stock Market Game helped me learn how to make better presentations.	1,411	11.8%	31.3%	39.1%	17.7%

Several student characteristics were examined for significant differences in the Rasch-derived scale scores. Statistically significant differences were found on the following two characteristics:

Gender. Older boys had significantly higher *financial life skills* scores than older girls.[59]

Liked the Class. Older students who indicated they liked the class a lot had significantly higher *financial life skills* scores than students who liked the class a little.[60]

BEYOND THE CLASSROOM

Some students reported applying learning from The Stock Market Game beyond the classroom.

The construct *beyond the classroom* is composed of six survey questions related to how The Stock Market Game affected (1) talking to parents and teaching them about the stock market, (2) thinking about investing and sharing information with friends, and (3) accessing financial media (e.g., newspapers, television shows, websites).

Students in Grades 4–6 (Younger Students)

Some younger students reported applying learning from The Stock Market Game beyond the classroom. The majority of younger students in Grades 4–6 *agreed* or *really agreed* with the statements related to sharing information with their parents/guardians (58 percent) and teaching their parents/guardians things they learned from the game (51 percent). In addition, 44 percent of students reported looking at the newspaper or websites to find out about stocks or companies and 40 percent thought about investing a lot outside class.

Table 40 presents the younger student responses to all questions related to applying their learning outside the classroom.

[59] $F_{(1,1405)} = 16.81$, $p < .001$.

[60] $F_{(1,1404)} = 132.20$, $p < .001$.

Table 40. Beyond the Classroom—Student Surveys (Grades 4–6)

Decide how much you agree or disagree with the following statement.	N	Really Agree	Agree	Disagree	Really Disagree
I talk about The Stock Market Game with my parent/guardian a lot.	1,304	22.6%	35.3%	25.9%	16.2%
I often teach my parent/guardian things I learned from The Stock Market Game.	1,303	22.1%	28.9%	27.6%	21.4%
When I am not in school, I often look in the newspaper or on the Internet to research stocks or companies.	1,299	15.7%	28.6%	30.0%	25.7%
When I am not in class, I think about investing a lot, even when I am not doing class homework.	1,293	16.0%	24.1%	34.7%	25.1%
When I am not in class, I often talk about The Stock Market Game with my friends.	1,302	13.2%	24.2%	33.6%	29.0%
I often watch shows on television or on the Internet about investing or the stock market.	1,301	15.6%	21.4%	31.7%	31.3%

Several student characteristics were examined for significant differences in the Rasch-derived scale scores. Statistically significant differences were found on the following two characteristics:

First Time Playing. Overall, younger students who had played The Stock Market Game before had significantly higher *beyond the classroom* scores than students who were playing for the first time.[61]

Grade Category. Overall, students at the elementary school level (Grades 4–5) had significantly higher *beyond the classroom* scores than the students at the middle school level (Grade 6).[62]

Students in Grades 7–10 (Older Students)

Some older students reported extending learning from The Stock Market Game beyond the classroom. Although students in Grades 7–10 mostly disagreed with the statements related to extending the game beyond the classroom, some students *agreed* or *strongly agreed* with the statement related to talking to their parents/guardians about The Stock Market Game (39 percent) and teaching their parents/guardians things they learned from the game (34 percent).

Table 41 presents the older student responses to all questions related to *beyond the classroom.*

[61] $F_{(1,1301)} = 8.98$, $p = .003$.

[62] $F_{(1,1314)} = 16.34$, $p < .001$.

Table 41. Beyond the Classroom—Student Surveys (Grades 7–10)

Decide how much you agree or disagree with the following statement.	N	Strongly Agree	Agree	Disagree	Strongly Disagree
I talk about The Stock Market Game with my parent/guardian a lot.	1,411	11.1%	27.8%	32.2%	28.9%
I often teach my parent/guardian things I learned from The Stock Market Game.	1,412	9.7%	23.9%	35.3%	31.2%
When I am not in school, I often look in the newspaper or on the Internet to research stocks or companies.	1,411	7.9%	21.8%	34.6%	35.6%
When I am not in class, I think about investing a lot, even when I am not doing class homework.	1,409	7.4%	20.7%	38.4%	33.6%
When I am not in class, I often talk about The Stock Market Game with my friends.	1,409	7.9%	19.6%	34.7%	37.8%
I often watch shows on television or on the Internet about investing or the stock market.	1,408	7.8%	18.8%	35.8%	37.6%

Several student characteristics were examined for significant differences in the Rasch-derived scale scores. Statistically significant differences were found on the following two characteristics:

Gender. Overall, older boys had significantly higher *beyond the classroom* scores than older girls.[63]

Liked the Class. Overall, older students who indicated they liked the class a lot had higher *beyond the classroom* scores than students who liked the class a little.[64]

Summary of Student Experience Findings

The surveys given to students asking about their experience with The Stock Market Game suggest that students have a positive experience with the game as a whole. The following paragraphs summarize students' reports of engagement with the game, interactions with others, development of financial life skills, and applying learning beyond the classroom, as well as variations among different groups of students.

Engagement With the Game. Most students reported that they enjoyed playing The Stock Market Game and learned a lot. Most students indicated that they enjoyed, and learned about, the different aspects of the game, such as choosing which stocks to buy and trading

[63] $F_{(1,1405)} = 8.18$, $p = .004$.

[64] $F_{(1,1404)} = 114.52$, $p < .001$.

stocks on the computer. Approximately 90 percent of younger students in Grades 4–6 reported that they enjoyed playing The Stock Market Game, as did 78 percent of older students in Grades 7–10. When asked, most older students agreed that they learned a lot about investing and researching companies on the computer.

Interactions With Others. Most students reported that playing on a team during The Stock Market Game was a positive experience and improved their interaction with others. Most students indicated that they enjoyed, and learned about, competition, communication, compromise, and conflict resolution while playing The Stock Market Game. The majority of students said that if they played the game again, they would like to play on a team—70 percent of younger students and 71 percent of older students.

Financial Life Skills. The majority of students reported that The Stock Market Game influenced their development of financial life skills needed in adulthood. The majority of students agreed that playing The Stock Market Game influenced them to think more about budgeting and financial planning. Younger students (87 percent) and older students (67 percent) agreed that The Stock Market Game taught them to be more careful with how they spend their money. The younger students (67 percent) and older students (48 percent) were excited about investing in the real stock market in the future.

Beyond the Classroom. Some students reported applying outside the classroom what they learned while playing The Stock Market Game. Some students reported thinking about investing outside class, talking to their friends about the game, watching financial television shows, or looking at stocks or companies in newspapers or on the Internet in their spare time. For example, 44 percent of younger students and 30 percent of older students reported researching stocks or companies on the Internet or in newspapers when not in class. In addition, almost 58 percent of younger students, and 39 percent of older students, reported that they talked to their parents about The Stock Market Game.

VARIATIONS IN FINDINGS BY STUDENT CHARACTERISTICS

Some survey results varied significantly by student characteristics. When students were separated into subgroups for the ANOVA analyses, there were some significant differences observed within five student factors:

Gender. According to the overall results from both student surveys, males had significantly higher *engagement with the game* scores than females. In addition, older males reported significantly higher scores related to extending the game *beyond the classroom* and higher *financial life skills* scores than older females.

Played on a Team. Overall, both older and younger students who played on a team reported significantly higher *engagement with the game* scores and a higher *interactions with others* scores than those who played alone.

First Time Playing The Stock Market Game. For the younger students, those who indicated they had played the game before had significantly higher *engagement with the game* scores and extending the game *beyond the classroom* scores than those younger students who were playing for the first time.

Liked the Class. A significant difference was observed on all four survey constructs between the scores of older students who indicated they liked the class a lot and the scores of those who liked the class a little. Older students who liked the class a lot had significantly higher scores for *engagement with the game, interactions with others,* extending the game *beyond the classroom,* and *financial life skills*.

Grade Category. Within the younger student survey, it appears that the students in the elementary category (Grades 4–5) reported higher *interactions with others* scores and higher extending the game *beyond the classroom* scores than the students in the middle category (Grade 6).

The Relationship Between Teacher Implementation and Student Experience

To examine the relationship between teacher implementation of The Stock Market Game and student experience playing The Stock Market Game, mixed model analyses were conducted using the survey data from participating teachers and students in the treatment group.

Analytic Methodology

Rasch-derived scale scores from the teacher and student surveys were analyzed using a mixed modeling approach. Both surveys were investigated with regard to psychometric validity and reliability using Rasch analysis. A scale score was calculated for each teacher for each of three implementation constructs (a*ctivities in the classroom, lessons and materials created by The Stock Market Game,* and *connections to outside resources*) based on ten to fourteen survey items per construct. In addition, a Rasch scale score for an overall measure of implementation was calculated. Similarly, each student received a scale score for each of the four constructs—*engagement, interaction with others, financial life skills,* and *beyond the classroom*—based on four to seven items per construct. Teacher scale scores were used to explore variation in student experience scale scores. In other words, this analysis answers the question: Is the variability in student experience (student scale scores) explained by variation in the ways in which teachers implement the game (teacher scale scores)?

For teachers, the overall implementation score was created to have a mean of 50 and standard deviation of 10, and the other three construct means and standard deviations varied as determined by their linking to the overall implementation score. For the student surveys, a different set of scale scores was calculated for each version of the two student surveys. All student constructs also have scale score mean of 50 and standard deviations of 10.

Given the structure of the data (students are nested within classrooms) a mixed model analysis was used. This method provides a more accurate measure of the contribution of

each of the teacher implementation scale scores in accounting for the variability in student scale scores than multiple linear regression.

Each student scale score was modeled with the overall *implementation* (teacher) scale score as well as for each of the three other teacher scale scores. This led to 14 models. Only the significant results are discussed in what follows. Appendix F provides the results for all these analyses.

Participants

Only data from those teachers and students who were in the treatment group of the RCT were used for this analysis. Classrooms that had only a teacher survey or only student surveys were not included. A total of 173 classrooms had both teacher and student surveys submitted. There were 2,619 student surveys submitted from these 173 classrooms.

Teacher Implementation and Student Experience Findings

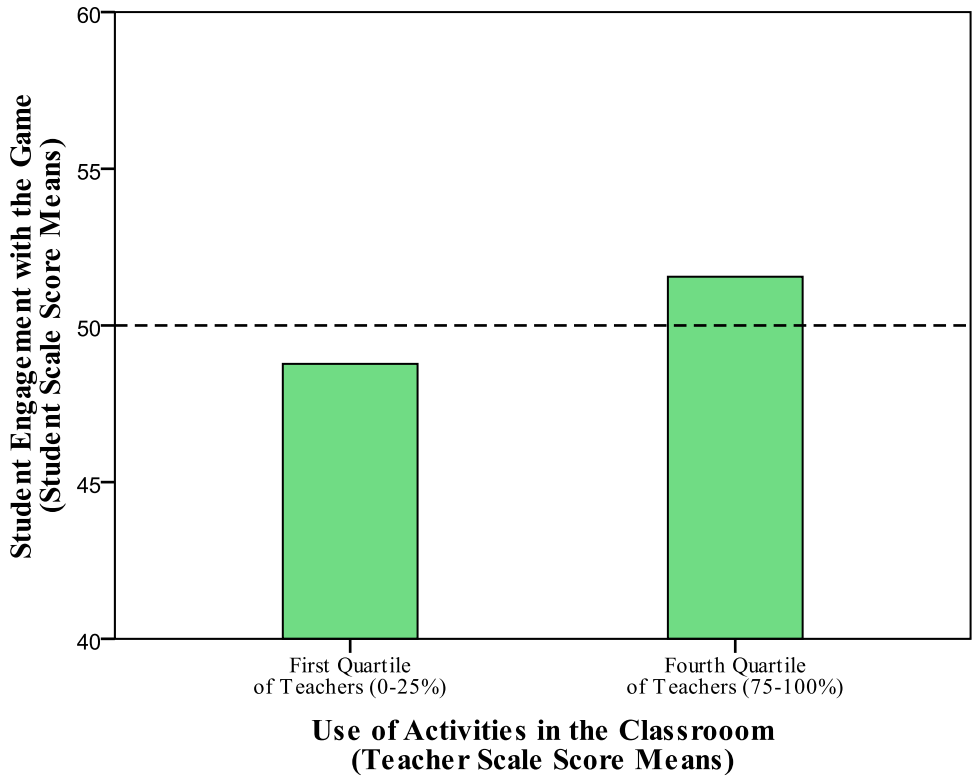
Findings are organized by three of the four student constructs—*engagement, interaction with others*, and *beyond the classroom.* None of the relationships between the student scale scores for *financial life skills* and the teacher scale scores was significant.

ENGAGEMENT WITH THE GAME

There was only one significant finding associated with the relationship between student engagement and teacher implementation. There was a positive association between teachers who reported using a more extensive set of materials and activities to teach The Stock Market Game and the reported engagement of younger students in Grades 4–6 (t = 2.10, p = .039)

Figure 10 illustrates the *activities in the classroom* scale score means of the teachers in the first quartile (bottom 25 percent) and teachers in the fourth quartile (top 25 percent) as they relate to the *engagement with the game* student scale score means. Teachers in the top quartile who had the highest scale scores for *activities in the classroom* (representing agreement with items such as creating their own assessments and projects for the game) had above-average levels of *student engagement* associated with them. Younger students reported higher levels of enjoyment with The Stock Market Game when they had teachers who used a more extensive set of materials and activities in the classroom.

Figure 10. Relationship of Teacher *Activities in the Classroom* to *Engagement With the Game* for Younger Students (Grades 4–6)



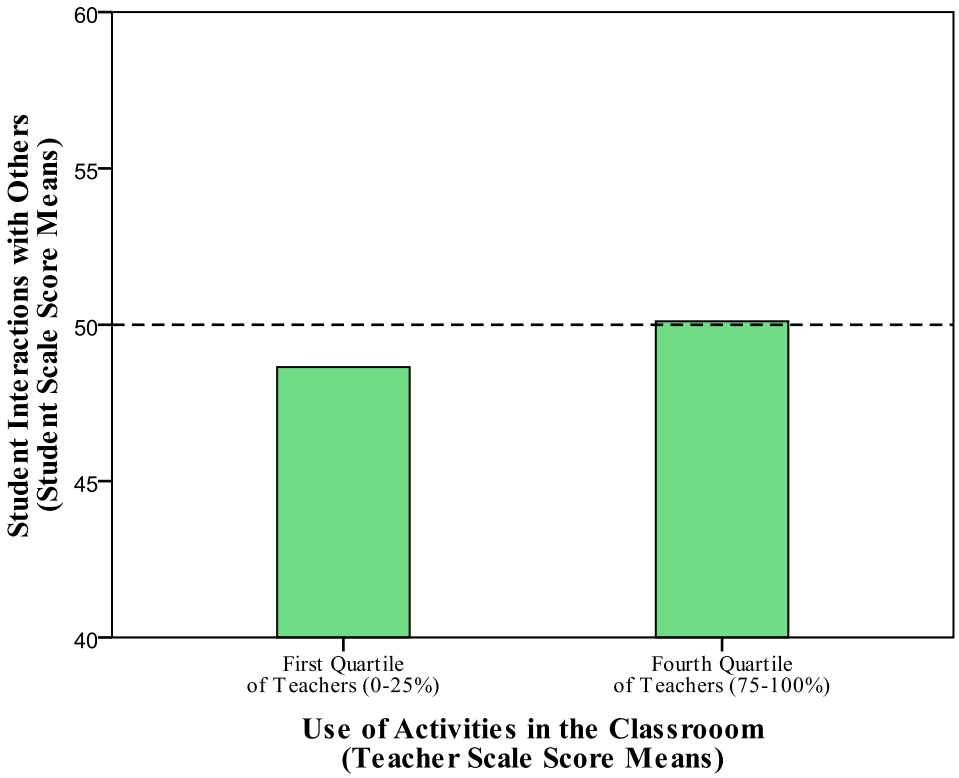
Note: 50 represents the average scale score for the engagement *construct.*

INTERACTIONS WITH OTHERS

There was only one significant finding associated with the relationship between student *interactions with others* and teacher implementation. Teachers who reported using a more extensive set of materials and activities to teach The Stock Market Game were associated with stronger positive *interactions* for younger students in Grades 4–6 (t = 1.95, p = .055).

Figure 11 illustrates the *Activities in the Classroom* scale score means of the teachers in the first quartile (bottom 25 percent) and teachers in the fourth quartile (top 25 percent) as they relate to the *interaction with others* scale score means of the younger students. Teachers in the top quartile who had the highest scale scores for *activities* were associated with higher levels of student interactions than teachers in the bottom quartile. That is, younger students reported higher levels of interactions with others when they had teachers who used a more extensive set of materials and activities in the classroom.

Figure 11. Relationship of Teacher *Activities in the Classroom* to *Interactions With Others*, Student Survey (Grades 4–6)



Note: 50 represents the average scale score for the activities in the classroom *construct.*

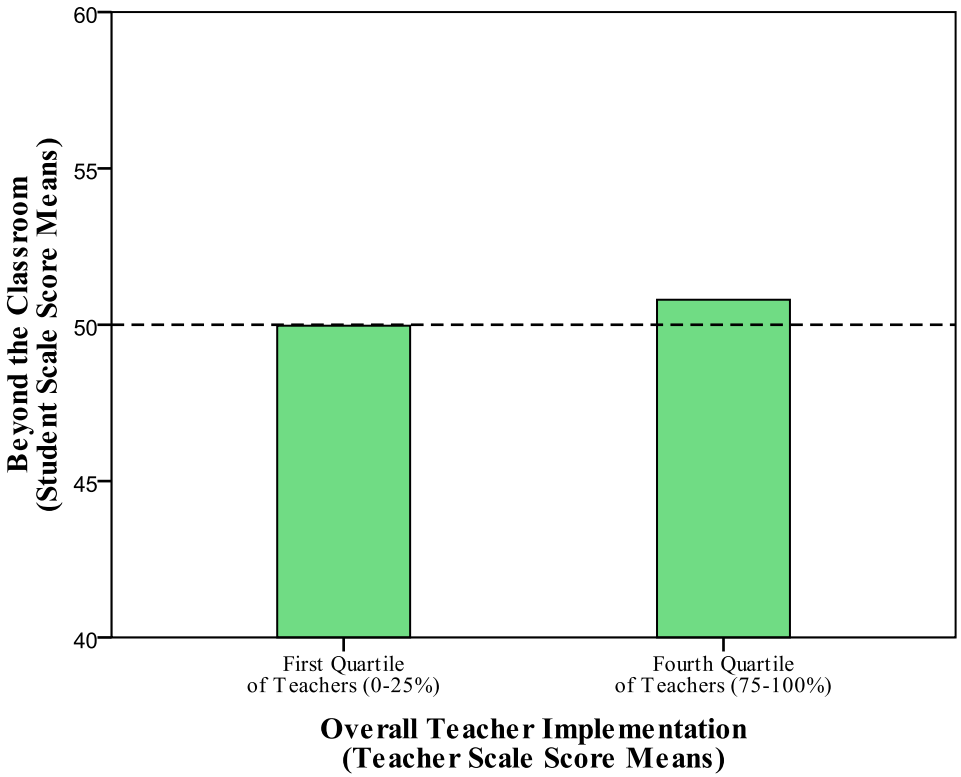
BEYOND THE CLASSROOM

There were three significant associations between student scales scores for *beyond the classroom* scale score and overall teacher implementation scale scores. Discussion of each association follows.

There was a positive association between the overall teacher implementation scale score and the scale scores for *beyond the classroom* for younger students in Grades 4–6 ($t = 2.76$, $p = .007$)

Figure 12 compares the overall implementation scale score means of the teachers in the first quartile (bottom 25 percent) and teachers in the fourth quartile (top 25 percent) as they relate to the *beyond the classroom* student scale score means. Teachers in the top quartile, who had the highest levels of overall implementation, were associated with students who had above-average *beyond the classroom* scale scores.

Figure 12. Relationship of Teacher *Overall Implementation* to *Beyond the Classroom*, Student Survey (Grades 4–6)

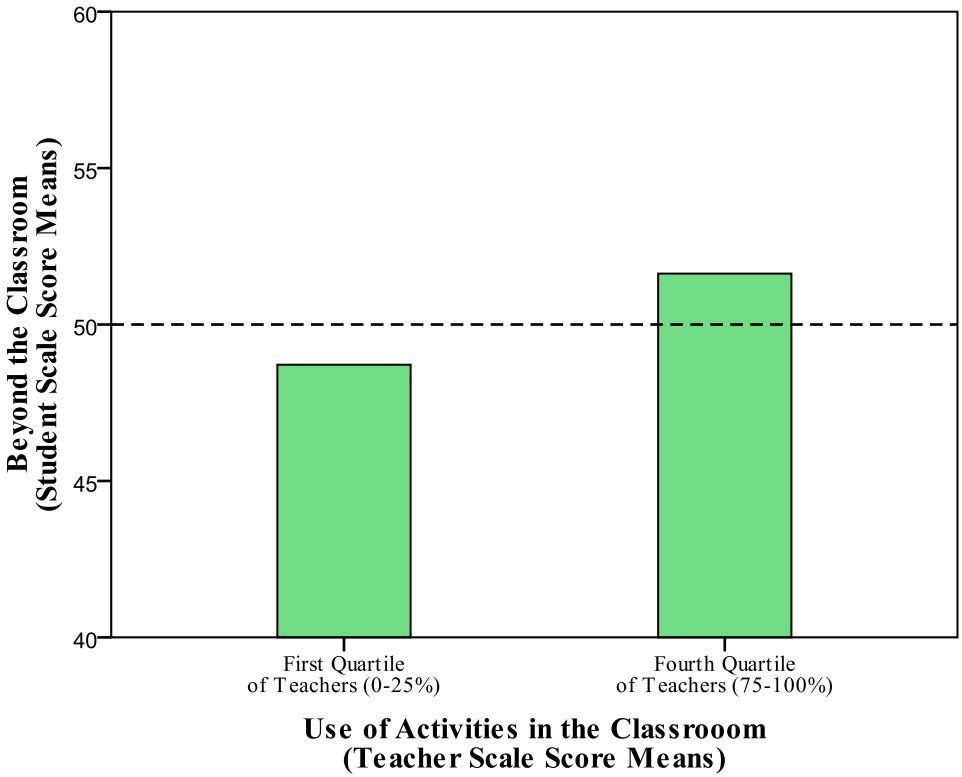


Note: 50 represents the average scale score for the beyond the classroom *construct.*

There was a positive association between teachers who specifically reported using a more extensive set of materials and activities to teach The Stock Market Game and higher levels of applying the learning from the game beyond the classroom for younger students in Grades 4–6 (t = 2.64, p = .010).

Figure 13 illustrates the relationship between the *activities in the classroom* scale score means of the teachers in the first quartile (bottom 25 percent) and teachers in the fourth quartile (top 25 percent) and the *beyond the classroom* student scale score means. Teachers in the top quartile who reported the highest use of activities in the classroom were associated with students with above-average *beyond the classroom* scale scores.

Figure 13. Relationship of Teacher *Activities in the Classroom* to *Beyond the Classroom*, Younger Student Survey (Grades 4–6)

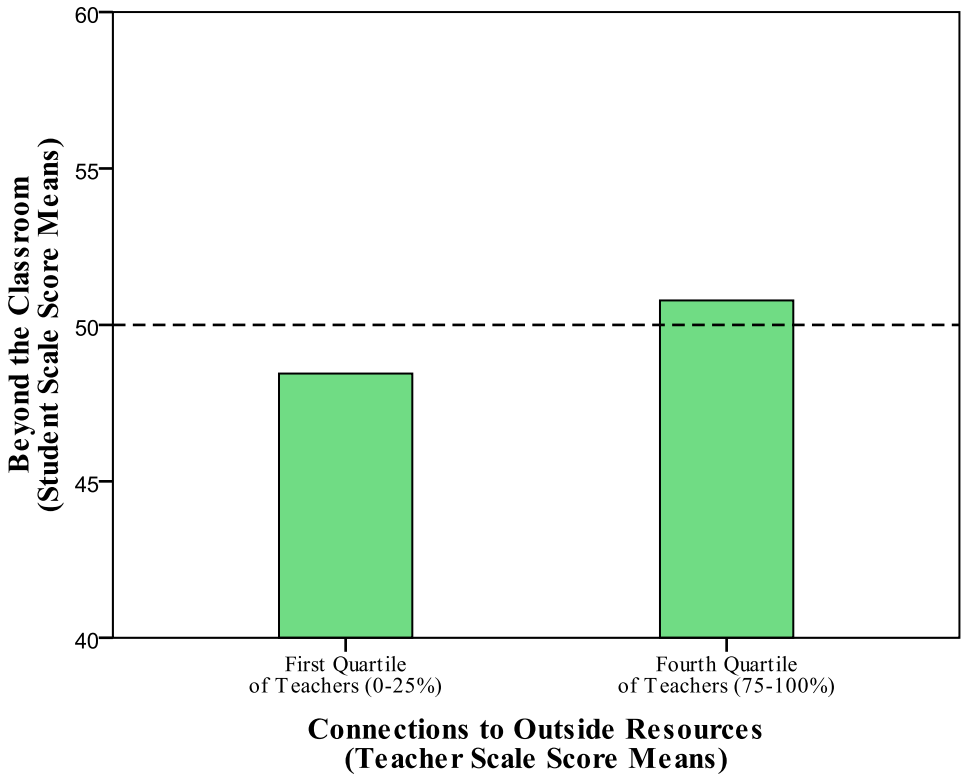


Note: 50 represents the average scale score for the beyond the classroom *construct.*

There was also a positive association between teachers who reported linking the stock market game to outside resources and the extension of the game beyond the classroom for older students in Grades 7–10 ($t = 2.54$, $p = .010$).

Figure 14 illustrates the relationship between the *connections to outside resources* scale score means of the teachers in the first quartile (bottom 25 percent) and teachers in the fourth quartile (top 25 percent) to the *beyond the classroom* student scale score means. Teachers in the top quartile who reported the highest incorporation of outside resources such as organizing class field trips and inviting guest speakers were associated with students who had above-average levels of extending the learning from the game beyond the classroom.

Figure 14. Relationship of Teacher *Connections to Outside Resources* to *Beyond the Classroom*, Older Student Survey (Grades 7–10)



Note: 50 represents the average scale score for the beyond the classroom *construct.*

Summary of Teacher Implementation and Student Experience

The analyses of the teacher and student surveys suggest that there is a positive relationship between teacher implementation of The Stock Market Game and how students experience the game. The specific area of implementation that appears to be most strongly related to student experience was measured by the construct *activities in the classroom*. There was a positive significant relationship between higher scores on this scale and three of the four student experience scales. In other words, using a more extensive set of materials and activities in the classroom is related to greater amounts of student engagement, beneficial student interactions, and greater application of student learning outside the classroom. These findings can be summarized as follows.

Teaching The Stock Market Game with a greater breadth and depth of practices was found to be related to stronger engagement for younger students. Students in Grades 4–6 taught by teachers who used a more extensive set of materials and teaching practices (such as posting student scores, assigning grades, and creating assessments/projects) reported higher levels of engagement with playing The Stock Market Game.

Teaching The Stock Market Game with a greater breadth and depth of practices was found to be related to stronger positive interactions among younger students. Students in Grades 4–6 taught by teachers who used a more extensive set of materials and teaching practices reported higher levels of positive interactions with others and development of interpersonal skills.

Teachers with higher levels of overall implementation of The Stock Market Game were found to be related to younger students extending their learning activities beyond the classroom. Students in Grades 4–6 taught by teachers with a higher overall level of implementation more often reported that they extended their learning beyond the classroom with activities such as talking about the stock market with their parents and friends, thinking about investing outside school, and accessing financial media (television, newspapers) at home.

Teaching The Stock Market Game with a greater breadth and depth of practices was found to be related to younger students extending their learning activities beyond the classroom. Students in Grades 4–6 taught by teachers who specifically used a more extensive set of materials and teaching practices more frequently reported extending their learning beyond the classroom.

Teaching The Stock Market Game with more advanced methods of linking the game to outside resources was found to be related to older students extending their learning beyond the classroom. Students in Grades 7–10 taught by teachers who related the course to more outside resources (such as linking the game to current events, organizing related field trips, and involving parents and guest speakers) more frequently reported extending their learning beyond the classroom.

Effect of Implementation on Student Learning

To further examine the variation in student learning in classrooms participating in The Stock Market Game, we analyzed survey data from students and teachers in relation to student test score data. We analyzed data along two lines. First, we examined the data to determine the extent to which teacher-reported implementation of The Stock Market Game correlated with greater student learning. For this analysis, we compared a measure of overall implementation, as well as aspects of implementation (i.e., *activities in the classroom*, *lessons and materials created by The Stock Market Game,* and *connections to outside resources),* with changes in student learning.

Second, student perceptions of their *engagement with the game*, their *interactions with others*, and their application of learning *beyond the classroom* were compared with their test scores on the investor knowledge and mathematics assessments.

The analyses suggest some significant relationships between student learning and student experiences as well as between student learning and teacher implementation. The findings for the mathematics and investor knowledge tests follow.

Analytic Methodology

To account for the nested nature of the data (students nested within classrooms), the analyses used a hierarchical linear modeling approach (also known as mixed-effects regression). This modeling framework accounts for variance in the data that is attributable to both differences among students within a classroom and differences among classrooms.

The effect of implementation was modeled from two perspectives. First, the effect of overall teacher implementation of The Stock Market Game was analyzed to determine any relationship between teachers' ratings and students' learning. Second, the effect of the specific aspects of implementation (*activities in the classroom, lessons and materials,* and *connections to outside resources*) was modeled in relationship to student learning. For the models that examined the relationship between student perceptions and student learning, no teacher-level variables were included (i.e., no interaction between teacher implementation and student survey responses was modeled in relation to student learning). Table 42 shows the fit of the models for each of the assessments and the student and teacher variables used in the models.

Table 42. Student Learning Models (for Mathematics and Investor Knowledge) and Included Variables

Modeled Relationship	Student Variables	Teacher Variables
Overall teacher implementation on student learning	• Pretest • Gender • Played The Stock Market Game in another class	• Overall implementation scale score
Specific aspects of implementation on student learning	• Pretest • Gender • Played The Stock Market Game in another class	• *Activities in the classroom* scale score • *Lessons and materials* scale score • *Connections to outside resources* scale score
Student perceptions on student learning	• Pretest • Gender • Played The Stock Market Game in another class • *Engagement with the game* scale score • *Interactions with others* scale score • *Beyond the classroom* scale score	

Model fit and the significance of the relationship between the variables (and their interactions) were considered in determining the best final model. The details of the modeling of implementation and student experiences on student learning are included in

Appendix G. The following sections provide the major findings from these analyses, presenting the results first for mathematics followed by investor knowledge.

Mathematics

Student learning in mathematics was examined in relation to survey data on teacher implementation and student experiences. The data were analyzed separately for students who took the Grades 4–6 mathematics assessment and who took the Grades 7–10 mathematics assessment. The results for teacher implementation are provided first, followed by the findings for student experiences.

TEACHER IMPLEMENTATION

Statistical modeling found no significant relationship between overall teacher implementation of the game and student mathematics learning. This finding was consistent for both students in the lower Grades (4–6) and in the upper Grades (7–10). Although no effect of overall implementation was discovered during the analysis, the construct addressing *activities in the classroom* did show a positive, significant relationship with student mathematics learning for students in Grades 7–10 ($t = 2.29$, $p = 0.025$). More specifically, a 10-point increase in teacher implementation of the game in the classroom (a one-standard-deviation change) was predictive of a 7.6-point change in student learning.

The modeling also revealed that the relationship of implementation with learning sometimes depended on the age of the students. In particular, for the younger students (Grades 4–6) there was an interaction between the construct addressing *lessons and materials* and gender. A higher teacher score for the *lessons and materials* construct tended to be more beneficial for boys than for girls ($t = 2.06$, $p = 0.039$). For the older students (Grades 7–10), there was a significant negative interaction between the construct addressing *connections to outside resources* and student pretest scores ($t = –3.40$, $p = 0.001$). That is, students who scored lower on the pretest tended to benefit more from higher *connections to outside resources* scores than did students who did better on the pretest. Furthermore, there was a significant positive interaction between the construct *activities in the classroom* and student pretest scores ($t = 3.21$, $p = 0.001$). These findings indicate that making connections between the game and the outside world may work better for students who have less mathematics ability at the start of the game, whereas students with higher initial mathematics ability may benefit more from greater use of The Stock Market Game *activities in the classroom.*

STUDENT EXPERIENCES

Statistical modeling revealed that there did not appear to be a significant statistical relationship between individual student perceptions of The Stock Market Game and their mathematics learning. Although the construct *engagement* (for example) had no relationship that was consistent for the average student, some student experiences did matter for particular groups of students. There was a significant negative interaction between student *engagement* scores and their pretest scores ($t = –2.45$, $p = 0.015$), and a significant positive interaction between student *beyond the classroom* scores and their pretest scores ($t = 3.25$, $p = 0.001$). These findings imply that lower-ability students may

benefit more from being more engaged with the game than students with higher initial ability. Trying to engage lower-ability students with the game may result in greater growth in mathematics ability. In contrast, students with higher initial ability may benefit more from relating the principles of The Stock Market Game to *activities beyond the classroom*—that is, seeing the connection between The Stock Market Game and the outside world may help facilitate greater growth in mathematics achievement.

Investor Knowledge

Changes in students' investor knowledge scores were examined in relation to survey data on teacher implementation and student experiences. The data were analyzed separately for students who took the elementary school, middle school, and high school investor knowledge assessments. The results for teacher implementation are provided first, followed by the findings for student perceptions.

TEACHER IMPLEMENTATION

Overall teacher implementation of The Stock Market Game showed a significant relationship with student investor knowledge learning for many students, especially for students in middle school. Although no such significant relationship was found for elementary students or high school students in general, the relationship was positive and significant for students at the middle school grade levels ($t = 2.03$, $p = 0.046$). For middle school students, a 10-point change in teacher implementation (a one-standard-deviation change) was predictive of a 10.4-point score change on the investor knowledge assessment. In addition, there was a significant relationship between teachers' scores on the construct addressing *connections to outside resources* and student learning ($t = 2.30$, $p = 0.024$).

Furthermore, although there was no significant effect of overall implementation at the high school level, teachers' scale scores for *activities in the classroom* showed a significant positive relationship with investor knowledge learning ($t = 2.39$, $p = 0.23$). In particular, a 10-point change in the teacher-reported scale for this area of implementation (a one-standard-deviation change) was predictive of a 23-point change in a student's score on the investor knowledge assessment. This effect appeared to be larger for students with higher pretest scores ($t = 3.43$, $p = 0.001$)—that is, students with more initial investor knowledge tended to benefit more than lower-ability students from higher implementation of The Stock Market Game activities in their classroom.

In addition to the main effects of teacher implementation, there were also several interactions between predictors of student learning that yielded interesting findings. For elementary students, the construct addressing *connections to outside resources* had no overall effect but showed a negatively significant interaction with student pretest scores ($t = -4.04$, $p < 0.001$). In general, students with lower pretest scores tended to see greater benefit from higher teacher ratings for the *connections to outside resources* construct. For high school students, there was a significant negative interaction between the *lessons and materials* construct and student pretest scores—indicating that students with lower pretest scores tended to gain a greater benefit of more use of The Stock Market Game–provided lessons and materials ($t = -3.86$, $p < 0.001$).

STUDENT EXPERIENCES

For both middle school and high school students, student perceptions of playing The Stock Market Game and learning about investment had a significant relationship with their level of investor knowledge learning. Students who reported a greater engagement with the game tended to demonstrate significantly more learning than students who were less engaged with the game. For middle school students, a 10-point change in their reported engagement (a one-standard-deviation change) was predictive of a 11.8-point increase in their investor knowledge assessment score ($t = 3.55$, $p < 0.001$). For high school students, the effect was even more profound, with a similar change in engagement corresponding to a 20.4 point increase in the investor knowledge score ($t = 4.12$, $p < 0.001$). Student-reported perceptions of interactions with their team members also had a significant relationship with their investor knowledge learning; for interactions, however, the relationship with student learning was negative. That is, students who reported more favorable interactions with their team members and classmates tended to have lower investor knowledge assessment scores (middle school: $t = -1.84$, $p = 0.066$; high school: $t = -1.97$, $p = 0.050$).

Summary of Findings on Student Learning

The examination of the relationship between teacher-reported implementation of the game, student perceptions of their experiences with the game, and student learning revealed several important findings on effective use of the game to promote better outcomes for students. The previous section described the aspects of the game that proved most beneficial for students. The overarching themes of those findings are summarized here.

- Teacher implementation matters most for middle school students. Students whose teachers had higher reported implementation of The Stock Market Game had higher investor knowledge assessment scores.
- At the high school level, students whose teachers reported greater *activities in the classroom* had higher investor knowledge assessment scores.
- Higher reported implementation of The Stock Market Game had a minimal relationship with scores on the mathematics assessment.
- Middle school and high school students who reported higher *engagement with the game* had significantly higher scores on the investor knowledge assessment. An emphasis on engaging students with the game may lead to more development of investor knowledge.
- Middle school and high school students who reported higher levels of *interactions with others* had significantly lower scores on the investor knowledge assessment. That is, students who tended to interact more and be more social may have experienced a negative effect on the development of investor knowledge from those activities.

Effect on Teacher Investment Practices

Although The Stock Market Game targets students, an added benefit might be an effect on teacher investment practices. In order to explore the effect of teaching the game on teachers' investment practices and obtain a representative sample, the respondent group was expanded beyond those teachers in the RCT and a survey was administered nationwide to teachers of The Stock Market Game.

The teacher survey was designed specifically for the study with guidance from the SIFMA Foundation to identify areas of particular relevance to the program. The final survey contained 20 items that measured investment practices organized by three constructs of interest: *engaging in financial planning*, *conducting financial research*, and *using investment products and services*. The survey also included a number of demographic items to capture teacher characteristics that might affect teachers' investment practices or their perceptions of the influence of the program on those practices.

The data-collection process, analytic methods, and participants are described in the previous section on the Teacher Implementation of The Stock Market Game.

Investment Practices Findings

For each construct—*financial planning*, *financial research*, and *investment products and services*—responses were analyzed to explore whether teachers generally employ these practices and products, and, for those who use them, the perceived influence of the program on those practices and products.

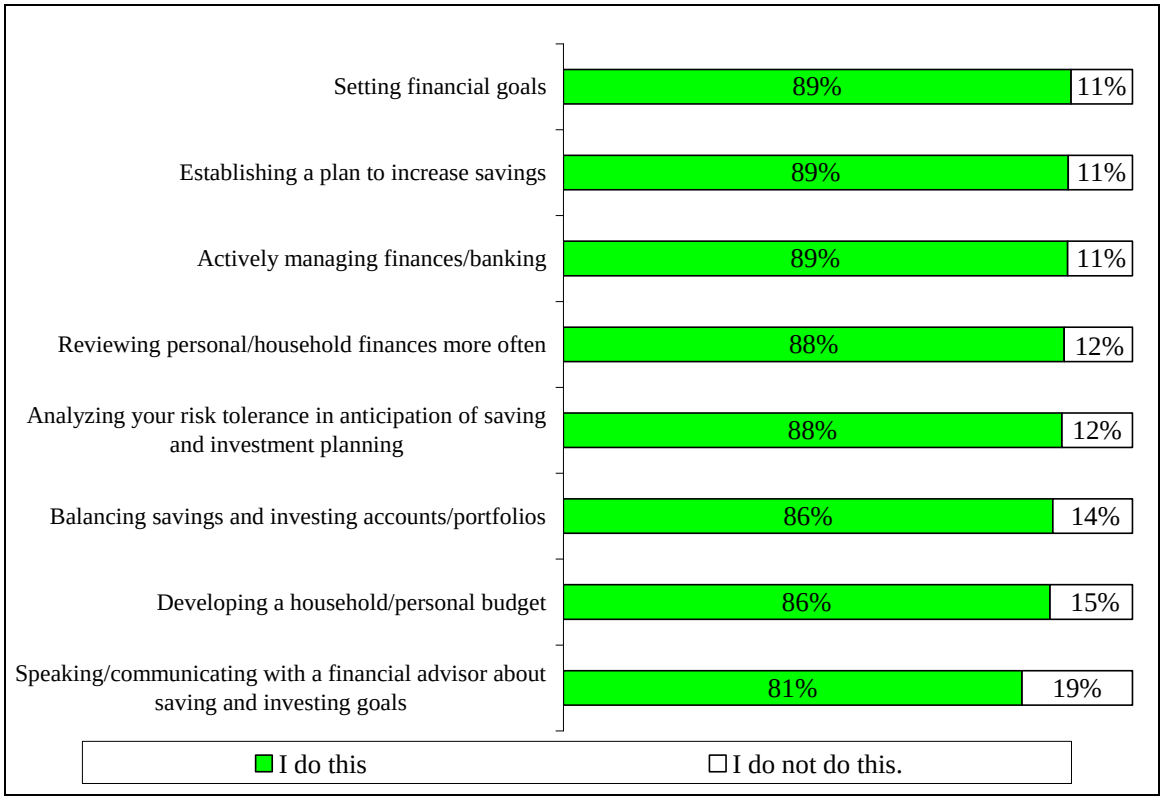
As previously discussed, descriptive information for an overall level of use of investment practices, as well as program influence, is provided in terms of the percentage categories of teachers who selected a particular rating: *most* (100 to 75 percent), *majority* (74 to 50 percent), *some* (49 to 25 percent), and *few* (24 to 0 percent).

ENGAGING IN FINANCIAL PLANNING

Most teachers reported engaging in financial planning practices, and for some, The Stock Market Game had a *moderate* or *major* influence on their doing so.

The construct *engaging in financial planning practices* is composed of eight survey questions related to (1) the use and (2) the perceived influence of the program on practices in financial planning. Most teachers reported engaging in each of the financial planning practices—ranging by item from 81 percent (speaking with a financial adviser about savings) to 89 percent (setting financial goals). Figure 15 details teachers' responses on the use of specific practices in financial planning.

Figure 15. Percentages of Teachers Indicating Engaging in Financial Planning Practices



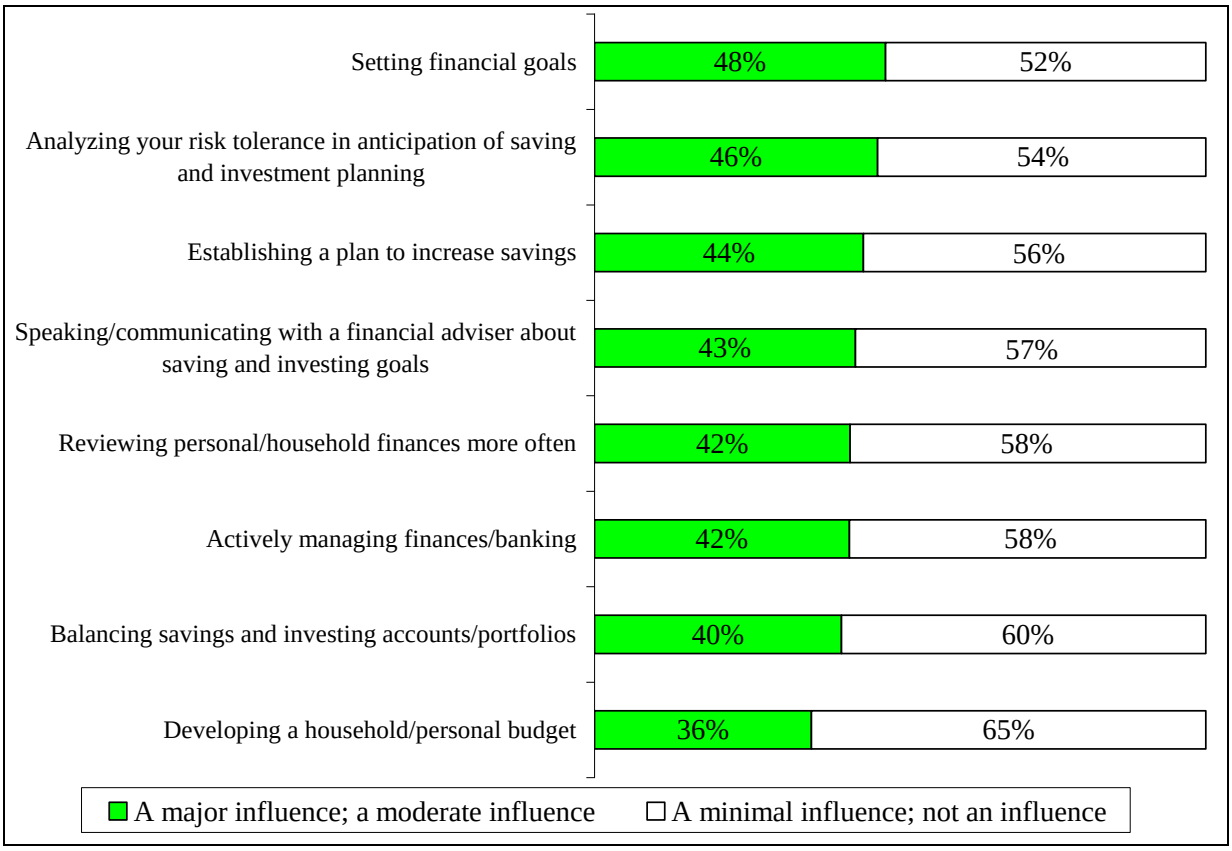
Of those teachers who engaged in financial planning practices, some reported the program had a *moderate* or *major* influence on their doing so, ranging by item from 36 percent (developing a household or personal budget) to 48 percent (setting financial goals). Figure 16 details teachers' responses on the influence of The Stock Market Game on financial planning practices.

The items in this construct were fit with the Rasch model to create scale scores indicating teachers' perception of the overall influence of The Stock Market Game on financial planning practices. Each teacher received a score for this construct; the higher the score, the more that teacher perceived the program as having influenced his or her financial planning practices. These scale scores were examined for differences across teacher groups in *grade level*, *experience teaching*, *experience with the program*, *subject*, *locale*, and *session length*. Statistically significant differences were found for the following four characteristics:

Grade Level. Teachers of high school students (Grades 9–12) had significantly higher scores for the influence of The Stock Market Game on financial planning than teachers of students in middle school (Grades 6–8).[65]

[65] Tukey's HSD Mean Difference = 1.146, p = .007.

Figure 16. Teachers' Rating of Program Influence on Engaging in Financial Planning Practices



Subject. Business teachers had a significantly higher scores for the influence of The Stock Market Game on financial planning than nonbusiness teachers.[66]

Session Length. Teachers of sessions of approximately 15 weeks had significantly higher scores for the influence of The Stock Market Game on financial planning than teachers of sessions of approximately 10 weeks.[67]

Locale. Teachers in rural[68] and urban[69] schools had significantly higher scores for the influence of The Stock Market Game on financial planning than teachers in suburban schools.

Conducting Financial Research

The majority of teachers reported conducting financial research, and for some, The Stock Market game had a *moderate* or *major* influence on whether they did so.

[66] $F_{(1,3954)} = 9.827$, $p = .002$.

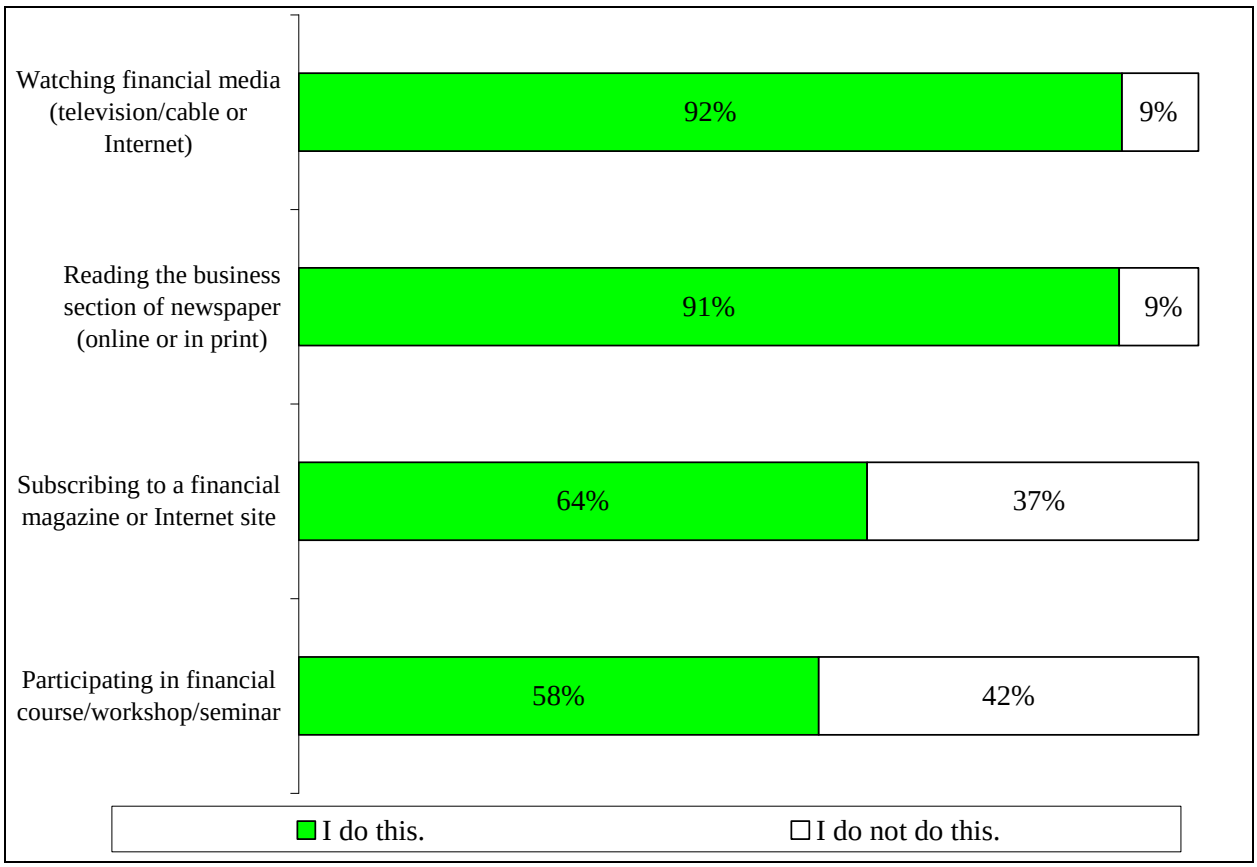
[67] Tukey's HSD Mean Difference = .930, $p = .047$.

[68] Tukey's HSD Mean Difference = 2.042, $p = .000$.

[69] Tukey's HSD Mean Difference = 2.305, $p = .000$.

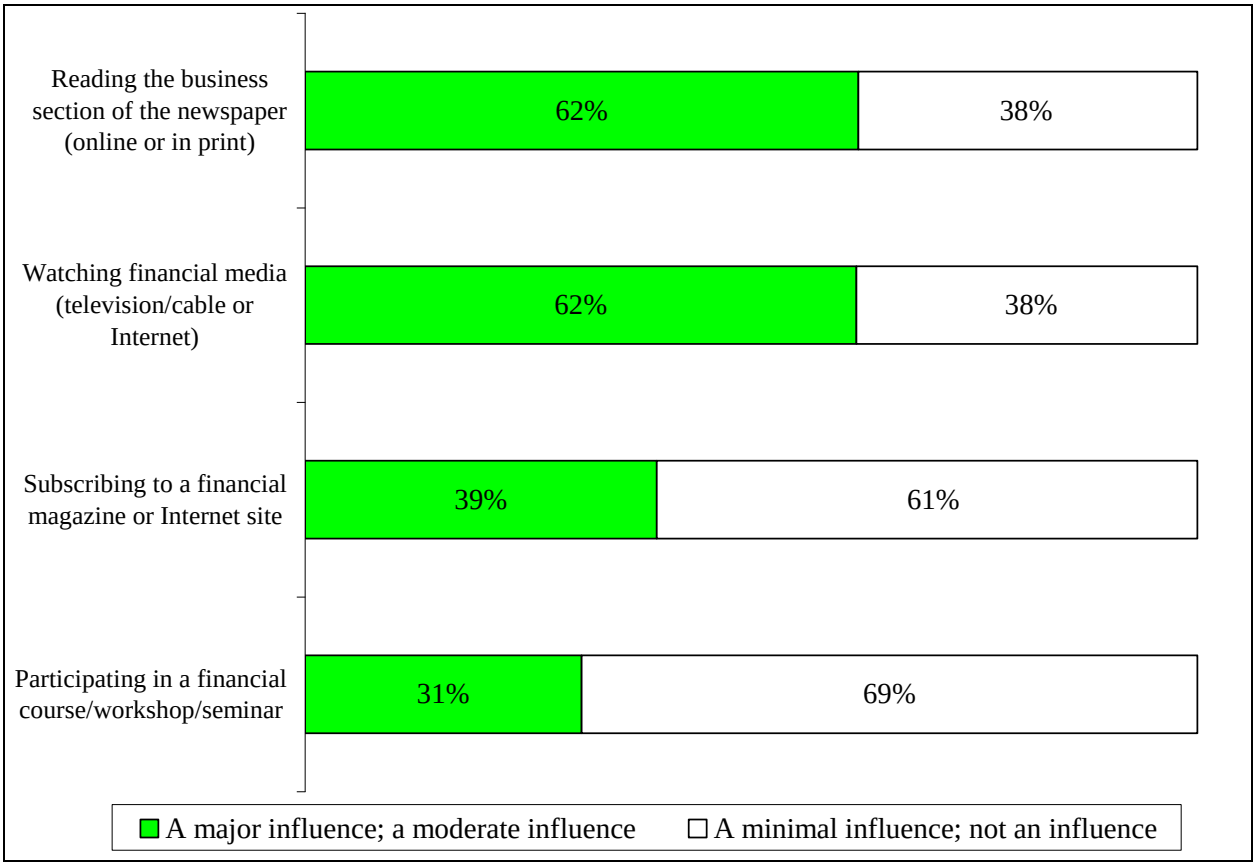
The construct *conducting financial research* is composed of four items related to (1) the use and (2) the perceived influence of The Stock Market Game on using sources of financial research. These items referred to various sources, such as the business section of the newspaper (online or in print), financial media (television or Internet), and financial workshops or courses. The majority of teachers (58 to 92 percent) reported using these sources of financial research. Higher percentages of teachers reported using more readily available resources of financial media (92 percent) and the newspaper business section (91 percent), and lower percentages reported using resources that are more difficult to access, such as subscribing to a financial magazine or Internet site (64 percent) or participating in a financial course/workshop/seminar (58 percent). Figure 17 details teachers' responses on the use of financial research.

Figure 17. Percentages of Teachers Indicating Conducting Financial Research



Of those teachers who conducted financial research, some teachers reported The Stock Market Game had a *moderate* or *major* influence on their doing so. For the two items used by higher percentages of teachers overall (the business section and financial media), the majority of teachers who used those sources reported the program had a *moderate* or *major* influence (62 percent each). For the two items used by lower percentages of teachers (subscribing to a financial magazine and participating in a financial course, workshop, or seminar), some teachers who used those sources of financial research reported the program had a *moderate* or *major* influence (39 percent and 31 percent, respectively). Figure 18 details teachers' responses on the influence of The Stock Market Game on their use of financial research.

Figure 18. Teachers' Rating of Program Influence on Conducting Financial Research



Scale scores were created using the items in this construct indicating teachers' perceptions of the influence of The Stock Market Game on their overall use of financial research. These scores were examined to detect differences within several teacher characteristics. Statistically significant differences were found for the following three characteristics:

Experience Teaching. Teachers who had taught six years or more had significantly higher scores for the influence of The Stock Market Game on their use of financial research than teachers who had taught one to two years.[70]

Experience With Program. The more teachers teach The Stock Market Game, the greater their report of the influence of The Stock Market Game on their use of financial research. Teachers who had taught the program six times or more had higher scores for the influence of teaching than teachers who had taught two to five times[71] and than teachers who were teaching the game for the first time.[72] Teachers who had taught—two to five times reported higher influence than did teachers who were teaching the game for the first time.[73]

Locale. Teachers in rural schools had significantly higher scores for the influence of The Stock Market Game on their use of financial research than did teachers in suburban schools.[74]

Using Investment Products and Services

The majority of teachers reported using investment products and services, and for some, The Stock Market game had a *moderate* or *major* influence on their use.

The construct *using investment products and services* is composed of eight items related to (1) the use and (2) the perceived influence of the program on using investment products and services. Teachers were asked about various investment products and services, including joining a local credit union, opening an investment account, and investing in the stock market. The majority of teachers reported using these types of products and services. Percentages ranged from 55 percent (joining a local credit union) to 75 percent (investigating securities, such as stocks, bonds, and mutual funds). Figure 19 details teachers' responses on the use of services and products.

[70] Tukey's HSD Mean Difference = 2.492, $p = .002$.

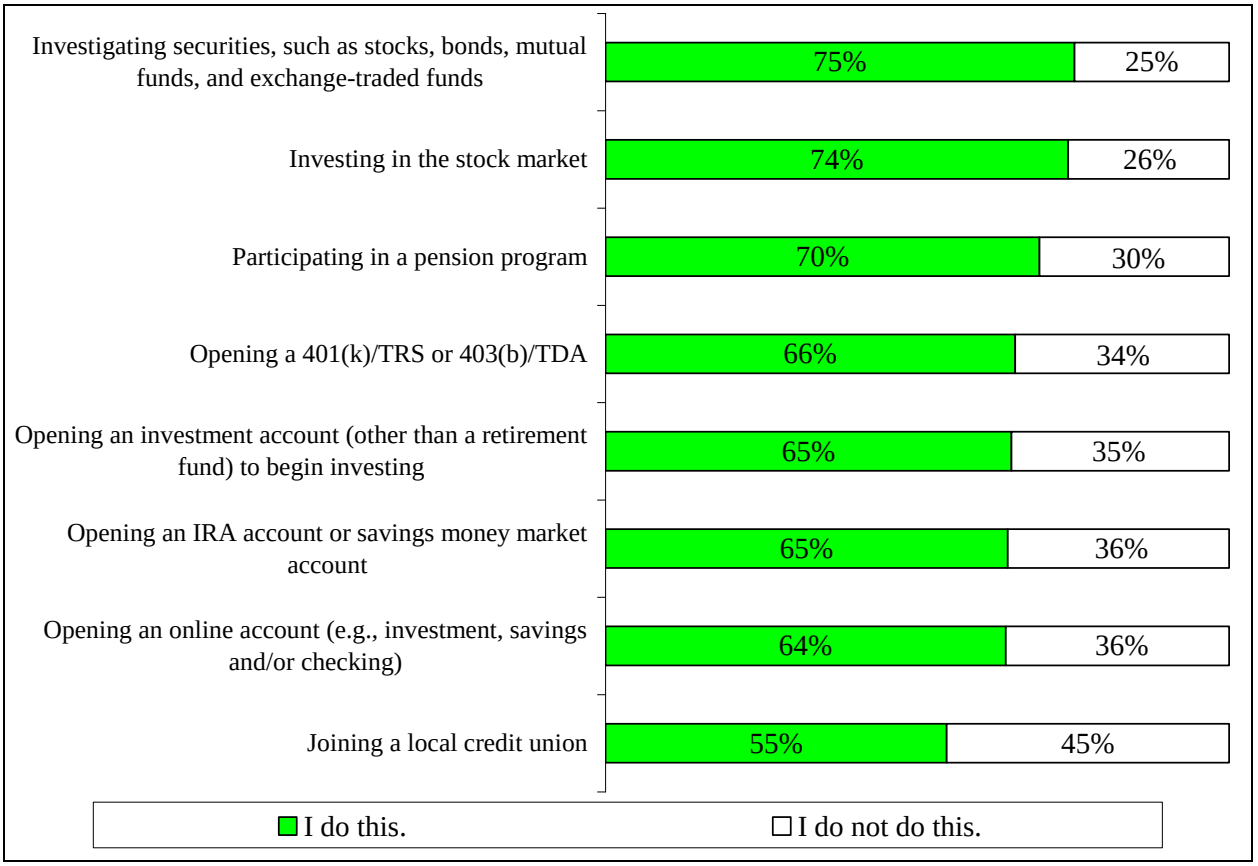
[71] Tukey's HSD Mean Difference = 2.065, $p < .001$.

[72] Tukey's HSD Mean Difference = 3.044, $p < .001$.

[73] Tukey's HSD Mean Difference = .979, $p = .040$.

[74] Tukey's HSD Mean Difference = .991, $p = .021$.

Figure 19. Percentages of Teachers Indicating Using Investment Products and Services*



**Note: TRS stands for Teacher Retirement System; TDA stands for tax-deferred annuity.*

Of those teachers who use these products and services, some teachers reported The Stock Market Game had a *moderate* or *major* influence on their doing so. Percentages ranged from 28 percent (opening an IRA or savings money market account) to 39 percent (investigating securities, such as stocks, bonds, mutual funds, and exchange-traded funds). Figure 20 details teachers' responses on the influence of The Stock Market Game on their use of investment products and services.

Rasch-derived scale scores were examined for differences in perceptions of program influence within various teacher characteristics. Statistically significant differences were found for the following three characteristics:

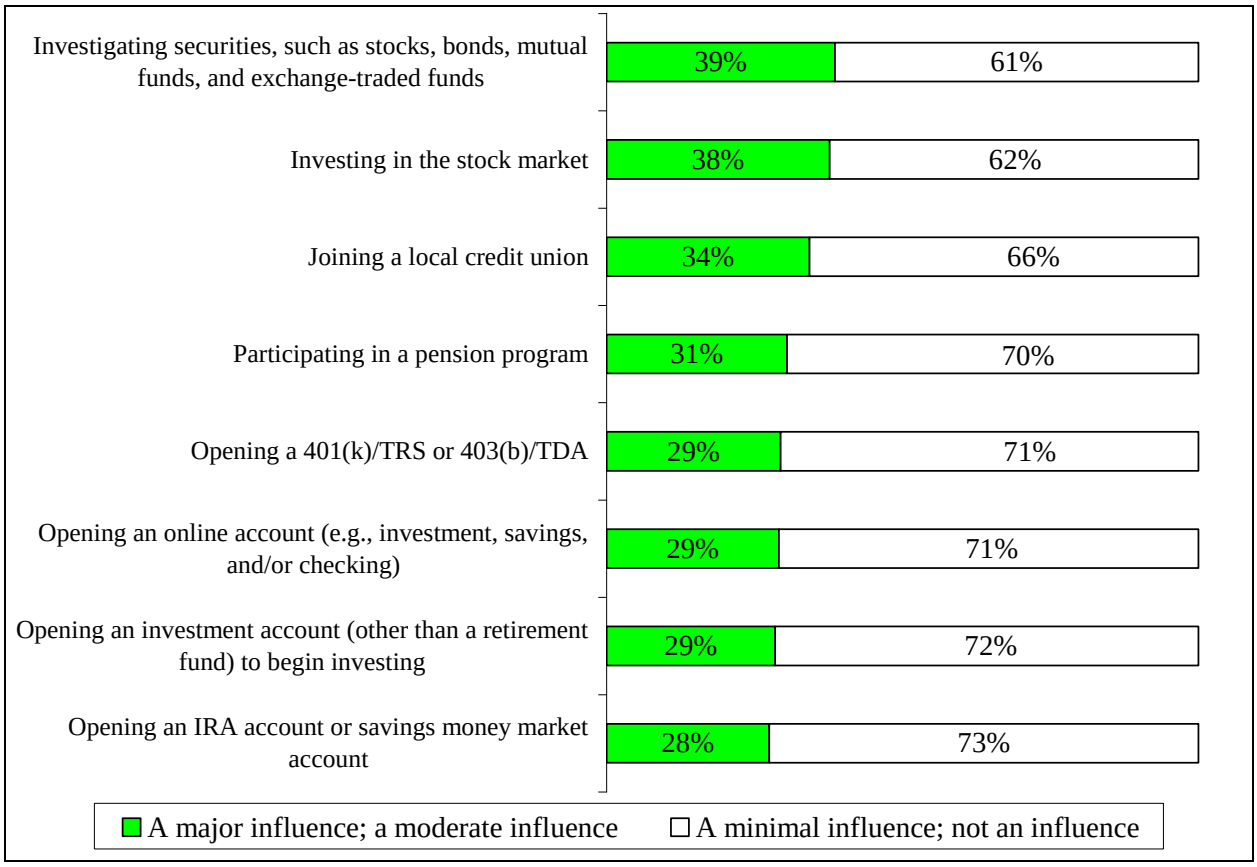
Experience With the Program. Teachers who had taught The Stock Market Game six times or more had significantly higher scores for the influence of The Stock Market Game on using these products and services than did teachers who had taught two to five times[75] and teachers who were teaching the game for the first time.[76] Neither of these findings was

[75] Tukey's HSD Mean Difference = 1.263, p = .003.

[76] Tukey's HSD Mean Difference = 1.347, p = .010.

significant, however, once RCT teachers were removed from the data set. For more information, see Appendix D.

Figure 20. Teachers' Rating of Program Influence on Using Investment Products and Services



Session Length. Teachers of full-year sessions had significantly higher scores for the influence of The Stock Market Game on their use of investment products and services than teachers of sessions of approximately 10 weeks.[77]

Locale. Teachers in rural[78] and urban schools[79] had significantly higher scores for the influence of The Stock Market Game on their use of investment products and services than teachers in suburban schools.

Summary of Investment Practices Findings

Teachers' investment practices and perception of the influence of The Stock Market Game were measured with three constructs: engaging in financial planning; conducting financial

[77] Tukey's HSD Mean Difference = 1.991, p = .032.

[78] Tukey's HSD Mean Difference = 1.983, p = .000.

[79] Tukey's HSD Mean Difference = 2.001 p = .000.

research; and using investment products and services. Summary findings for each construct follow.

Most teachers reported engaging in financial planning practices, and for some, The Stock Market Game had a moderate or major influence on their doing so. Teachers were asked about the actions they might take to control their finances and prepare for the future, including, for example, setting financial goals, reviewing household finances, analyzing their risk tolerance, and establishing a plan to increase savings. Most teachers (81 to 89 percent) reported engaging in all of these practices. Of those teachers who engaged in financial planning practices, 36 to 48 percent reported the program had a *moderate* or *major* influence on their doing so. Significant differences in the program influence on these practices were related to grade level, locale, subject, and session length.

The majority of teachers reported conducting financial research, and for some, The Stock Market Game had a moderate or major influence on whether they did so. Teachers were asked about actions they may take to expand their knowledge of financial planning and products, such as reading the business section of the newspaper (online or in print), subscribing to a financial magazine, and participating in a financial course. More than half the teachers surveyed (58 to 92 percent) reported engaging in those practices. Of those teachers who conducted financial research, 31 to 62 percent reported the program had a *moderate* or *major* influence on their doing so. Significant differences in the program influence on the use of financial research were related to experience teaching, experience with the program, and locale.

The majority of teachers reported using investment products and services, and for some, The Stock Market game had a moderate or major influence on their use. Teachers reported on their use of specific products or services for financial planning, such as opening an investment account, investing in the stock market, joining a local credit union, and participating in a pension program. The majority of teachers (55 to 75 percent) reported using these products or services. Of those teachers who used these products and services, 28 to 39 percent reported the program had a *moderate* or *major* influence on their doing so. Significant differences in the program influence on the use of financial research were related to experience with the program, session length, and locale.

CONCLUSIONS

The four research questions addressed by this study can be conceptualized in terms of varying degrees of expectation. Research questions were developed on the following:

- Potential program impact on student academic performance
- The various facets of teacher implementation (including its effect on student performance)
- Student experiences, including educational benefits of the game
- Possible program impact on teacher investment practices

Several conclusions about the program and its use in classrooms can be drawn by revisiting the initial expectations in light of findings from the study.

A supplemental educational program can be expected to improve students' understanding of program-related content and student performance on related assessments. The findings indicate that The Stock Market Game does positively impact students' financial literacy. Students who played The Stock Market Game scored higher on investor knowledge tests than students who did not play the game. An analysis comparing the scores of treatment students with control students revealed an effect size of 0.43 for students in Grades 4–5, 0.45 for students in Grades 6–8, and 0.39 for students in Grades 9–10 with students playing the game outperforming those who did not play. The results indicate the program can provide teachers with tools to expand students' knowledge of financial literacy and related topics, including investing in the stock market, establishing a spending and investment plan in consideration of personal risk level, and balancing an investment portfolio.

Although the mathematical nature of the program content could impact students' performance in mathematics, a question remained: Could the program have a detectable effect on mathematics scores? Study findings indicate that The Stock Market Game does improve students' mathematics skills. Students who played The Stock Market Game scored higher on mathematics tests than students who did not play the game. An analysis comparing the scores of treatment students to control students revealed an effect size of 0.25 for students in Grades 4–6 and 0.17 for students in Grades 7–10 with students playing the game outperforming those who did not play. The results indicate the mathematical aspect of the program, although secondary to financial literacy topics, is strong enough to improve students' mathematics skills and their performance on standardized test items. The findings indicate The Stock Market Game may be a way to improve students' mathematical performance.

With no required curriculum for The Stock Market Game and a variety of lesson plans, activities, and materials available for teacher use, it was expected that teacher implementation of the program varies widely. Study findings indicate implementation fell into two major categories (basic and advanced), with more than half the teachers reporting the use basic activities (e.g., using worksheets) and fewer than half engaging in more advanced activities (e.g., organizing related field trips). The implications of this finding

may be that the program is easily adaptable for most teachers to incorporate into basic classroom practices and that some teachers, such as those more familiar with the program, are able to expand the program with more advanced teaching methods.

Teachers' level of implementation of the program could have an impact on student learning. Analysis indicated a relationship between the use of more advanced practices and higher investor knowledge scores for middle school students, but minimal relationships with higher scores on the other assessments (i.e., elementary school investor knowledge, both mathematics assessments). The use of advanced activities is not, however, necessary for improving student learning, because teachers who used more basic activities were able to positively impact their students' performance on assessments. These findings indicate that teachers at any level of program use and knowledge can successfully impart program information to students.

While anecdotal reports and the continued use of the program suggest that students enjoy playing The Stock Market Game, the program could have an effect on students beyond core academic outcomes, such as interpersonal and financial life skills. Study findings indicate that students perceived that The Stock Market Game improved their interpersonal skills and encouraged them to use financial skills in their everyday lives. Most students reported that playing the game on a team led to the development of better communication, compromise, and conflict-resolution skills, and more than half the students agreed that playing The Stock Market Game influenced them to think more about budgeting and financial planning. The findings indicate that the program may help students develop skills that can benefit them beyond the classroom in their everyday lives.

Finally, the program could affect the adults who teach the program, who may change their own financial behaviors after teaching related concepts to students. Study findings indicate that some teachers perceive The Stock Market Game as affecting their own financial practices. Teaching the game affected such practices as investing in the stock market and establishing a plan to increase personal savings.

As the results of this study indicate, The Stock Market Game can benefit students in many areas, including assisting in the development of academic, interpersonal, and financial life skills. The program appears to be user-friendly, with teachers at any level of program knowledge and familiarity able to implement the program. Further, the program encourages teachers to better understand and to take control of their personal finances. With the wide availability of computers and the Internet in classrooms across the country, the thirty-year program may benefit even more teachers and students in the years to come.

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APPENDIX A. CHARACTERISTICS OF TREATMENT AND CONTROL GROUPS

Treatment and Control Group Characteristics at Randomization

Random-assignment studies are based on the fact that the control and treatment groups are equivalent in expectation on both observed and unobserved characteristics. As a result, the control group serves as a test of what would have happened to the treatment group had it not played The Stock Market Game. However, even when randomization is carried out perfectly, there is a chance that the groups are different in some way. To check this, the treatment and control groups were compared on all observable characteristics. In this study, the treatment and control groups did not differ significantly on any of the characteristics for which we had data. Tables A1–A7 display a comparison of the treatment and control groups at randomization.

Table A1. Number of Semesters Classroom Teacher Has Taught The Stock Market Game by Treatment and Control Status

	I Have Not Taught The Stock Market Game	1 to 3 Semesters	4 to 5 Semesters	6 to 10 Semesters	11 or more Semesters
Treatment (*n* = 383)	4.7%	51.7%	15.9%	17.5%	10.2%
Control (*n* = 395)	6.1%	51.1%	13.9%	16.7%	12.2%

$\chi^2 = 1.961$, $p = .743$

Table A2. Number of Years Classroom Teacher Has Taught by Treatment and Control Status

	0 to 3 Years	4 to 5 Years	6 to 10 Years	11 or More Years
Treatment (*n* = 406)	10.6%	6.9%	26.4%	56.2%
Control (*n* = 417)	8.6%	11.3%	24.0%	56.1%

$\chi^2 = 5.602$, $p = .133$

Table A3. Number of Classes the Classroom Teacher Planned to Teach The Stock Market Game in Fall 2008

	1 Class	2 to 3 Classes	4 to 5 Classes	6 or More Classes
Treatment (*n* = 406)	34.0%	45.8%	14.3%	5.9%
Control (*n* = 417)	35.5%	44.4%	13.4%	6.7%

χ^2 = .548, *p* = .908

Table A4. School Location by Treatment and Control Status

	Urban	Rural	Suburban
Treatment (*n* =399)	29.3%	22.3%	48.4%
Control (*n* = 413)	31.7%	20.6%	47.7%

χ^2 = .682, *p* = .711

Table A5. Region of Classrooms by Treatment and Control Status

	Midwest	Northeast	South	West
Treatment (*n* = 406)	20.4%	23.2%	40.6%	15.8%
Control (*n* = 416)	23.1%	23.6%	38.7%	14.7%

χ^2 = 1.027, *p* = .795

Table A6. Grade Level by Treatment and Control Status

	Primary	Middle	High	Other
Treatment (*n* = 377)	46.2%	19.4%	27.1%	7.4%
Control (*n* = 383)	43.1%	21.4%	30.0%	5.5%

χ^2 = 2.293, *p* = .477

Table A7. Mean School Demographics by Treatment and Control Status

	Treatment	Control
Mean Percentage of Students Who Qualify for Free or Reduced-Price Lunch (*t* = −.685, *p* = .494)	36.5%	38.1%
Mean Percentage of Minority Students (*t* = −.240, *p* = .811)	37.7%	38.2%

Characteristics of Treatment and Control Classrooms That Did Not Provide Assessment Data

Not all of the study teachers required their students to complete the investor knowledge and mathematics assessments that were called for by the study. If the types of classrooms that leave the study are different across treatment and control groups, then attrition can compromise the equivalence of the treatment and control groups. If this occurs, it is plausible that the treatment and control groups vary on a characteristic other than exposure to The Stock Market Game, which could in turn bias estimates of the effect of the game. Analyses were undertaken to investigate the extent to which either of these issues had to be addressed in this study. Treatment and control classrooms for which assessment data were not received were not different in terms of most observable characteristics, as can be seen in Tables A8–A14. This suggests that study attrition did not generally compromise the equivalence of the treatment and control groups.

The one exception to this can be seen in Table A10. The distribution of the number of classes teachers expected to teach in the fall of 2008 varied by treatment and control among classrooms that did not submit investor knowledge assessment data ($\chi^2 = 8.621$, $p = .035$) and among classrooms that did not submit math assessment data ($\chi^2 = 9.227$, $p = .026$). Post hoc analyses revealed that control classrooms in both groups were more likely to report planning to teach The Stock Market Game in six or more classes.

Table A8. Experience Teaching The Stock Market Game of Teachers in Attrition Classrooms

		I Have Not Taught The Stock Market Game	1 to 3 Semesters	4 to 5 Semesters	6 to 10 Semesters	11 or More Semesters
Classrooms Without Investor Knowledge Assessments ($\chi^2 = 4.236$, $p = .375$)	**Treatment ($n = 115$)**	6.1%	60.9%	12.2%	14.8%	6.1%
	Control ($n = 140$)	5.7%	53.6%	13.6%	13.6%	13.6%
Classrooms Without Math Assessments ($\chi^2 = 4.323$, $p = .364$)	**Treatment ($n = 119$)**	6.7%	60.5%	10.1%	15.1%	7.6%
	Control ($n = 148$)	5.4%	56.8%	12.8%	10.8%	14.2%

Table A9. Teaching Experience of Teachers in Attrition Classrooms

		0 to 3 Years	4 to 5 Years	6 to 10 Years	11 or More Years
Classrooms Without Investor Knowledge Assessments (χ^2 = 3.628, *p* = .304)	**Treatment (*n* = 132)**	18.2%	7.6%	29.5%	44.7%
	Control (*n* = 158)	12.7%	10.8%	24.7%	51.9%
Classrooms Without Math Assessments (χ^2 = 3.558, *p* = .313)	**Treatment (*n* = 138)**	15.9%	8.7%	30.4%	44.9%
	Control (*n* = 166)	10.8%	10.8%	25.3%	53.0%

Table A10. Number of Classes Teachers in Attrition Classrooms Expected to Teach in Fall 2008 by Assessment and Treatment and Control Status

		1 Class	2 to 3 Classes	4 to 5 Classes	6 or More Classes
Classrooms Without Investor Knowledge Assessments (χ^2 = 8.621, *p* = .035)	**Treatment (*n* = 132)**	31.8%	52.3%	13.6%	2.3%
	Control (*n* = 158)	32.9%	41.8%	15.2%	10.1%
Classrooms Without Math Assessments (χ^2 = 9.227, *p* = .026)	**Treatment (*n* = 138)**	34.8%	46.4%	17.4%	1.4%
	Control (*n* = 166)	31.9%	44.0%	14.5%	9.6%

Table A11. Location of Attrition Classrooms by Assessment and Treatment and Control Status

		Urban	Rural	Suburban
Classrooms Without Investor Knowledge Assessments (χ^2 = 1.336, *p* = .513)	**Treatment (*n* = 127)**	33.9%	20.5%	45.7%
	Control (*n* = 155)	28.4%	19.4%	52.3%
Classrooms Without Math Assessments (χ^2 = 1.427, *p* = .490)	**Treatment (*n* = 133)**	33.8%	23.3%	42.9%
	Control (*n* = 163)	32.1%	21.3%	46.6%

Table A12. Region of Attrition Classrooms by Assessment and Treatment and Control Status

		Midwest	Northeast	South	West
Classrooms Without Investor Knowledge Assessments (χ^2 = 1.958, *p* = .581)	**Treatment (*n* = 132)**	15.9%	27.3%	39.4%	17.4%
	Control (*n* = 157)	19.1%	31.8%	35.7%	13.4%
Classrooms Without Math Assessments (χ^2 = 1.573, *p* = .666)	**Treatment (*n* = 138)**	16.7%	26.1%	40.6%	16.7%
	Control (*n* = 165)	20.0%	29.7%	34.5%	15.8%

Table A13. Grade Level of Attrition Classrooms by Assessment and Treatment and Control Status

		Primary	Middle	High	Other
Classrooms Without Investor Knowledge Assessments (χ^2 = 3.806 , *p* = .283)	**Treatment (*n* = 121)**	43.0%	19.0%	28.9%	9.1%
	Control (*n* = 143)	35.0%	23.8%	35.7%	5.6%
Classrooms Without Math Assessments (χ^2 = 4.960, *p* = .175)	**Treatment (*n* = 128)**	42.2%	15.6%	32.0%	10.2%
	Control (*n* = 151)	36.4%	23.2%	35.1%	5.3%

Table A14. Mean School Demographics of Attrition Classrooms by Assessment and Treatment and Control Status

	Classrooms Without Investor Knowledge Assessments		**Classrooms Without Math Assessments**	
	Treatment	**Control**	**Treatment**	**Control**
Mean Percentage of Students Who Qualify for Free or Reduced-Price Lunch	41.3%	36.5%	40.4%	40.7%
Mean Percentage of Minority Students	41.2%	39.1%	40.7%	37.1%

Note. The mean differences between the groups were not statistically significant.

Characteristics of Sample Classrooms and Classrooms That Provided Assessment Data

The research team recruited widely to ensure that the study sample reflected the broad array of classrooms that play the game. The study sample includes rural, urban, and suburban classrooms, as well as classrooms from all regions of the country. Teachers in these classrooms vary in terms of how long they have been teaching, their level of experience teaching The Stock Market Game, and the number of classes to which they planned to teach The Stock Market Game in the fall of 2008. The schools containing these classrooms ranged from those in which no students qualified for free or reduced-price lunch to those in which nearly all students qualified. The racial and ethnic makeup of the schools varied as well. A complete description of the sample demographics is shown in Tables A15–A22.

Table A15. Number of Semesters Classroom Teacher Has Taught The Stock Market Game by Full Sample and Classrooms That Provided Assessment Data

	I Have Not Taught The Stock Market Game	1 to 3 Semesters	4 to 5 Semesters	6 to 10 Semesters	11 or more Semesters
Full Sample (*N* = 778)	5.4%	51.4%	14.9%	17.1%	11.2%
Classrooms That Provided Assessment Data (*n* = 545)	5.3%	49.2%	16.1%	18.3%	11.0%

Table A16. Number of Years Classroom Teacher Has Taught by Full Sample and Classrooms That Provided Assessment Data

	0 to 3 Years	4 to 5 Years	6 to 10 Years	11 or More Years
Full Sample (*N* = 823)	9.6%	9.1%	25.2%	56.1%
Classrooms That Provided Assessment Data (*n* = 555)	7.4%	9.0%	24.3%	59.3%

Table A17. Number of Classes the Classroom Teacher Planned to Teach The Stock Market Game in Fall 2008 by Full Sample and Classrooms That Provided Assessment Data

	1 Class	2 to 3 Classes	4 to 5 Classes	6 or More Classes
Full Sample (*N* = 823)	34.8%	45.1%	13.9%	6.3%
Classrooms That Provided Assessment Data (*n* = 555)	36.0%	44.7%	13.2%	6.1%

$\chi^2 = .548$, $p = .908$

Table A18. School Location by Full Sample and Classrooms That Provided Assessment Data

	Urban	Rural	Suburban
Full Sample (*N* = 812)	30.5%	21.4%	48.0%
Classrooms That Provided Assessment Data (*n* = 552)	30.6%	21.4%	48.0%

Table A19. Region of Classrooms by Full Sample and Classrooms That Provided Assessment Data

	Midwest	Northeast	South	West
Full Sample (*N* = 822)	21.8%	23.4%	39.7%	15.2%
Classrooms That Provided Assessment Data (*n* = 555)	23.4%	20.9%	40.5%	15.1%

Table A20. Grade Level by Full Sample and Classrooms That Provided Assessment Data

	Primary	Middle	High	Other
Full Sample (*N* = 760)	44.6%	20.4%	28.6%	6.4%
Classrooms That Provided Assessment Data (*n* = 515)	48.3%	20.2%	25.8%	5.6%

Table A21. Percentage of Minority Students by Full Sample and Classrooms That Provided Assessment Data

	Minimum	Maximum	Mean
Full Sample (*N* = 757)	0.0%	100.0%	37.3%
Classrooms That Provided Assessment Data (*n* = 516)	0.0%	100.0%	36.4%

Table A22. Percentage of Students Who Qualify for Free or Reduced-Price Lunch

	Minimum	Maximum	Mean
Full Sample (*N* = 637)	0.0%	99.7%	37.9%
Classrooms That Provided Assessment Data (*n* = 432)	0.0%	99.3%	37.4%

APPENDIX B. PSYCHOMETRIC ANALYSIS

This appendix includes the psychometric methods used for the student tests and the student and teacher surveys. The results are first presented for the student tests. Methods and results for the teacher and student surveys are presented in the latter part of the appendix.

Student Test Psychometrics

A psychometric evaluation and analysis was conducted on the student mathematics tests (Grades 4–6 and Grades 7–10) and investor knowledge tests (elementary, middle school, and high school). These analyses were conducted to ensure the psychometric functioning of the instruments to industry standards as set out in the Standards for Educational and Psychological Testing (American Educational Research Association, American Psychological Association, and National Council on Measurement in Education, 1999). The tests were equated and scaled to determine a final scoring metric that could be used in the analysis of the impact of The Stock Market Game. The following steps were taken in the psychometric analysis:

1. Each test (pretest and posttest versions) was analyzed separately to examine the quality of the test as a stand-alone instrument.
2. The stability of the linking items (items common to the pretest and posttest) were studied and a final linking constant was determined. The linking constant was then used to map the pretest scores onto the same scale as the posttest scores.
3. A scale transformation was applied to the Rasch metric scores to ease interpretation of the results.

All psychometric analyses were conducted on the Rasch dichotomous model (Rasch, 1980; Wright & Masters, 1982) as implemented with WINSTEPS (Linacre, 2005). The dichotomous model can be written in the following format:

$$\pi_{ij} = \frac{\exp(\beta_i - \delta_j)}{1 + \exp(\beta_i - \delta_j)}$$

The above equation describes the probability that a respondent *i,* with ability $\_i$ on the underlying construct, responds correctly to item *j* of difficulty $\_j$. Psychometric models typically are based on three assumptions: unidimensionality, local independence, and monotonicity of the item response functions. While adhering to these three assumptions, the Rasch model additionally requires the assumption of strict invariant item ordering—specifically that item response functions do not cross (and are parallel). This final assumption allows for the sufficiency of the category counts as estimators of the person and item parameters, leading to person parameters that are free of the distributional properties of the item parameters (within a conformable class of items) and item parameters that are free of the distributional properties of the person parameters (Schumacker, 2004).

In contrast with the scores used in classical test theory, when data fit the Rasch model, the scale scores that result from the analysis provide an interval measure of the person's ability with respect to the latent trait (Wright, 1977). These interval-level measures then can be used to determine group differences and individual differences through the use of traditional parametric statistical modeling techniques.

Each of the assessments was analyzed for the following aspects of psychometric functioning. An introduction to the types of analyses conducted can be found in Wolfe and Smith (2007b).

- Person reliability and separation
- Item fit
- Person fit
- Overall fit
- Point-measure correlation
- Local independence
- Principal components analysis (PCA)
- Targeting of items
- Score distribution

Equating and Scaling Procedures

In addition to converting the raw scores to scale scores, the Rasch model was used to equate the pretest and posttest scores of each test. Equating refers to the process of mapping the scores from multiple forms of an assessment onto the same scale. Equating these scores was a necessary step to ensure that comparisons could be made between scores from the pretest and scores from the posttest. Data were analyzed such that the posttest was considered the frame of reference. That is, because playing The Stock Market Game was supposed to have an effect at the time of the posttest, using the posttest as the frame of references emphasizes the goal toward which the program was aiming. The equating analysis utilized a linking constant approach (Wright & Stone, 1979).

The steps in the equating process were as follows:

1. Calculate the mean and standard deviation of the item difficulties for all potential linking items on the posttest.
2. Calculate the mean and standard deviation of the item difficulties for all potential linking items on the pretest.
3. Calculate the ratio of the standard deviations of the linking item difficulties for the posttest and pretest.

4. Calculate the correlation between the pretest and posttest item difficulties.
5. Calculate the difference between the pretest and posttest item difficulties.
6. Calculate the mean of the differences.
7. Calculate the median of the differences.
8. Calculate the interquartile range of the differences.
9. Calculate the robust *Z*-statistic for each potential linking item (calculated as below).

$$Z_i = \frac{(\delta_{i\mathrm{Pre}} - \delta_{iPost} - Median)}{.74 \times IQR}$$

Once the robust *Z*-statistic was calculated for each linking item, the final set of linking items was selected along the following guidelines:

- Exclude items with an absolute value of *Z* greater than 1.645.
- Use at least 80 percent of available linking items.
- The ratio of standard deviations should fall between 0.90 and 1.10.
- The correlation between pretest and posttest item difficulties should be at least 0.95.

After the final linking constant had been calculated, the item difficulties for the pretest were mapped with this constant (i.e., the linking constant was added to each item difficulty for each item on the pretest). The scores for the pretest were then calculated by running an anchored calibration of the pretest data (using these new values based on the linking constant). The posttest scores remained in their original metric (to which the pretest scores were equated).

Finally, once the Rasch scaled scores from the pretest and posttest version of the tests were equated to one another, the scores were mapped onto a final scale to provide meaning to the scale scores. For the tests, the average score (for all students, regardless of treatment group) was set to 500, and the standard deviation was set to 100. Therefore, for the posttests, roughly 68 percent of scores were between 400 and 600, roughly 95 percent of scores were between 300 and 700, and roughly 99 percent of scores were between 200 and 800.

Student Test Results

Psychometric analysis of the student tests indicated that the test functioned well as unidimensional measures of student mathematics ability and investor knowledge. No major problems were found relating to any of the test items and, as a result, all original items were included in the final scales. The reliability values for the tests were sufficient for the low-stakes nature of this study. In particular, the posttest reliabilities were all over 0.80 (considered to be good reliability). The pretest measures of reliability were somewhat low for the investor knowledge pretests. This result becomes understandable, however, with the

realization that many students had received no instruction on these concepts—which resulted in low scores with little variability across students. The reliability for each of the tests is shown in the table below.

Table B1. Student Score Rasch Reliabilities

Test	Pretest	Posttest
Mathematics 4–6	0.83	0.83
Mathematics 7–10	0.89	0.89
Investor Knowledge Elementary	0.68	0.82
Investor Knowledge Middle School	0.74	0.82
Investor Knowledge High School	0.82	0.86

As described earlier, the scale scores for each test were adjusted so that the average score for all students (in the final calibration sample) on the posttest was roughly 500 and the standard deviation of those scores was 100. The pretest means and standard deviations varied with the results of the equating procedures. Table B2 shows the descriptive statistics for each test. An interesting feature of these statistics is the small standard deviations for the investor knowledge pretests—a feature that is indicative of students' lack of investor knowledge prior to playing The Stock Market Game.

Table B2. Student Test Scale Score Descriptive Statistics

Test	Mean	Std. Dev	Min	Max	*N*
Mathematics 4–6 pretest	479.5	110.9	12.7	813.5	4,143
Mathematics 4–6 posttest	499.7	100.1	49.2	870.6	3,385
Mathematics 7–10 pretest	500.8	108.0	51.8	854.7	4,231
Mathematics 7–10 posttest	499.7	100.0	74.5	847.5	3,116
Investor Knowledge Elementary pretest	466.5	74.4	69.0	867.3	2,385
Investor Knowledge Elementary posttest	500.1	100.4	60.2	932.7	2,039
Investor Knowledge Middle School pretest	479.7	78.1	22.6	897.1	3,880
Investor Knowledge Middle School posttest	500.0	100.0	36.3	1,013.7	3,100
Investor Knowledge High School pretest	506.7	80.5	186.7	1,055.2	1,555
Investor Knowledge High School posttest	499.7	100.2	63.8	915.2	1,051

Teacher and Student Survey Psychometrics

The teacher and student surveys were analyzed using the Rasch rating scale model (Andrich, 1978; Wright & Masters, 1982) as implemented with WINSTEPS (Linacre, 2005). The rating scale model (RSM) can be written in the following format (Linacre, 2004):

$$\pi_{nix} = \frac{\exp \sum_{j=0}^{x} (\beta_n - (\delta_i + \tau_j))}{\sum_{k=0}^{m} \exp \sum_{j=0}^{k} (\beta_n - (\delta_i + \tau_j))} \quad (1)$$

The above equation describes the probability that a respondent *n*, with trait level β_n (e.g., implementation) on the underlying construct, responds with a rating of *x* to item *i* of difficulty δ_i (where the response scale is ordered from 0 to *m*). The τ_j represent the rating scale thresholds, or transition points, between categories.

To generate scores for the surveys, it was first necessary to transform the response data into ordinal categories that could be input to the Rasch model. For the surveys, a polytomous scoring model was used to assign an ordinally increasing number to each consecutive category. For example, the teacher survey contained the following response options (*strongly disagree, disagree, agree, strongly agree*), which were mapped to the numbers 0, 1, 2, and 3, respectively.

Each of the surveys was analyzed for the following aspects of psychometric functioning. An introduction to the types of analyses conducted can be found in Wolfe and Smith (2007b).

- Person reliability and separation
- Item fit
- Person fit
- Overall fit
- Point-measure correlation
- Rating scale functioning
- Local independence
- PCA
- Targeting of items
- Score distribution

Teacher Survey Results

Psychometric analysis of the teacher survey indicated that the survey functioned well as a unidimensional measure of implementation as well as teacher financial practices. The reliabilities for the survey construct scores were sufficient for the low-stakes nature of this study. In particular, the posttest reliabilities were all over 0.60 (which is likely sufficient for group comparisons and use in statistical models).

Table B3. Teacher Survey Construct Reliabilities

Construct	Rasch Reliability
Total implementation	0.84
Activities in the classroom	0.66
Lessons and materials	0.77
Connections to outside resources	0.66
Financial planning	0.88
Investment products and services	0.79

The scale scores for each survey construct were adjusted so that the average score for all teachers (in the final calibration sample) on the total implementation construct was roughly 50 and the standard deviation of those scores was 10. For the implementation subconstructs, the mean score and standard deviation could vary because the subconstructs were anchored to the main implementation scale. For example, the standard deviation for lessons and materials is 20.4—implying that there was considerably more variation in these scores than in the total implementation scale. The means for the financial practices scales were set to 50 with standard deviation 10. Table B4 shows the descriptive statistics for each of the survey constructs.

Table B4. Teacher Survey Scale Score Descriptive Statistics

Construct	Mean	Std. Dev	Min	Max	*N*
Total implementation	50.0	10.0	–23.4	90.2	4,393
Lessons and materials	47.9	20.4	1.7	102.4	4,337
Connections to the outside world	50.3	11.8	–3.9	105.8	4,392
Classroom activities	49.5	12.7	–17.9	90.9	4,393
Financial planning	50.0	10.0	34.5	72.4	3,956
Financial resources	50.0	10.0	33.7	69.0	3,979
Investment products and services	50.0	10.0	37.7	72.1	3,649

Younger Student Survey Results

Psychometric analysis of the younger student survey indicated that the survey functioned well as a unidimensional measure of each aspect of the student experience. The reliabilities for the survey construct scores were sufficient for the low-stakes nature of this study. In particular, the posttest reliabilities were all over 0.77 (which is good for group comparisons and use in statistical models).

Table B5. Younger Student Survey Construct Reliabilities

Construct	Rasch Reliability
Engagement with the game	0.77
Interactions with others	0.76
Beyond the classroom	0.80

As with the teacher survey, the average construct scale score was set to 50 with a standard deviation of 10. The descriptive statistics for each of the younger student survey constructs are presented in Table B6:

Table B6. Younger Student Survey Scale Score Descriptive Statistics

Construct	Mean	Std. Dev	Min	Max	*N*
Engagement with the game	50.0	10.0	8.2	79.6	1,316
Interactions with others	50.0	10.0	16.5	72.0	1,316
Beyond the classroom	50.0	10.0	28.6	74.2	1,316

Older Student Survey Results

Psychometric analysis of the older student survey indicated that the survey functioned well as a unidimensional measure of each aspect of the student experience. The reliabilities for the survey construct scores were sufficient for the low-stakes nature of this study. In particular, the posttest reliabilities were all over 0.72 (which is good for group comparisons and use in statistical models).

Table B7. Older Student Survey Construct Reliabilities

Construct	Rasch Reliability
Engagement with the game	0.82
Interactions with others	0.81
Financial life skills	0.72
Beyond the classroom	0.82

As with the other surveys, the average construct scale score was set to 50 with a standard deviation of 10. The descriptive statistics for each of the older student survey constructs are presented in Table B8.

Table B8. Older Student Survey Scale Score Descriptive Statistics

Construct	Mean	Std. Dev	Min	Max	*N*
Engagement with the game	50.0	10.0	13.8	84.5	1,756
Interactions with others	50.0	10.0	23.5	70.3	1,756
Financial life skills	50.0	10.0	24.0	73.8	1,756
Beyond the classroom	50.0	10.0	34.2	76.1	1,756

APPENDIX C. ESTIMATING THE IMPACT OF PLAYING THE STOCK MARKET GAME ON STUDENT ACHIEVEMENT

Our approach to estimating the impact of playing The Stock Market Game on student achievement was to examine the data under a variety of statistical approaches. This examination included using an Intent-to-Treat approach as well as a Treatment-on-the-Treated approach. This section details the model fit for all outcome measures (five tests). Following are the results for each test.

Data Collection

Pretests and posttests were made electronically available to all students in the sample. Teachers were e-mailed individual identification numbers to give to each of their students and were asked at the start of data collection to give each student only one ID. These IDs were linked to teacher IDs, but they were not linked to any specific identifying information about students. Therefore, as a check on whether students used the same ID at the time of pretest and posttest, we checked whether the student's self-reported birthday and gender were the same. If a student did not provide the same birthday or gender, then his or her pretest score was removed from the data set. This allowed us to be relatively certain that the same individual was being assessed at both pretest and posttest, and because of the structure of the ID numbers, we are certain that student data are aligned with the correct teachers.

Test scores from students who reported being in Grades 11 or 12 were removed from the analysis. If a student reported being in Grade 10 at one time point and Grade 11 at another, only the test score at the time point marking their Grade 11 status was removed.

Covariates

There were five student-level covariates:

1. Pretest scale score
2. Indication of a completed pretest (complete=1; incomplete=0)
3. Indication of a completed posttest (complete=1; incomplete=0)
4. Gender (male=0, female=1)
5. Self-report on whether the student had played The Stock Market Game in another class (yes=1, no=0)

Each variable was tested for differences between treatment and control groups. For those variables that were dichotomous, we used a mixed logistic model (fit using PROC GLIMMIX—SAS version 9.0) and for those that were continuous we used a mixed model

(fit using PROC MIXED). These models allowed us to take into consideration the nested structure of the data and appropriately partition the variance of students within classrooms.

Modeling

This section outlines the nine models that we fit using three approaches (three models for each approach). First the three models are described, then the three approaches are discussed.

Models

Three models were used to measure the impact of playing The Stock Market Game on student achievement. The first modeled achievement based only on the experimental indicator (i.e., treatment and control). Because analysis of the pretest sometimes indicated differences between the two conditions, a second model was fit to test for program impact adjusting for pretest abilities. As an exploratory approach, a third model was designed that included the pretest scores as well as the student-level covariates listed earlier. This third model was designed to improve precision of the impact estimates by taking into account all the available covariates.

Models were fit using PROC MIXED (SAS 9.0), designed as random coefficients models and all covariates were grand-mean-centered.

FIRST MODEL

The first model assessed the impact of playing The Stock Market Game on student achievement (*POSTTEST*) by including only an indicator of experimental condition (*Tx*). Using hierarchical linear modeling notation, the model is written as follows:

Level 1:

$$POSTTEST_{ij} = \beta_{0j} + r_{ij}$$

Level 2:

$$\beta_{0j} = \gamma_{00} + \gamma_{01} Tx_j + u_{0j}$$

Using mixed-modeling notation, the model can be conceived as

$$POSTTEST_{ij} = \gamma_{00} + \gamma_{01} Tx_j + u_{0j} + r_{ij}$$

In the above models, $POSTTEST_{ij}$ represents the scale score on the posttest for student *i* in classroom *j*. Tx_j indicates the experimental condition for classroom *j* and γ_{01} represents the coefficient for the treatment effect. The two sources of error are represented by r_{ij} (student-level) and u_{0j} (classroom-level).

SECOND MODEL

In an effort to improve precision of the impact estimates and account for any differences in skill between treatment and control groups, the second model assessed the impact of playing the game by including an indicator of experimental condition and the student-specific pretest score (*PRETEST*). Using hierarchical modeling notation, the model is written as follows:

Level 1:

$$POSTTEST_{ij} = \beta_{0j} + \beta_{1j}(\text{PRETEST}_{ij} - \overline{\text{PRETEST}}_{..}) + r_{ij}$$

Level 2:

$$\beta_{0j} = \gamma_{00} + \gamma_{01} Tx_j + u_{0j}$$

$$\beta_{1j} = \gamma_{10}$$

Combining the two, the model can be written as

$$POSTTEST_{ij} = \gamma_{00} + \gamma_{01} Tx_j + \gamma_{10}(PRETEST_{ij} - \overline{PRETEST}..) + u_{0j} + r_{ij}$$

As with the above model, $POSTTEST_{ij}$ represents the posttest score for student *i* in classroom *j*, Tx_j indicates the experimental condition of classroom *j*, γ_{01} represents the coefficient for the treatment effect. This model includes one other variable: $PRETEST_{ij}$, which is a measure of the pretest score for student *i* in classroom *j*.

THIRD MODEL

A third model, which explored further possible improvements in the precision of the impact estimates, included several other student-specific covariates: completion indicators of pretest and posttest (*COMP_PRE*; *COMP_POST*), gender (*GENDER*), and an indicator of previously playing The Stock Market Game (*PLAY_SMG*). Using hierarchical modeling notation, the model is written as follows:

Level 1:

$$\begin{aligned} POSTTEST_{ij} = {} & \beta_{0j} + \beta_{1j}(PRETEST_{ij} - \overline{PRETEST}_{..}) \\ & + \beta_{2j}(COMP\_PRE_{ij} - \overline{COMP\_PRE}_{..}) \\ & + \beta_{3j}(COMP\_POST_{ij} - \overline{COMP\_POST}_{..}) \\ & + \beta_{4j}(GENDER_{ij} - \overline{GENDER}_{..}) \\ & + \beta_{5j}(PLAY\_SMG_{ij} - \overline{PLAY\_SMG}_{..}) + r_{ij} \end{aligned}$$

Level 2:

$$\beta_{0j} = \gamma_{00} + \gamma_{01} Tx_j + u_{0j}$$

$$\beta_{1j} = \gamma_{10}$$

Combining the two, the model can be written as

$$
\begin{aligned}
POSTTEST_{ij} &= \gamma_{00} + \gamma_{01} Tx_j \\
&\quad + \gamma_{10}(PRETEST_{ij} - \overline{PRETEST}_{..}) \\
&\quad + \gamma_{20}(COMP\_PRE_{ij} - \overline{COMP\_PRE}_{..}) \\
&\quad + \gamma_{30}(COMP\_POST_{ij} - \overline{COMP\_POST}_{..}) \\
&\quad + \gamma_{40}(GENDER_{ij} - \overline{GENDER}_{..}) \\
&\quad + \gamma_{50}(PLAY\_SMG_{ij} - \overline{PLAY\_SMG}_{..}) + u_{0j} + r_{ij}
\end{aligned}
$$

As with the above model, $POSTTEST_{ij}$ represents the posttest score and $PRETEST_{ij}$ represents the pretest score for student *i* in classroom *j*. Tx_j indicates the experimental condition of classroom *j* and γ_{01} represents the coefficient for the treatment effect. This model includes four additional student-level covariates, each for student *i* in classroom *j*.

Analytic Approaches

The achievement data were analyzed using intent-to-treat (ITT) and treatment-on-the-treated (ToT) approaches. For the first set of ITT models, we used a multiple imputation procedure to impute missing data for all covariates. For the other ITT models, we analyzed only complete cases; that is, those cases for which there was a score for pretest and posttest. The ToT models used only complete cases.

INTENT-TO-TREAT: MULTIPLE IMPUTATION

The purpose of this analysis was to estimate impact while also estimating missing data values. As in any intent-to-treat analysis, no adjustment is made for noncompliance. In other words, regardless of whether treatment was received or not received, participants are studied according to the original assignment condition. Estimating impact, using this approach, was accomplished by imputing missing outcome and covariate data. Since only student-level variables were used in the estimation of the imputed values, we were unable to impute data for those classrooms in which no students submitted data. Therefore, imputation was restricted to those students for which there was either a pretest or a posttest. The variables used in the imputation were pretest score, posttest score, gender,[1] and variables indicating whether the students completed the pretest or the posttest. Data were imputed to create ten data sets. These data sets were then analyzed using PROC MIXED and the resulting estimates were analyzed using PROC MIANALYZE.

INTENT-TO-TREAT: COMPLETE CASE

An analysis of program completers provides an answer to the question *How does the sample who completed the experiment respond?* This analysis, therefore, includes only data from those students who provided both pretest and posttest data. Furthermore, as with the

[1] Gender was not imputed, as those data were collected at both pretest and posttest.

previous intent-to-treat analysis, this analysis does not adjust for noncompliance. In other words, there is no check on whether classrooms complied with their assignment condition. Because no identifying student information was collected, we determined pretest and posttest to come from the same student if the following three criteria were met: the same unique student ID was used, the same birthday was given, and the same gender was given. Again, we used SAS PROC MIXED to implement these models.

TREATMENT-ON-TREATED: INSTRUMENTAL VARIABLES

Compliance with random assignment is not always perfect. Therefore, one question that needs to be answered in an analysis of an RCT is, *How did the sample respond, given the actual receipt of treatment?* Therefore, this analysis classifies classrooms as treatment or control based on what was reported by the students. If 70 percent or more of the students tested, at the time of the posttest, reported that they had played the game in the current semester in the current class, the class was considered to have played the game. The actual level of noncompliance was relatively minor and is reported in each of the test sections later in this Appendix. This analysis was a two-stage process. The first model used assignment status to predict participation in the game. The second model then used the inverse of the resulting probability as a weight in modeling the outcome.

Impact on Students' Mathematics Achievement (Grades 4–6)

This section describes the findings associated with the impact of playing The Stock Market Game on mathematics achievement for students in Grades 4 through 6.

Sample

Data were collected from 4,358 students in 281 classrooms at pretest and/or posttest. Table C1 shows the pattern in the data collected. For example, from the treatment group, 1,232 students submitted both pretest and posttest data. This number represents 58.1 percent of the treatment group data. The average pretest score for those students in the treatment group submitting both pretest and posttest data was 514.89. The final sample breakdown is given in Table C1.

Table C1. Sample Submitting Mathematics 4–6 Achievement Data

Group	Pretest	Posttest	Frequency	Percent	Unadjusted Means	
					Pretest	Posttest
Treatment	X	X	1,232	58.1	514.89	530.69
	X		476	22.5	458.72	
		X	412	19.4		497.99
Control	X	X	1,144	51.1	471.02	484.45
	X		497	22.2	445.62	
		X	597	26.7		466.02

Table C1 represents the pattern in the data after removing the pretest data from those records that did not match on ID, birthday, and gender. Using only the unique ID to match data between pretest and posttest, we found approximately 73 percent of the sample submitting both pretest and posttest data and about 5 percent submitting only posttest data.

Differences Between Treatment and Control Groups on Measured Covariates

As part of checking for whether covariates were necessary in the modeling of achievement, we tested for difference between the treatment and control groups on student level covariates. We tested for differences on the pretests in two ways: by first checking whether there was a difference in all pretests and then checking for differences on pretests for only those students who also provided posttests. We also tested for differences in other student covariates including gender, completion of the pretest, completion of the posttest, and whether students had played The Stock Market Game in another class.

Pretest. Using mixed modeling (with students nested in classrooms), we tested for differences between treatment and control for all pretest data and for pretest data only from those students who also submitted posttest data. In both cases there was a significant difference between treatment and control groups with the treatment group having a higher mean score than the control group.

In all pretest data, the difference between treatment and control was 31.45 points ($t = 2.94$, $p = .004$), and for those who submitted pretest and posttest data, the difference was 33.25 ($t = 2.81$, $p = .006$). Means and standard errors are in Tables C2 and C3.

Table C2. Means and Standard Errors for All Pretest Data

Group	Estimate	Std. Error
Treatment	493.24	7.46
Control	461.79	7.66

Table C3. Means and Standard Errors for Pretest Data From Those Students Who Submitted Posttest Data

Group	Estimate	Std. Error
Treatment	509.93	8.42
Control	476.68	8.34

Other Covariates: *Gender, Completion of Pretest, Completion of Posttest, Played The Stock Market Game in Another Class*. There was no statistical difference between treatment and control groups in terms of gender makeup ($t = 0.6$, $p = .55$), completion of pretest ($t = –0.95$, $p = .35$), completion of posttest ($t = –0.62$, $p = .54$), or having played The Stock Market Game in another class ($t = 0.95$, $p = .35$).

Findings for Mathematics Achievement (Grades 4–6)

Findings for each model follow. They are organized according to approach: ITT, multiple imputation; ITT, complete case; ToT, complete case. Overall, there were only minor differences in the estimates, significance levels, and effect sizes of all models.

INTENT-TO-TREAT: MULTIPLE IMPUTATION

The first analysis compares all three models after having used a multiple-imputation procedure to estimate missing values. In each model, the treatment effect is significant. Adding the pretest to the model affects the magnitude of the treatment estimate quite substantially, but there appears to be less of an impact on the effect size. Adding the covariates does not appear to improve the model. Table C4 shows the estimates from each model, and Table C5 provides the effect-size estimates and the confidence intervals for those estimates.

Table C4. Estimates From Three Models Using a Multiple Imputation Technique

	Models*		
Estimates	**Treatment**	**Treatment + Pretest**	**Treatment + Pretest + Covariates**
Intercept	473.98	485.34	485.05
Treatment	***35.98***	***18.20***	***18.29***
Pretest		0.56	0.56
Gender			0.85
Different class			–4.73
Completed pretest			–22.84
Completed posttest			76.25

The only estimates that were **not significant were DIFF_CLASS and GENDER.*

Table C5 shows that each model produced similar effect sizes and confidence intervals. The effect size, and confidence interval, for the model with the treatment indicator only is slightly smaller.

Table C5. Treatment Effect Sizes and Confidence Intervals From Three Models Using a Multiple Imputation Technique

Model	Effect Sizes		
	Treatment Effect Size	Lower Bound	Upper Bound
Treatment	0.25	0.13	0.37
Treatment + Pretest	0.28	0.13	0.43
Treatment + Pretest + Other Covariates	0.28	0.13	0.43

Tables C6, C7, and C8 show the full fixed-effects results from each model.

Table C6. ITT, Multiple Imputation, Treatment Indicator Only

Parameter	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	473.98	6.43	249.61	73.67	<0.001
Treatment	35.98	8.94	262.09	4.02	<0.001

Table C7. ITT, Multiple Imputation, Treatment Indicator and Pretest

Parameter	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	485.34	3.48	193.73	139.57	<0.001
Treatment	18.20	4.96	169.67	3.67	<0.001
Pretest	0.56	0.02	22.18	33.09	<0.001

Table C8. ITT, Multiple Imputation, Treatment Indicator and All Covariates

Parameter	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	485.05	3.44	189.97	141.20	<0.001
Treatment	18.29	4.86	177.54	3.76	<0.001
Pretest	0.56	0.52	0.53	33.24	<0.001
Different class	0.85	–8.08	–2.77	0.19	0.849
Gender	–4.73	–10.03	–6.93	–1.81	0.079
Completed pretest	–22.84	–36.09	–26.95	–3.47	0.001
Completed posttest	76.25	63.92	72.74	12.30	<0.001

INTENT-TO-TREAT: COMPLETE CASE

The second analysis compares the three models including only those students who submitted both pretest and posttest data. In each model, the treatment effect is significant and, as with multiple imputation, adding the pretest score changes the estimate by a substantial amount (see Table C9). The effect size, however, changes only slightly when the pretest scores are added to the model.

Table C9. Estimates From Three Models Using Only Complete Cases

Estimates	Models*		
	Treatment	Treatment + Pretest	Treatment + Pretest + Covariates
Intercept	477.01	489.33	488.92
Treatment	***41.61***	***23.16***	***23.43***
Pretest		0.55	0.55
Gender			–7.25
Different class			2.65
Completed pretest			–25.82
Completed posttest			65.78

The only estimate that was **not significant was Different class.*

Table C10 shows that each model produced similar effect sizes and confidence intervals.

Table C10. Treatment Effect Sizes and Confidence Intervals From Three Models Using Only Complete Cases

Model	Effect Sizes		
	Treatment Effect Size	Lower Bound	Upper Bound
Treatment	0.28	0.15	0.41
Treatment + Pretest	0.26	0.11	0.41
Treatment + Pretest + Other Covariates	0.27	0.12	0.41

Tables C11, C12, and C13 show the full fixed-effects results from each model.

Table C11. ITT, Complete Case, Treatment Indicator Only

Effect	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	477.01	7.07	217	67.51	<0.001
Treatment	41.61	10.10	217	4.12	<0.001

Table C12. ITT, Complete Case, Treatment Indicator and Pretest

Effect	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	489.33	4.66	180	105.11	<0.001
Treatment	23.16	6.61	180	3.50	0.001
Pretest	0.55	0.02	2,193	35.47	<0.001

Table C13. ITT, Complete Case, Treatment Indicator and All Covariates

Effect	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	488.92	4.63	180	105.51	<0.001
Treatment	23.43	6.58	180	3.56	0.001
Pretest	0.55	0.02	2,189	35.49	<0.001
Different class	–7.25	2.53	2,189	–2.87	0.004
Gender	2.65	4.88	2,189	0.54	0.588
Completed pretest	–25.82	8.18	2,189	–3.16	0.002
Completed posttest	65.78	7.58	2,189	8.68	<0.001

TREATMENT-ON-THE-TREATED: INSTRUMENTAL VARIABLES

The third analysis compares the three models, each of which was fit using a two stage approach. The first model uses random assignment status as the outcome measure predicted by student report of having played the game. The second model weights the outcome by the inverse of the predicted values from the first model. Approximately 93 percent of the treatment classrooms played the game and 13 percent of the control classrooms played (see Table C14).

Table C14. Number of Classrooms That Played and Did Not Play The Stock Market Game

Game Status	Treatment	Control
Played the game	*n* = 99	*n* = 14
Column percentage	*92.5%*	*12.5%*
Did not play the game	*n* = 8	*n* = 98
Column percentage	*7.5%*	*87.5%*

Results for the ToT analysis are given in Table C15. The model with only a treatment indicator produced a larger impact estimate, but in terms of the effect size, the estimates are similar across all three models (see Table C16).

Table C15. Estimates From Three ToT Models

	Models*		
Estimates	**Treatment**	**Treatment + Pretest**	**Treatment + Pretest + Covariates**
Intercept	477.26	490.13	490.00
Treatment	***37.21***	***26.88***	***23.96***
Pretest		0.35	0.46
Gender			–8.81
Different class			6.81
Completed pretest			–38.39
Completed posttest			67.88

The only estimate that was **not significant was Different class.*

Table C16 shows that each model produced similar effect sizes and confidence intervals.

Table C16. Treatment Effect Sizes and Confidence Intervals From Three ToT Models

	Effect Sizes		
Model	**Treatment Effect Size**	**Lower Bound**	**Upper Bound**
Treatment	0.23	0.10	0.36
Treatment + Pretest	0.25	0.11	0.40
Treatment + Pretest + Other Covariates	0.25	0.10	0.39

Tables C17, C18, and C19 show the full fixed-effects results from each model.

Table C17. ToT, Treatment Indicator Only

Effect	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	477.26	7.61	217	62.68	<0.001
Treatment	37.21	10.93	217	3.40	<0.001

Table C18. ToT, Treatment Indicator and Pretest

Effect	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	490.13	5.54	180	88.52	<0.001
Treatment	26.88	7.91	180	3.40	0.001
Pretest	0.35	0.01	2,193	24.76	<0.001

Table C19. ToT, Treatment Indicator and All Covariates

Effect	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	490.00	5.08	180	96.39	<0.001
Treatment	23.96	7.26	180	3.30	0.001
Pretest	0.46	0.01	2,189	30.67	<0.001
Different Class	–8.81	2.47	2,189	–3.57	<0.001
Gender	6.81	3.60	2,189	1.89	0.060
Completed pretest	–38.39	8.47	2,189	–4.53	<0.001
Completed posttest	67.88	10.04	2,189	6.76	<0.001

Impact on Students' Mathematics Achievement (Grades 7–10)

This section describes the findings associated with the impact of playing The Stock Market Game on mathematics achievement for students in Grades 7 through 10.

Sample

Data were collected from 4,500 students in 328 classrooms at pretest and/or posttest. Table C20 gives the final breakdown and shows the pattern in the data collected. For example, from the treatment group, 1,273 students submitted both pretest and posttest data. This number represents 52.1 percent of the treatment group data. The average pretest score for those students in the treatment group submitting both pretest and posttest data was 513.77.

Table C20. Sample Submitting Math 7–10 Achievement Data

Group	Pretest	Posttest	Frequency	Percent	Unadjusted Means	
					Pretest	Posttest
Treatment	X	X	1,273	52.1	513.77	515.83
	X		738	30.2	497.84	
		X	431	17.7		478.98
Control	X	X	965	46.9	510.62	500.94
	X		685	33.3	479.69	
		X	408	19.9		470.96

Table C20 represents the pattern in the data after removing the pretest data from those records that did not match on ID, birthday, or gender. Using only unique ID to match data between pretest and posttest, we found approximately 60–63 percent of the sample submitting both pretest and posttest data and about 6–7 percent submitting only posttest data.

Differences Between Treatment and Control Groups on Measured Covariates

As part of checking whether covariates were necessary in the modeling of achievement, we tested for differences between the treatment and control groups on student-level covariates. We tested for differences in pretest scores in two ways: by first checking whether there was a difference in all pretests and then checking for differences in pretest scores for only those students who also provided posttests. We also tested for differences in other student covariates, including gender, completion of the pretest, completion of the posttest, and whether students had played The Stock Market Game in another class.

Pretest. Using mixed modeling (with students nested in classrooms), we tested for differences between treatment and control for all pretest data and for pretest data only from those students who also submitted posttest data. In both cases there was not a significant difference between treatment and control groups.

In all pretest data, the difference between treatment and control was 11.82 points ($t = 1.23$, $p = .22$) and for those that submitted pretest and posttest data the difference was 0.34 ($t = 0.03$, $p = .98$). Means and standard errors are given in Tables C21 and C22.

Table C21. Means and Standard Errors for All Pretest Data

Group	Estimate	Std. Error
Treatment	501.27	6.71
Control	489.45	6.88

Table C22. Means and Standard Errors for Pretest Data From Those Students Who Submitted Posttest Data

Group	Estimate	Std. Error
Treatment	512.37	7.82
Control	512.03	8.09

Other Covariates: Gender, Completion of Pretest, Completion of Posttest, Played The Stock Market Game in Another Class. There was no statistical difference between treatment and control groups in terms of gender makeup ($t = –0.16$, $p = .88$), completion of pretest ($t = –1.88$, $p = .06$), completion of posttest ($t = 1.41$, $p = .16$), or having played The Stock Market Game in another class ($t = 0.05$, $p = .96$).

Findings for Mathematics Achievement (Grades 7–10)

Findings for each model follow. They are organized according to approach: ITT, multiple imputation; ITT, complete case; ToT, complete case. For this analysis, there were some differences in the estimates produced by the different models. Four of the nine models yielded significant impact estimates as follows:

- None of the ITT models with multiple imputation yielded significant impact estimates.
- The two models with pretest scores in the ITT complete cases analysis yielded significant impact estimates; the others did not.
- The two models with pretest scores in the ToT analysis yielded significant impact estimates; the others did not.

INTENT-TO-TREAT: MULTIPLE IMPUTATION

The first analysis compares all three models after having used a multiple imputation procedure to estimate missing values. In each model, the treatment effect is significant. Adding the pretest to the model changes the estimate of the treatment estimate quite substantially, but changes the estimate of the effect size only by 0.03. Adding the covariates does not improve the model results. Table C23 shows the estimates from each model and Table C24 provides the effect-size estimates and the confidence intervals for those estimates, all of which indicate nonsignificance.

Table C23. Estimates From Three Models Using a Multiple Imputation Technique

Estimates	Models*		
	Treatment	Treatment + Pretest	Treatment + Pretest + Covariates
Intercept	490.93	495.79	494.31
Treatment	***10.98***	***5.34***	***7.25***
Pretest		0.63	0.65
Gender			6.13
Different class			1.68
Completed pretest			–58.77
Completed posttest			68.79

The treatment effect was **not significant in these models. In addition, two covariates were **not** significant: Different class and Gender.*

Table C24. Treatment Effect Sizes and Confidence Intervals From Three Models Using a Multiple Imputation Technique

Model	Effect Sizes		
	Treatment Effect Size	Lower Bound	Upper Bound
Treatment	0.09	–0.03	0.21
Treatment + Pretest	0.10	–0.05	0.24
Treatment + Pretest + Other Covariates	0.16	–0.01	0.32

Tables C25, C26, and C27 show the full fixed-effects results from each model.

Table C25. ITT, Multiple Imputation, Treatment Indicator Only

Parameter	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	490.93	5.48	268.98	89.62	<0.001
Treatment	10.98	7.60	277.01	1.44	0.150

Table C26. ITT, Multiple Imputation, Treatment Indicator and Pretest

Parameter	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	495.79	2.95	156.84	168.02	<0.001
Treatment	5.34	4.02	195.68	1.33	0.185
Pretest	0.63	0.01	45.66	46.64	<0.001

Table C27. ITT, Multiple Imputation, Treatment Indicator and All Covariates

Parameter	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	494.31	2.80	122.82	176.77	<0.001
Treatment	7.25	3.83	142.95	1.89	0.060
Pretest	0.65	0.63	0.65	48.26	<0.001
Different class	6.13	–3.47	–0.40	1.32	0.200
Gender	1.68	–3.42	–0.43	0.66	0.511
Completed pretest	–58.77	–77.70	–68.07	–6.75	<0.001
Completed posttest	68.79	55.37	59.81	10.49	<0.001

INTENT-TO-TREAT: COMPLETE CASE

The second analysis compares the three models including only those students who submitted both pretest and posttest data. The treatment effect is not significant in the model with only the treatment indicator (see Table C28).

Table C28. Estimates From Three Models Using Only Complete Cases

	Models*		
Estimates	**Treatment**	**Treatment + Pretest**	**Treatment + Pretest + Covariates**
Intercept	492.79	496.09	494.92
Treatment	***13.91***	***12.33***	***15.03***
Pretest		0.63	0.65
Gender			2.24
Different class			5.65
Completed pretest			–54.15
Completed posttest			67.46

The treatment effect was **not significant in the first model, nor were the two covariates: Gender* and *Different class.*

Table C29 shows effect sizes and confidence intervals for the three complete-case models. As indicated by the confidence intervals, those models that included the pretest score yielded significant impact estimates.

Table C29. Treatment Effect Sizes and Confidence Intervals From Three Models Using Only Complete Cases

Model	Effect Sizes		
	Treatment Effect Size	Lower Bound	Upper Bound
Treatment	0.10	–0.03	0.23
Treatment + Pretest	0.16	0.01	0.31
Treatment + Pretest + Covariates	0.21	0.06	0.36

Tables C30, C31, and C32 show the full fixed-effects results from each model.

Table C30. ITT, Complete Case, Treatment Indicator Only

Effect	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	492.79	6.69	225	73.70	<0.001
Treatment	13.91	9.32	225	1.49	0.137

Table C31. ITT, Complete Case, Treatment Indicator and Pretest

Effect	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	496.09	4.24	174	116.88	<0.001
Treatment	12.33	5.87	174	2.10	0.037
Pretest	0.63	0.02	2,061	40.64	<0.001

Table C32. ITT, Complete Case, Treatment Indicator and All Covariates

Effect	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	494.92	3.94	174	125.62	<0.001
Treatment	15.03	5.43	174	2.77	0.006
Pretest	0.65	0.02	2,057	42.31	<0.001
Different class	2.24	2.65	2,057	0.84	0.399
Gender	5.65	4.36	2,057	1.30	0.195
Completed pretest	–54.15	7.44	2,057	–7.28	<0.001
Completed posttest	67.46	7.74	2,057	8.72	<0.001

TREATMENT-ON-THE-TREATED: INSTRUMENTAL VARIABLES

The third analysis compares the three models, each of which was fit in two stages. The first model uses random assignment status as the outcome measure predicted by student report of having played the game. The second model weights the outcome by the inverse of the predicted values from the first model. Approximately 89 percent of the treatment classrooms played the game and 15 percent of the control classrooms played (see Table C33).

Table C33. Number of Classrooms That Played and Did Not Play The Stock Market Game

Game Status	Treatment	Control
Played the game	*n* = 105	*n* = 16
Column percentage	*89.0%*	*14.7%*
Did not play the game	*n* = 13	*n* = 93
Column percentage	*11.0%*	*85.3%*

The results from the ToT analysis follow. The estimates from the three models are presented in Table C34. The two models with the pretest scores yielded significant results, but the model without pretest scores did not.

Table C34. Estimates From Three ToT Models

Estimates	Models*		
	Treatment	Treatment + Pretest	Treatment + Pretest + Covariates
Intercept	492.20	493.34	491.51
Treatment	***15.26***	***14.52***	***17.47***
Pretest		0.63	0.66
Gender			–6.30
Different class			–1.13
Completed pretest			–57.94
Completed posttest			73.56

The treatment effect was **not significant in the first model (without pretest score). In addition, the covariate indicating Gender was **not** significant.*

Table C35 shows the effect-size estimates and the confidence intervals as well as indicates that the first model (with only the treatment indicator) was not significant.

Table C35. Treatment Effect Sizes and Confidence Intervals From Three ToT Models

Model	Effect Sizes		
	Treatment Effect Size	Lower Bound	Upper Bound
Treatment	0.11	–0.02	0.24
Treatment + Pretest	0.17	0.02	0.32
Treatment + Pretest + Other Covariates	0.22	0.07	0.37

Tables C36, C37, and C38 show the full fixed-effects results from each model.

Table C36. ToT, Treatment Indicator Only

Effect	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	492.20	6.58	225	74.84	<0.001
Treatment	15.26	9.21	225	1.66	0.099

Table C37. ToT, Treatment Indicator and Pretest

Effect	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	493.34	4.62	174	106.79	<0.001
Treatment	14.52	6.43	174	2.26	0.025
Pretest	0.63	0.02	2,061	39.19	<0.001

Table C38. ToT, Treatment Indicator and All Covariates

Effect	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	491.51	4.43	174	111.02	<0.001
Treatment	17.47	6.14	174	2.85	0.005
Pretest	0.66	0.02	2,057	40.31	<0.001
Different class	–6.30	2.57	2,057	–2.45	0.014
Gender	–1.13	3.74	2,057	–0.30	0.762
Completed pretest	–57.94	8.68	2,057	–6.67	<0.001
Completed posttest	73.56	7.79	2,057	9.45	<0.001

Impact on Students' Investor Knowledge (Grades 4–5)

This section describes the findings associated with the impact of playing The Stock Market Game on students' investor knowledge in Grades 4 and 5.

Sample

Data were collected from 2,616 students in 203 classrooms at pretest and/or posttest. Table C39 shows the pattern in the data collected. For example, from the treatment group, 700 students submitted both pretest and posttest data. This number represents 52.7 percent of the treatment group data. The average pretest score for those students in the treatment group submitting both pretest and posttest data was 486.40. The final sample breakdown is given in Table C39.

Table C39. Sample Submitting Investor Knowledge Data (Grades 4–5)

					Unadjusted Means	
Group	**Pretest**	**Posttest**	**Frequency**	**Percent**	**Pretest**	**Posttest**
Treatment	X	X	700	52.7	486.40	538.02
	X		311	23.4	463.30	
		X	317	23.9		512.39
Control	X	X	646	50.2	457.51	471.23
	X		266	20.7	450.31	
		X	376	29.2		468.98

Table C39 represents the pattern in the data after removing the pretest data from those records that did not match on ID, birthday, or gender. Using only unique ID to match data between pretest and posttest, we found approximately 69 percent of the sample submitting both pretest and posttest data and about 9 percent submitting only posttest data.

Differences Between Treatment and Control Groups on Measured Covariates

As part of checking whether covariates were necessary in the modeling of achievement, we tested for differences between the treatment and control groups on student-level covariates. We tested for differences on the pretests in two ways: by first checking whether there was a difference in all pretests and then checking for differences on pretests for only those students who also provided posttests. We also tested for differences in other student covariates including gender, completion of the pretest, completion of the posttest, and whether students had played The Stock Market Game in another class.

Pretest. Using mixed modeling (with students nested in classrooms), we tested for differences between treatment and control for all pretest data and for pretest data only from those students who also submitted posttest data. In both cases there was a significant difference between treatment and control groups, with the treatment group having a higher mean score than the control group.

In all pretest data, the difference between treatment and control was 21.94 points ($t = 2.61$, $p < .01$) and for those that submitted pretest and posttest data the difference was 27.07 ($t = 3.49$, $p < .01$). Means and standard errors are given in Tables C40 and C41.

Table C40. Means and Standard Errors for All Pretest Data

Group	Estimate	Std. Error
Treatment	474.81	5.85
Control	452.87	6.05

Table C41. Means and Standard Errors for Pretest Data From Those Students Who Submitted Posttest Data

Group	Estimate	Std. Error
Treatment	484.55	5.46
Control	457.48	5.51

Other Covariates: *Gender, Completion of Pretest, Completion of Posttest, Played The Stock Market Game in Another Class.* There was no statistical difference between treatment and control groups in terms of gender makeup ($t = –0.5$, $p = .55$), completion of pretest ($t = –0.52$, $p = .21$), completion of posttest ($t = –0.02$, $p = .95$), or having played The Stock Market Game in another class ($t = –0.41$, $p = .26$).

Findings for Investor Knowledge (Grades 4–5)

Findings for each model follow. They are organized according to approach: ITT, multiple imputation; ITT, complete case; ToT: complete case. All the models yielded significant results, though the magnitudes of the estimates were different.

INTENT-TO-TREAT: MULTIPLE IMPUTATION

The first analysis compares all three models after having used a multiple imputation procedure to estimate missing values. In each model, the treatment effect is significant. Adding the pretest and the covariates to the models lowers impact but the effect sizes are fairly consistent across the three models. Table C42 shows the estimates from each model, and Table C43 provides the effect-size estimates and the confidence intervals for those estimates.

Table C42. Estimates From Three Models Using a Multiple Imputation Technique

	Models*		
Estimates	**Treatment**	**Treatment + Pretest**	**Treatment + Pretest + Covariates**
Intercept	476.79	483.82	485.51
Treatment	***44.21***	***33.36***	***31.68***
Pretest		0.56	0.55
Gender			10.37
Different class			–1.93
Completed pretest			–20.86
Completed posttests			100.86

The only estimates that were **not significant were Different class, Gender, and Completed Pretest.*

Table C43 shows that all models produced similar effect sizes and confidence intervals.

Table C43. Treatment Effect Sizes and Confidence Intervals From Three Models Using a Multiple Imputation Technique

	Effect Sizes		
Model	**Treatment Effect Size**	**Lower Bound**	**Upper Bound**
Treatment	0.30	0.14	0.45
Treatment + Pretest	0.32	0.15	0.49
Treatment + Pretest + Other Covariates	0.30	0.13	0.46

Tables C44, C45, and C46 show the full fixed-effects results from each model.

Table C44. ITT, Multiple Imputation, Treatment Indicator Only

Parameter	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	476.79	8.23	181.89	57.96	<0.001
Treatment	44.21	11.61	166.09	3.81	<0.001

Table C45. ITT, Multiple Imputation, Treatment Indicator and Pretest

Parameter	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	483.82	6.49	135.15	74.52	<0.001
Treatment	33.36	9.07	132.43	3.68	<0.001
Pretest	0.56	0.03	49.39	21.11	<0.001

Table C46. ITT, Multiple Imputation, Treatment Indicator and All Covariates

Parameter	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	485.51	6.32	144.16	76.79	<0.001
Treatment	31.68	8.77	148.85	3.61	0.001
Pretest	0.55	0.50	0.53	19.18	<0.001
Different class	10.37	–0.48	7.93	1.89	0.061
Gender	–1.93	–8.43	–4.47	–0.59	0.556
Completed pretest	–20.86	–49.29	–36.85	–1.55	0.140
Completed posttest	100.86	73.99	88.21	7.83	<0.001

INTENT-TO-TREAT: COMPLETE CASE

The second analysis compares the three models including only those students who submitted both pretest and posttest data. In each model, the treatment effect is similar and significant (see Table C47).

Table C47. Estimates From Three Models Using Only Complete Cases

Estimates	Models*		
	Treatment	Treatment + Pretest	Treatment + Pretest + Covariates
Intercept	475.19	477.54	479.02
Treatment	***55.23***	***55.77***	***54.47***
Pretest		0.46	0.46
Gender			–6.07
Different class			11.32
Completed pretest			–37.07
Completed posttest			84.29

**The only estimates that were not significant were Different class and Gender.*

Table C48 shows that the models that included the pretest scores produced larger effect sizes than the model without the pretest score.

Table C48. Treatment Effect Sizes and Confidence Intervals From Three Models Using Only Complete Cases

Model	Effect Sizes		
	Treatment Effect Size	Lower Bound	Upper Bound
Treatment	0.34	0.18	0.50
Treatment + Pretest	0.42	0.24	0.60
Treatment + Pretest + Other Covariates	0.42	0.23	0.60

Tables C49, C50, and C51 show the full fixed-effects results from each model.

Table C49. ITT, Complete Case, Treatment Indicator Only

Effect	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	475.19	9.35	155	50.85	<0.001
Treatment	55.23	13.13	155	4.21	<0.001

Table C50. ITT, Complete Case, Treatment Indicator and Pretest

Effect	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	477.54	8.66	117	55.14	<0.001
Treatment	55.77	12.25	117	4.55	<0.001
Pretest	0.46	0.03	1,226	15.26	<0.001

Table C51. ITT, Complete Case, Treatment Indicator and All Covariates

Effect	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	479.02	8.55	117	56.02	<0.001
Treatment	54.47	12.09	117	4.51	<0.001
Pretest	0.46	0.03	1,222	15.48	<0.001
Different class	–6.07	3.46	1,222	–1.75	0.080
Gender	11.32	7.39	1,222	1.53	0.126
Completed pretest	–37.07	11.89	1,222	–3.12	0.002
Completed posttest	84.29	10.37	1,222	8.13	<0.001

TREATMENT-ON-THE-TREATED: INSTRUMENTAL VARIABLES

The third analysis compares the three models in two stages. The first model uses random assignment status as the outcome measure predicted by student report of having played the game. The second model weights the outcome by the inverse of the predicted values from the first model. Approximately 94 percent of the treatment classrooms played the game and 20 percent of the control classrooms did (see Table C52).

Table C52. Number of Classrooms That Played and Did Not Play The Stock Market Game

Game Status	Treatment	Control
Played the game	*n* = 75	*n* = 15
Column percentage	*93.8%*	*19.5%*
Did not play the game	*n* = 5	*n* = 62
Column percentage	*6.3%*	*80.5%*

Results for the ToT analysis produced a similar pattern of estimates across the three models with the magnitude of the treatment effect increasing as covariates were added to the model (see Table C53).

Table C53. Estimates From Three ToT Models

Estimates	Models		
	Treatment	Treatment + Pretest	Treatment + Pretest + Covariates
Intercept	475.38	476.13	474.28
Treatment	***52.93***	***61.51***	***69.05***
Pretest		0.30	0.15
Gender			–9.18
Different class			–16.56
Completed pretest			–139.16
Completed posttest			18.52

Estimates for the following three covariates were **not significant: Gender, Different class and Completed posttest.*

Table C54 shows that adding the pretest to the model increased the magnitude of the effect size.

Table C54. Treatment Effect Sizes and Confidence Intervals From Three ToT Models

Model	Effect Sizes		
	Treatment Effect Size	Lower Bound	Upper Bound
Treatment	0.29	0.13	0.45
Treatment + Pretest	0.43	0.24	0.61
Treatment + Pretest + Other Covariates	0.43	0.25	0.61

Tables C55, C56, and C57 show the full fixed-effects results from each model.

Table C55. ToT, Treatment Indicator Only

Effect	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	475.38	10.37	155	45.86	<0.001
Treatment	52.93	14.75	155	3.59	<0.001

Table C56. ToT, Treatment Indicator and Pretest

Effect	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	476.13	9.41	117	50.62	<0.001
Treatment	61.51	13.30	117	4.63	<0.001
Pretest	0.30	0.04	1,226	7.56	<0.001

Table C57. ToT, Treatment Indicator and All Covariates

Effect	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	474.28	10.53	117	45.03	<0.001
Treatment	69.05	14.86	117	4.65	<0.001
Pretest	0.15	0.05	1,222	3.18	0.002
Different class	–9.18	5.65	1,222	–1.62	0.105
Gender	–16.56	12.38	1,222	–1.34	0.181
Completed pretest	–139.16	18.92	1,222	–7.35	<0.001
Completed posttest	18.52	16.57	1,222	1.12	0.264

Impact on Students' Investor Knowledge (Grades 6–8)

This section describes the findings associated with the impact of playing The Stock Market Game on students' investor knowledge in Grades 6–8.

Sample

Data were collected from 4,275 students in 275 classrooms at pretest and/or posttest. Table C58 shows the pattern in the data collected. For example, from the treatment group, 1,226 students submitted both pretest and posttest data. This number represents 51.9 percent of the treatment group data. The average pretest score for those students in the treatment group submitting both pretest and posttest data was 488.87. The final sample breakdown is given in Table C58.

Table C58. Sample Submitting Investor Knowledge Data (Grades 6–8)

Group	Pretest	Posttest	Frequency	Percent	Unadjusted Means	
					Pretest	Posttest
Treatment	X	X	1,226	51.8	488.87	523.64
	X		682	28.8	481.67	
		X	459	19.4		525.06
Control	X	X	878	46.0	480.62	475.42
	X		493	25.8	462.24	
		X	537	28.1		464.76

Table C58 represents the pattern in the data after removing the pretest data from those records that did not match on ID, birthday, and gender. Using only unique ID to match data between pretest and posttest, we found approximately 63 percent of the sample submitting both pretest and posttest data and about 8–11 percent submitting only posttest data.

Differences Between Treatment and Control Groups on Measured Covariates

As part of checking whether covariates were necessary in the modeling of achievement, we tested for difference between the treatment and control groups on student-level covariates. We tested for differences on the pretests in two ways: by first checking whether there was a difference in all pretests and then checking for differences on pretests for only those students who also provided posttests. We also tested for differences in other student covariates including gender, completion of the pretest, completion of the posttest, and whether students had played The Stock Market Game in another class.

Pretest. Using mixed modeling (with students nested in classrooms), we tested for differences between treatment and control for all pretest data and for pretest data only from those students who also submitted posttest data. In both cases, there was not a significant difference between treatment and control groups.

In all pretest data, the difference between treatment and control was 11.09 points (t = 1.66, p = .10) and for those who submitted pretest and posttest data, the difference was 11.92 (t = 1.70, p = .09). Means and standard errors are in Tables C59 and C60.

Table C59. Means and Standard Errors for All Pretest Data

Group	Estimate	Std. Error
Treatment	485.70	4.53
Control	474.61	4.90

Table C60. Means and Standard Errors for Pretest Data From Those Students Who Submitted Posttest Data

Group	Estimate	Std. Error
Treatment	490.80	4.73
Control	478.88	5.20

Other Covariates: *Gender, Completion of Pretest, Completion of Posttest, Played The Stock Market Game in Another Class.* There was no statistical difference between treatment and control groups in terms of gender makeup (t = –0.11, p = .91), completion of pretest (t = –1.88, p = .06), completion of posttest (t = –0.91, p = .36), or having played The Stock Market Game in another class (t = 0.80, p = .42).

Findings for Investor Knowledge (Grades 6–8)

Findings for each model follow. They are organized according to approach: ITT, multiple imputation; ITT, complete case; ToT, complete case. Overall, there were some differences in the magnitude of the estimates and effect sizes across all models. However, each model yielded a significant estimate of treatment effect.

INTENT-TO-TREAT: MULTIPLE IMPUTATION

The first analysis compares all three models after having used a multiple imputation procedure to estimate missing values. In each model, the treatment effect is significant. Adding the pretest to the model decreases the magnitude of the treatment estimate, but the estimate of the effects size increases. Table C61 shows the estimates from each model and Table C62 provides the effect-size estimates and the confidence intervals for those estimates.

Table C61. Estimates From Three Models Using a Multiple Imputation Technique

Estimates	Models*		
	Treatment	Treatment + Pretest	Treatment + Pretest + Covariates
Intercept	477.86	483.56	483.68
Treatment	***41.44***	***30.15***	***29.30***
Pretest		0.66	0.67
Gender			9.62
Different class			1.10
Completed pretest			–28.49
Completed posttest			102.56

The only estimates that was **not significant was Gender.*

Table C62. Treatment Effect Sizes and Confidence Intervals From Three Models Using a Multiple Imputation Technique

Model	Effect Sizes		
	Treatment Effect Size	Lower Bound	Upper Bound
Treatment	0.39	0.24	0.54
Treatment + Pretest	0.49	0.31	0.68
Treatment + Pretest + Other Covariates	0.51	0.33	0.70

Tables C63, C64, and C65 show the full fixed-effects results from each model.

Table C63. ITT, Multiple Imputation, Treatment Indicator Only

Parameter	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	477.86	5.80	204.42	82.35	<0.001
Treatment	41.44	8.14	171.06	5.09	<0.001

Table C64. ITT, Multiple Imputation, Treatment Indicator and Pretest

Parameter	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	483.56	3.96	152.61	121.99	<0.001
Treatment	30.15	5.59	118.91	5.39	<0.001
Pretest	0.66	0.02	24.85	28.12	<0.001

Table C65. ITT, Multiple Imputation, Treatment Indicator and All Covariates

Parameter	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	483.68	3.70	164.04	130.82	<0.001
Treatment	29.30	5.26	117.52	5.57	<0.001
Pretest	0.67	0.62	0.64	29.37	<0.001
Different class	9.62	1.60	5.96	2.38	0.019
Gender	1.10	–4.69	–0.89	0.38	0.704
Completed pretest	–28.49	–55.90	–49.78	–2.24	0.043
Completed posttest	102.56	88.54	94.85	14.76	<0.001

INTENT-TO-TREAT: COMPLETE CASE

The second analysis compares the three models including only those students who submitted both pretest and posttest data. In each model, the treatment effect is significant (see Table C66). Adding the pretest score decreases the estimates, but the effect sizes increase (see Table C67).

Table C66. Estimates From Three Models Using Only Complete Cases

	Models*		
Estimates	**Treatment**	**Treatment + Pretest**	**Treatment + Pretest + Covariates**
Intercept	470.09	477.27	475.76
Treatment	***57.74***	***41.07***	***42.33***
Pretest		0.62	0.63
Gender			1.94
Different class			6.93
Completed pretest			–28.20
Completed posttest			101.67

The only estimates that were **not significant were Gender and Different class.*

Table C67 shows effect sizes and confidence intervals from each of the ITT complete case models.

Table C67. Treatment Effect Sizes and Confidence Intervals From Three Models Using Only Complete Cases

Model	Effect Sizes		
	Treatment Effect Size	Lower Bound	Upper Bound
Treatment	0.42	0.29	0.55
Treatment + Pretest	0.45	0.29	0.61
Treatment + Pretest + Other Covariates	0.50	0.34	0.65

Tables C68, C69, and C70 show the full fixed-effects results from each model.

Table C68. ITT, Complete Case, Treatment Indicator Only

Effect	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	470.09	6.68	221	70.41	<0.001
Treatment	57.74	9.23	221	6.26	<0.001

Table C69. ITT, Complete Case, Treatment Indicator and Pretest

Effect	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	477.27	5.34	159	89.36	<0.001
Treatment	41.07	7.22	159	5.69	<0.001
Pretest	0.62	0.02	1,942	25.96	<0.001

Table C70. ITT, Complete Case, Treatment Indicator and All Covariates

Effect	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	475.76	5.01	159	94.89	<0.001
Treatment	42.33	6.77	159	6.25	<0.001
Pretest	0.63	0.02	1,938	26.84	<0.001
Different class	1.94	3.07	1,938	0.63	0.527
Gender	6.93	5.02	1,938	1.38	0.167
Completed pretest	–28.20	11.51	1,938	–2.45	0.014
Completed posttest	101.67	8.32	1,938	12.22	<0.001

TREATMENT-ON-THE-TREATED: INSTRUMENTAL VARIABLES

The third analysis compares the three models, each of which was constructed using a two stage approach. The first model uses random assignment status as the outcome measure predicted by student report of having played the game. The second model weights the outcome by the inverse of the predicted values from the first model. Approximately 91 percent of the treatment classrooms played the game and 20 percent of the control classrooms played (see Table C71).

Table C71. Number of Classrooms That Played and Did Not Play The Stock Market Game

Game Status	Treatment	Control
Played the game	*n* = 105	*n* = 21
Column percentage	*90.5%*	*19.6%*
Did not play the game	*n* = 11	*n* = 86
Column percentage	*9.5%*	*80.4%*

Results for the ToT analysis produced a similar pattern of estimates across the three models. The model with only a treatment indicator produced a larger estimate, but in terms of the effect sizes, the estimates are similar across all three models (see Table C73).

Table C72. Estimates From Three ToT Models

	Models*		
Estimates	**Treatment**	**Treatment + Pretest**	**Treatment + Pretest + Covariates***
Intercept	474.96	476.51	474.67
Treatment	***51.43***	***42.75***	***44.70***
Pretest		0.59	0.61
Gender			8.49
Different class			15.60
Completed pretest			–27.50
Completed posttest			88.31

The only estimate that was **not significant was Completed pretest.*

Table C73 shows that each model produced similar effect sizes and confidence intervals.

Table C73. Treatment Effect Sizes and Confidence Intervals From Three ToT Models

Model	Effect Sizes		
	Treatment Effect Size	Lower Bound	Upper Bound
Treatment	0.40	0.24	0.55
Treatment + Pretest	0.45	0.29	0.60
Treatment + Pretest + Other Covariates	0.49	0.33	0.64

Tables C74, C75, and C76 show the full fixed-effects results from each model.

Table C74. ToT, Treatment Indicator Only

Effect	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	474.96	7.63	159	62.27	<0.001
Treatment	51.43	10.31	159	4.99	<0.001

Table C75. ToT, Treatment Indicator and Pretest

Effect	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	476.51	5.61	159	84.94	<0.001
Treatment	42.75	7.57	159	5.65	<0.001
Pretest	0.59	0.02	1,942	25.41	<0.001

Table C76. ToT, Treatment Indicator and All Covariates

Effect	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	474.67	5.40	159	87.83	<0.001
Treatment	44.70	7.29	159	6.14	<0.001
Pretest	0.61	0.02	1,938	26.65	<0.001
Different class	8.49	3.06	1,938	2.77	0.006
Gender	15.60	4.27	1,938	3.65	<0.001
Completed pretest	–27.50	15.16	1,938	–1.81	0.070
Completed posttest	88.31	9.74	1,938	9.07	<0.001

Impact on Students' Investor Knowledge (Grades 9–10)

This section describes the findings associated with the impact of playing The Stock Market Game on students' investor knowledge in Grades 9 and 10.

Sample

Data were collected from 1,703 students in 164 classrooms at pretest and/or posttest. Table C77 shows the pattern in the data collected. For example, from the treatment group, 394 students submitted both pretest and posttest data. This number represents 44.4 percent of the treatment group data. The average pretest score for those students in the treatment group submitting both pretest and posttest data was 520.48. The final sample breakdown is given in Table C77.

Table C77. Sample Submitting Investor Knowledge Data (Grades 9–10)

Group	Pretest	Posttest	Frequency	Percent	Unadjusted Means	
					Pretest	Posttest
Treatment	X	X	394	44.4	520.48	530.20
	X		329	37.1	510.20	
		X	164	18.5		497.06
Control	X	X	342	41.9	504.29	482.23
	X		342	41.9	484.34	
		X	132	16.2		457.19

Table C77 represents the pattern in the data after removing the pretest data from those records that did not match on ID, birthday, and gender. Using only unique ID to match data between pretest and posttest, we found approximately 49–53 percent of the sample submitting both pretest and posttest data and about 9 percent submitting only posttest data.

Differences Between Treatment and Control Groups on Measured Covariates

As part of checking whether covariates were necessary in the modeling of achievement, we tested for differences between the treatment and control groups on student-level covariates. We tested for differences on the pretests in two ways: by first checking whether there was a difference in all pretests and then checking for differences on pretests for only those students who also provided posttests. We also tested for differences in other student covariates, including gender, completion of the pretest, completion of the posttest, and whether students had played The Stock Market Game in another class.

Pretest. Using mixed modeling (with students nested in classrooms), we tested for differences between treatment and control for all pretest data and for pretest data only from those students who also submitted posttest data. In both cases, there was not a significant difference between treatment and control groups.

In all pretest data, the difference between treatment and control was 16.57 points (t = 1.69, p = .09), and for those that submitted pretest and posttest data, the difference was 18.43 (t = 1.82, p = .07). Means and standard errors are in Tables C78 and C79.

Table C78. Means and Standard Errors for All Pretest Data

Group	Estimate	Std. Error
Treatment	511.14	6.97
Control	494.57	6.90

Table C79. Means and Standard Errors for Pretest Data From Those Students Who Submitted Posttest Data

Group	Estimate	Std. Error
Treatment	520.07	7.26
Control	501.64	7.07

Other Covariates. ***Gender, Completion of Pretest, Completion of Posttest, Played The Stock Market Game in Another Class.*** There was no statistical difference between treatment and control groups in terms of gender makeup (t = 1.11, p = .27), completion of pretest (t = –0.71, p = .48), completion of posttest (t = –1.54, p = .13), or having played The Stock Market Game in another class (t = 1.32, p = .19).

Findings for Investor Knowledge (Grades 9–10)

Findings for each model follow. They are organized according to approach: ITT, multiple imputation; ITT, complete case; ToT, complete case. Overall, there were some differences in the magnitude of the estimates and effect sizes across all models. However, each model yielded a significant estimate of treatment effect.

INTENT-TO-TREAT: MULTIPLE IMPUTATION

The first analysis compares all three models after having used a multiple imputation procedure to estimate missing values. In each model, the treatment effect is significant. Adding the pretest to the model changes the estimate of the treatment estimate quite substantially, but the effect sizes are similar across all three models. Adding the covariates does not appear to improve the model. Table C80 shows the estimates from each model, and Table C81 provides the effect-size estimates and the confidence intervals for those estimates.

Table C80. Estimates From Three Models Using a Multiple Imputation Technique

Estimates	Models*		
	Treatment	Treatment + Pretest	Treatment + Pretest + Covariates
Intercept	479.21	486.15	488.76
Treatment	***26.79***	***17.69***	***14.04***
Pretest		0.66	0.78
Gender			–9.55
Different class			–3.38
Completed pretest			–88.45
Completed posttest			158.01

The only estimates that were **not significant were Gender and Different class.*

Table C81 shows that each model produced similar effect sizes and confidence intervals.

Table C81. Treatment Effect Sizes and Confidence Intervals From Three Models Using a Multiple Imputation Technique

Model	Effect Sizes		
	Treatment Effect Size	Lower Bound	Upper Bound
Treatment	0.24	0.06	0.42
Treatment + Pretest	0.26	0.05	0.47
Treatment + Pretest + Other Covariates	0.24	0.03	0.45

Tables C82, C83, and C84 show the full fixed-effects results from each model.

Table C82. ITT, Multiple Imputation, Treatment Indicator Only

Parameter	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	479.21	7.03	118.12	68.16	<0.001
Treatment	26.79	9.93	126.15	2.70	0.008

Table C83. ITT, Multiple Imputation, Treatment Indicator and Pretest

Parameter	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	486.15	5.15	73.79	94.41	<0.001
Treatment	17.69	7.14	89.72	2.48	0.015
Pretest	0.66	0.04	22.08	17.18	<0.001

Table C84. ITT, Multiple Imputation, Treatment Indicator and All Covariates

Parameter	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	488.76	4.39	79.06	111.44	<0.001
Treatment	14.04	6.13	90.39	2.29	0.024
Pretest	0.78	0.68	0.73	17.04	<0.001
Different class	–9.55	–30.45	–22.87	–0.97	0.346
Gender	–3.38	–12.40	–7.36	–0.76	0.454
Completed pretest	–88.45	–131.39	–111.42	–4.68	0.001
Completed posttest	158.01	134.43	143.84	13.81	<0.001

INTENT-TO-TREAT: COMPLETE CASE

The second analysis compares the three models including only those students who submitted both pretest and posttest data. The treatment effect is significant, and adding the covariates does not affect the magnitude of the estimates by a substantial amount (see Table C85); but using the pretest score in the model does increase the effect-size estimates (see Table C86).

Table C85. Estimates From Three Models Using Only Complete Cases

	Models		
Estimates	**Treatment**	**Treatment + Pretest**	**Treatment + Pretest + Covariates***
Intercept	472.01	481.47	485.07
Treatment	34.37	31.69	29.65
Pretest		0.65	0.71
Gender			–7.18
Different class			–0.54
Completed pretest			–86.00
Completed posttest			155.07

The only estimates that were **not significant were GENDER and DIFF_CLASS.*

Table C86 shows effect sizes and confidence intervals for the three models.

Table C86. Treatment Effect Sizes and Confidence Intervals From Three Models Using Only Complete Cases

Model	Effect Sizes		
	Treatment Effect Size	Lower Bound	Upper Bound
Treatment	0.26	0.07	0.46
Treatment + Pretest	0.36	0.13	0.58
Treatment + Pretest + Other Covariates	0.38	0.15	0.61

Tables C87, C88, and C89 show the full fixed-effects results from each model.

Table C87. ITT, Complete Case, Treatment Indicator Only

Effect	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	472.01	8.83	105	53.46	<0.001
Treatment	34.37	12.68	105	2.71	0.008

Table C88. ITT, Complete Case, Treatment Indicator and Pretest

Effect	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	481.47	7.11	76	67.67	<0.001
Treatment	31.69	10.21	76	3.10	0.003
Pretest	0.65	0.04	657	14.54	<0.001

Table C89. ITT, Complete Case, Treatment Indicator and All Covariates

Effect	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	485.07	6.24	76	77.67	<0.001
Treatment	29.65	8.95	76	3.31	0.001
Pretest	0.71	0.04	653	16.86	<0.001
Different class	–7.18	5.22	653	–1.38	0.170
Gender	–0.54	9.00	653	–0.06	0.953
Completed pretest	–86.00	14.99	653	–5.74	<0.001
Completed posttest	155.07	12.87	653	12.05	<0.001

TREATMENT-ON-THE-TREATED: INSTRUMENTAL VARIABLES

The third analysis compares the three models, each of which was constructed using a two stage approach. The first model uses random assignment status as the outcome measure predicted by student report of having played the game. The second model weights the outcome by the inverse of the predicted values from the first model. Approximately 90 percent of the treatment classrooms played the game and 11 percent of the control classrooms played (see Table C90).

Table C90. Number of Classrooms That Played and Did Not Play The Stock Market Game

Game Status	Treatment	Control
Played the game	*n* = 47	*n* = 6
Column percentage	*90.4%*	*10.9%*
Did not play the game	*n* = 5	*n* = 49
Column percentage	*9.6%*	*89.1%*

Results for the ToT analysis are provided in Table C91. Including the pretest score in the model increased the magnitude of the treatment estimates as well as the effect sizes (see Table C92).

Table C91. Estimates From Three ToT Models

	Models		
Estimates	**Treatment**	**Treatment + Pretest**	**Treatment + Pretest + Covariates***
Intercept	476.99	478.71	483.96
Treatment	***29.47***	***36.12***	***31.53***
Pretest		0.53	0.61
Gender			–3.67
Different class			12.89
Completed pretest			–84.27
Completed posttest			148.58

The only estimates that were **not significant were Gender and Different class.*

Table C92 shows that each model produced similar effect sizes and confidence intervals.

Table C92. Treatment Effect Sizes and Confidence Intervals From Three ToT Models

Model	Effect Sizes		
	Treatment Effect Size	Lower Bound	Upper Bound
Treatment	0.22	0.03	0.41
Treatment + Pretest	0.39	0.16	0.62
Treatment + Pretest + Other Covariates	0.37	0.14	0.59

Tables C93, C94, and C95 show the full fixed-effects results from each model.

Table C93. ToT, Treatment Indicator Only

Effect	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	476.99	9.01	105	52.96	<0.001
Treatment	29.47	13.04	105	2.26	0.026

Table C94. ToT, Treatment Indicator and Pretest

Effect	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	478.71	7.36	76	65.02	<0.001
Treatment	36.12	10.70	76	3.38	0.001
Pretest	0.53	0.05	657	11.15	<0.001

Table C95. ToT, Treatment Indicator and All Covariates

Effect	Estimate	Std. Error	DF	*t*-Value	Pr>|*t*|
Intercept	483.96	6.80	76	71.20	<0.001
Treatment	31.53	9.87	76	3.19	0.002
Pretest	0.61	0.04	653	13.86	<0.001
Different class	–3.67	4.64	653	–0.79	0.429
Gender	12.89	8.07	653	1.60	0.111
Completed pretest	–84.27	14.56	653	–5.79	<0.001
Completed posttest	148.58	14.28	653	10.41	<0.001

APPENDIX D.
TEACHER SURVEY ANALYSIS

Appendix D describes our approaches to analyzing the teacher survey for The Stock Market Game. Analysis included two methods: (1) item-level descriptions of teachers' responses and (2) analysis of variance (ANOVA) in teacher responses using Rasch-derived scale scores. The analyses were designed to measure teachers' implementation of The Stock Market Game, their own financial practices, and their perceptions of the impact of the program on those practices. The work provides insight into how teachers use The Stock Market Game and how their own financial practices may be affected by teaching the program.

Item-Level Analysis

The item-level analysis was intended to capture an overall picture of both implementation and teachers' financial practices. This picture was formed through a nationwide survey offered to all teachers who have taught The Stock Market Game since the 2007–08 school year, including those participating in the RCT of the study. We invited 11,813 non-RCT teachers nationwide to complete the survey; added to our pool of 568 teachers participating in the RCT, we invited a total of 12,381 teachers. Although we recruited widely, there was some concern about teacher self-selection bias, in that those teacher more interested in The Stock Market Game might complete the survey. To reduce the possibility of self-selection bias and to further ensure that we would gather enough completed surveys, we offered an incentive in the form of entry into a raffle for a $250 gift card.

In total, 4,804 surveys were completed (a response rate of 40 percent). However, 113 teachers had not taught The Stock Market Game since the fall of 2007 and therefore were removed, leaving 4,691 surveys for the analyses.

The following sections describe the item-level analysis in terms of (1) data collection, (2) characteristics of the sample, (3) analysis results regarding implementation, and (4) analysis results regarding financial practices.

Data Collection

The survey was administered electronically through a secure website created by Learning Point Associates. Teachers were invited to take the study through e-mail correspondence. The e-mail contained a link to the survey website as well as a unique login ID. This ID was linked to the teachers' group for the study (RCT or non-RCT), allowing the research team to compare the responses between RCT and non-RCT teachers. In addition, the use of the

unique ID ensured that teachers were automatically directed to the appropriate version of the survey[81].

The survey consisted of two main sections: implementation of The Stock Market Game and financial practices. The survey also included demographic items to capture teacher or class characteristics that might relate to implementation, student academic performance, or teachers' perceptions of the effect of the program on their financial practices.

Implementation of The Stock Market Game

The final survey consisted of 47 items that measured implementation regarding three constructs: *activities in the classroom*, *lessons and materials created by The Stock Market Game*, and *connections to outside resources*. There were three different types of implementation items with different response options. First, some items had a yes/no scale to indicate use of practices. Two of these items, related to the use of teams, also included the option "*My students did not play on teams*." Second, some items had the following four-point scale for teachers to indicate frequency of use of materials and practices:

- Almost all of the time
- Regularly, but not all of the time
- Some of the time
- Not at all

Third, some items (most of those pertaining to lessons and materials created by The Stock Market Game) had a five-point scale for teachers to indicate use and rate helpfulness as follows:

- Used and was very helpful
- Used and was moderately helpful
- Used and was minimally helpful
- Used and was not helpful
- Did not use

The survey also included multiple-choice items to capture game-setup logistics, such as access to computers, number of students per team, and weekly frequency of lessons related to The Stock Market Game. For all items regarding implementation, teachers were asked to reflect upon and respond regarding the most recent session of The Stock Market Game they taught.

[81] There were two slightly different versions of the teacher survey. The items regarding implementation and teacher financial practices were identical. However, the survey for the RCT teachers included six additional items that allowed for the research team to verify implementation issues.

FINANCIAL PRACTICES

The survey consisted of 20 financial practices items capturing three constructs of interest: *engaging in financial planning*, *conducting financial research*, and *using investment products and services*. There was one set of response options for these items: a five-point scale for teachers to indicate use of a practice or product and rate the influence of the program on that practice or product. The response options were as follows:

- A major influence
- A moderate influence
- A minimal influence
- Not an influence
- I do not do this.

Characteristics of the Sample

Teachers answered a number of demographic items related to themselves, their students, their session of The Stock Market Game, and their school. Items were selected to capture characteristics that may affect teachers' implementation of the program, their financial practices, and their perceptions of the influence of the program on those practices. Specific items and teachers' responses appear in Tables D1 through D9. The highlighting indicates the most frequent response.

Table D1. When was the most recent session of The Stock Market Game you taught?

	N	Percentage
Fall 2008	2,918	63.3%
Summer 2008	34	0.7%
Winter/Spring 2008	1,450	31.5%
Full year 2007–08	92	2.0%
Fall 2007 or earlier	107	2.3%
I have not taught SMG	6	0.1%
Total	4,607	100%

Table D2. How long was the most recent session of The Stock Market Game that you taught in your class?

	N	Percentage
10 weeks	3,103	70.0%
15 weeks	947	21.4%
A full year	196	4.4%
Other	188	4.2%
Total	4,434	100%

Table D3. In which subject do you teach The Stock Market Game? [Check all that apply]

	N	Percentage
Mathematics	938	22.4%
Business/Economics/Finance, etc.	2,794	66.8%
Social Studies	652	15.6%
General Classroom	286	6.8%
Other (Gifted)	424	10.1%
Other (Misc.)	754	18.0%
Total	4,183	-

Table D4. For the class(es) that you teach The Stock Market Game, what grade(s) are the students in? [Check all that apply]

	N	Percentage
4	323	7.7%
5	728	17.4%
6	637	15.3%
7	654	15.7%
8	767	18.4%
9	599	14.4%
10	972	23.3%
11	1,425	34.1%
12	1,952	46.8%
Total	4,174	-

Table D5. Including this year, how many years have you been a teacher?

	N	Percentage
First year	80	1.9%
2	132	3.2%
3	192	4.6%
4-5	402	9.6%
6-10	902	21.6%
11+	2,469	59.1%
Total	4,177	100%

Table D6. Including this year, how many times have you taught The Stock Market Game?

	N	Percentage
First year	991	23.9%
2–5	1,959	47.3%
6–10	717	17.3%
11+	474	11.4%
Total	4,141	100.0%

Table D7. Were you required to teach The Stock Market Game?

	N	Percentage
Yes	202	4.9%
No	3,960	95.1%
Total	4,162	100.0%

Table D8. In which state do you teach? (Used to calculate region based upon U.S. Census regions)

	N	Percentage
Midwest	970	22.9%
Northeast	1,092	25.8%
South	1,524	36.0%
West	645	15.2%
Total	4,231	100%

Table D9. How would you best characterize your school locale?

	N	Percentage
Rural	1,188	28.4%
Suburban	2,034	48.6%
Urban	956	22.9%

Analysis Results: Implementation

Teachers were asked 47 items about their implementation of The Stock Market Game. Items were analyzed individually to obtain basic descriptive statistics regarding the distribution of responses across response options. The results of the teacher survey for these items are detailed in the tables that follow. Item numbers refer to the numbering of the survey instrument. Percentages are reported for each item regarding all possible response options; teachers were allowed to skip items, so the sample size for each item will vary. Additional analyses were conducted including combining responses or using different denominators (such as looking at the frequency of use of materials for only those teachers who reported using that material)[82].

Reported below are the teacher responses regarding implementation for the following areas: game setup and the three aspects of implementation captured through the constructs: *activities in the classroom*, *lessons and materials created by The Stock Market Game*, and *connections to outside resources*.

GAME SETUP

Teachers were asked about nine elements regarding how they set up the program for their classroom, including logistical issues (such as where students accessed computers) and team assignments (such as whether they assigned specific roles to team members). The results are detailed in Tables D10 through D16.

Table D10. Item 4. In a typical week, how many days did you teach The Stock Market Game?

	N	Percentage
One	2,412	54.5%
Two to three	1,660	37.5%
Four to five	355	8.0%
Total	4,427	100.0%

[82] Results from the additional analyses are included in the body of the report.

Table D11. Item 5. About how many team members were on a typical team in your class?

	N	Percentage
One	169	3.8%
Two	571	12.9%
Three	1,230	27.8%
Four	1,434	32.4%
Five	604	13.7%
Six or more	414	9.4%
Total	4,422	100.0%

Table D12. Item 6. Where did students primarily access the computers they used to play The Stock Market Game?

	N	Percentage
A computer lab	1,991	44.9%
A mobile computer lab	561	12.6%
Permanent computers in the classroom	1,574	35.5%
Other	309	7.0%
Total	4,435	100.0%

Table D13. Item 7. In a typical week, how many days did students have access to computers to select and trade stocks and to monitor their portfolios?

	N	Percentage
One	1,085	24.6%
Two to three	1,334	30.2%
Four to five	1,998	45.2%
Total	4,417	100.0%

Table D14. Item 8. In a typical week, how many days did students use computers to select and trade stocks and to monitor their portfolio?

	N	Percentage
One	1,781	40.4%
Two to three	1,906	43.2%
Four to five	725	16.4%
Total	4,412	100.0%

Table D15. Item 9. On average, how much computer time did you give students during a lesson period for The Stock Market Game to select and trade stocks and to monitor their portfolios?

	N	Percentage
Less than 10 minutes	441	10.0%
10 to 20 minutes	1,750	39.5%
More than 20 minutes	2,241	50.6%
Total	4,432	100.0%

Table D16. Item 10. In the most recent session that you taught The Stock Market Game, did you…

	N	Yes	No
Assign teams yourself (rather than let the students make their own teams)?	4,210	48.8%	51.2%
Assign team member roles (e.g., captain/director or record keeper)?	4,198	24.3%	75.7%
Do team-building activities with your class?	4,200	46.4%	53.6%

ACTIVITIES IN THE CLASSROOM

Teachers were asked to respond to 13 items regarding the use of activities to teach The Stock Market Game, such as teaching specific concepts, developing their own assessments, assigning students grades for program activities, and encouraging or requiring student participation in InvestWrite. The results are detailed in Tables D17 and D18.

Table D17. Item 11. In the most recent session that you taught The Stock Market Game, did you…

	N	Yes	No
a. Develop your own projects for The Stock Market Game?	4,382	56.4%	43.6%
b. Recognize team or individual student achievement in The Stock Market Game (e.g., with certificates or prizes)?	4,384	62.6%	37.4%
c. Play the game on your own before beginning The Stock Market Game with your class?	4,375	21.7%	78.3%
d. Play the game with the students during The Stock Market Game session?	4,376	31.8%	68.2%
h. Encourage students to participate in the InvestWrite program?	4,374	40.0%	60.0%
i. Require students to participate in the InvestWrite program?	4,373	7.9%	92.1%
15. Did you teach your students the concept of a company before they began trading?	4,295	90.9%	9.1%
17. Did you teach your students the concept of a stock before they began trading?	4,276	97.8%	2.2%
19. Did you teach your students the concept of a ticker before they began trading?	4,270	77.5%	22.5%

Table D18. Item 12. In the most recent session that you taught The Stock Market Game, how often did you…

	N	Not at All	Some of the Time	Regularly, but Not All of the Time	Almost All of the Time
b. Create your own assessments?	4,321	23.7%	38.6%	20.8%	16.9%
c. Assign students a grade for The Stock Market Game activities?	4,318	36.1%	20.4%	17.6%	25.9%
d. Post The Stock Market Game team rankings?	4,317	25.5%	20.8%	18.0%	35.7%
e. Post The Stock Market Game–related student work?	4,306	51.8%	26.3%	12.3%	9.7%

Materials Created by The Stock Market Game

Teachers were asked to respond to 14 items regarding the use and helpfulness of resources created by The Stock Market Game for implementing the program, such as lessons, worksheets, publications, and projects. The results are detailed in Tables D19 and D20.

Table D19. Item 12. In the most recent session that you taught The Stock Market Game, how often did you…

	N	Not at All	Some of the Time	Regularly, but Not All of the time	Almost All of the Time
a. Integrate The Stock Market Game publications with lessons?	4,330	12.1%	55.5%	24.1%	8.4%
f. Look through the standards map in The Stock Market Game Teacher Support Center?	4,288	36.6%	40.3%	16.2%	6.9%
g. Use the standards map to align The Stock Market Game lessons with your state standards?	4,310	45.8%	32.0%	14.7%	7.5%

Table D20. In the most recent session that you taught The Stock Market Game, how helpful was…

	N	Did Not Use	Used and Was Not Helpful	Used and Was Minimally Helpful	Used and Was Moderately Helpful	Used and Was Very Helpful
14. The Stock Market Game lesson "What is a Company?"	4,293	44.6%	0.8%	7.0%	24.4%	23.2%
16. The Stock Market Game lesson "What is a Stock?"	4,288	33.4%	0.7%	5.8%	26.9%	33.3%
18. The Stock Market Game lesson "What is a Ticker?"	4,291	57.2%	0.5%	5.5%	15.6%	21.2%
19a. The InvestWrite program?	4,267	79.6%	1.9%	6.2%	6.5%	5.7%
19b. The Stock Market Game–created lessons?	4,264	25.1%	1.1%	11.3%	32.4%	30.0%
19c. Non-core lessons?	4,213	64.8%	1.8%	10.1%	15.6%	7.8%
19d. The Stock Market Game–created worksheets?	4,266	34.4%	1.0%	10.2%	27.8%	26.6%
19e. The Stock Market Game–created projects?	4,263	60.3%	1.1%	8.1%	16.7%	13.7%
19f. The Stock Market Game publications?	4,261	37.0%	1.7%	12.0%	27.4%	21.9%
19g. The Stock Market Game–created assessments?	4,251	62.4%	1.6%	8.0%	15.4%	12.7%
19h. The suggested postgame follow-through?	4,252	76.9%	1.2%	5.2%	9.9%	6.8%

Connections to Outside Resources

Teachers were asked to respond to 10 items regarding the use of practices to connect the game to people and things outside of the classroom, such as connecting the program to current events, discussing careers in the stock market and the financial sector, organizing field trips, and arranging for guest speakers. The results are detailed in Tables D21 and D22.

Table D21. Item 11. In the most recent session that you taught The Stock Market Game, did you…

	N	Yes	No
e. Notify parents of The Stock Market Game use in the classroom?	4,385	61.4%	38.6%
f. Involve parents in the program?	4,377	21.7%	78.3%
g. Use related field trips?	4,378	8.2%	91.8%
j. Utilize industry experts as guest speakers?	4,377	35.3%	64.7%

Table D22. Item 12. In the most recent session that you taught The Stock Market Game, how often did you…

	N	Not at All	Some of the Time	Regularly, but Not All of the Time	Almost All of the Time
h. Take an active role in increasing your own knowledge of investing in the stock market?	4,317	4.9%	26.5%	35.7%	32.9%
i. Attend workshops or webinars about The Stock Market Game?	4,310	54.9%	25.8%	10.6%	8.7%
j. Receive communications from your coordinator (e.g., "Week in Review")?	4,310	6.5%	11.7%	20.8%	61.0%
k. Communicate questions or concerns to your coordinator?	4,288	33.2%	35.8%	16.8%	14.2%
l. Connect The Stock Market Game lessons or concepts to current events?	4,308	2.9%	17.3%	34.0%	45.9%
m. Discuss careers related to the stock market or the financial sector with students?	4,318	9.9%	35.1%	31.9%	23.1%

Analysis Results: Financial Practices

Teachers were asked to respond to 20 items about their financial practices and their perceptions of the influence of The Stock Market Game on those practices. As with the implementation items, financial practices items were analyzed individually to obtain basic descriptive statistics regarding the distribution of responses across response options. The results of the teacher survey for these items are detailed in Tables D23, D24, and D25. Item numbers refer to the numbering of the survey instrument. Percentages are reported for each item regarding all possible response options; teachers were allowed to skip items, so the sample size for each item will vary. Additional analyses were conducted including combining responses or using different denominators (such as looking at the perceptions of

program influence for only the teachers who reported using financial practice)[83]. Following are the teacher responses regarding three aspects of financial practices captured through the constructs: *engaging in financial planning*; *conducting financial research*; and *using investment products and services*.

Engaging in Financial Planning

Teachers were asked to respond to eight items regarding actions they may take to control their finances and prepare for the future, such as setting financial goals, developing a household/personal budget, and establishing a plan to increase savings. The results are reported in Table D23.

Table D23. Item 20. How much influence did The Stock Market Game have on you personally in terms of…

	N	I do not do this.	Not an Influence	A Minimal Influence	A Moderate Influence	A Major Influence
a. Setting financial goals	4,191	10.8%	21.6%	25.1%	30.6%	11.8%
b. Speaking/communicating with a financial advisor about saving and investing goals	4,191	19.4%	24.5%	21.6%	24.3%	10.2%
c. Developing a household/personal budget	4,189	14.5%	34.1%	21.0%	20.5%	9.9%
d. Reviewing personal/household finances more often	4,185	12.0%	29.4%	21.9%	24.4%	12.4%
e. Establishing a plan to increase savings	4,181	11.3%	28.3%	21.5%	24.7%	14.3%
f. Analyzing your risk tolerance in anticipation of saving and investment planning	4,182	12.4%	23.4%	23.6%	26.1%	14.5%
g. Actively managing finances/banking	4,178	11.4%	29.3%	22.4%	24.0%	12.9%
h. Balancing savings and investing accounts/portfolios	4,168	14.0%	29.1%	22.3%	22.8%	11.8%

[83]Results from the additional analyses are included in the body of the report.

Conducting Financial Research

Teachers were asked to respond to four items regarding actions they may take to expand their knowledge about financial planning and products, such as reading business section of the newspaper (online or in print), watching financial shows (TV or Internet), and participating in financial courses or workshops. The results are reported in Table 24.

Table D24. Item 20. How much influence did The Stock Market Game have on you personally in terms of…

	N	I do not do this.	Not an Influence	A Minimal Influence	A Moderate Influence	A Major Influence
i. Reading the business section of newspaper (online or in print)	4,187	8.8%	15.9%	18.7%	28.6%	28.0%
j. Watching financial media (TV/Cable or Internet)	4,177	8.5%	15.4%	19.6%	28.7%	27.9%
k. Subscribing to a financial magazine or Internet site	4,158	37.2%	24.4%	13.6%	12.4%	12.3%
l. Participating in financial course/workshop/seminar	4,171	42.2%	27.1%	12.8%	10.2%	7.7%

Using Investment Products and Services

Teachers were asked to respond to eight items regarding the use of specific products or services teachers may use for their financial planning, such as joining a credit union, opening an investment account, and participating in a pension program. The results are reported in Table D25.

Table D25. Item 20. How much influence did The Stock Market Game have on you personally in terms of…

	N	I do not do this.	Not an Influence	A Minimal Influence	A Moderate Influence	A Major Influence
m. Joining a local credit union	4,160	45.3%	32.6%	8.8%	6.4%	6.9%
n. Opening a 401K/TRS (TDA)/403B	4,142	34.3%	35.5%	10.9%	10.6%	8.7%
o. Opening an IRA account or savings Money Market account	4,155	35.5%	35.5%	11.3%	10.1%	7.6%
p. Opening an investment account (other than a retirement fund) to begin investing	4,166	34.9%	34.3%	12.2%	10.4%	8.2%
q. Participating in a pension program	4,147	30.4%	37.6%	10.9%	10.2%	11.0%
r. Investing in the stock market	4,149	25.8%	30.4%	15.8%	14.9%	13.1%
s. Investigating securities, such as stocks, bonds, mutual funds, and exchange-traded funds	4,159	24.8%	29.2%	17.0%	15.3%	13.7%
t. Opening an online account (e.g., investment, savings and/or checking)	4,171	35.8%	35.0%	10.6%	9.3%	9.4%

Analysis of Variance (ANOVA)

The ANOVAs captured differences in teacher responses based on teacher, classroom, and school characteristics, including *grade level*, *experience teaching*, *experience with the program*, *subject*, *locale*, and *session length*. For example, a teacher new to the program may teach The Stock Market Game differently than one who has been participating for years or a teacher of a business class (e.g., economics) may implement differently than a teacher of a class that was not business focused.

For this analysis, we used the Rasch-derived scale scores[84] (also utilized for the impact analysis). Scales scores were created by combining the items in each construct to create an overall score indicating teachers' implementation level of the three constructs: *activities*, *materials*, and *connections*. In addition, all the items in the survey were combined to create an overall implementation score. The same analysis also was conducted for each of the three financial practices constructs, indicating teachers' overall perceptions of the influence of the program on their financial practices. Each teacher received a scale score for each

[84] See Appendix B for details on the Rasch modeling.

construct (as well as an overall implementation score which utilized all implementation items); the higher the score, the more practices that teacher used or the greater that teacher perceived the influence of The Stock Market Game on financial practices. These scale scores were analyzed using a one-way ANOVA method to detect any significant differences in implementation across teacher groups based on the aforementioned characteristics.

The following sections describe the analysis in terms of (1) categorizing teachers based on teacher, classroom, and school characteristics; (2) creating scale scores; (3) analysis results regarding implementation; and (4) analysis results regarding financial practices.

Categorizing Teachers

We identified six teacher, classroom, and school characteristics that could potentially impact teachers' implementation of the program, use of financial practices, and their perceptions of the impact of the program on those practices:

- Grade level
- Subject (business or nonbusiness)
- Experience teaching (years)
- Experience with the program (number of times they have taught the program)
- Length of The Stock Market Game session
- School locale

All of these characteristics were captured by the teacher survey. Some of the characteristics required combining response options (e.g., years of experience teaching, subject taught), which will be explained in this section of the appendix. The distributions within these characteristics are detailed in the following tables.

GRADE LEVEL

Teachers responded to the item "For the class(es) that you teach The Stock Market Game, what grade(s) are the students in?" Response options included Grades 4–12, and teachers were allowed to select multiple grades. To create categories for the analysis of variance, teachers were recategorized into one of three levels: elementary school (Grades 4–5), middle school (Grades 6–8), or high school (Grades 9–12). Teachers who taught multiple grades across levels were manually categorized into the level representing the majority of their grades. For example, a teacher who selected Grades 8, 9, and 10 would be categorized as teaching "high school" whereas a teacher who selected Grades 6, 7, 8, and 9 would be categorized as teaching "middle school." Teachers who could not be easily categorized (e.g., a teacher who selected Grades 8 and 10) and teachers who did not respond to the item were not included in the grade-level categories. There were 693 teachers (out of 4,691) that were removed for these reasons. The distribution across the three levels is detailed in Table D26.

Table D26. For the class(es) that you teach The Stock Market Game, what grade(s) are the students in?

	N	Percentage
Elementary School (Grades 4–5)	674	16.9%
Middle School (Grades 6–8)	1,103	27.6%
High School (Grades 9–12)	2,221	55.6%

SUBJECT

Teachers responded to the item "In which subject do you teach The Stock Market Game?" Response options included *mathematics*, *finance*, *business*, *economics*, *social studies*, *general classroom*, and *other*. Teachers were allowed to select multiple subjects. To create categories for the analysis of variance, teachers were recategorized as a business teacher or a nonbusiness teacher. Business teachers included those who selected *finance*, *business*, or *economics*, as well as teachers who described a business-type course when they selected *other* (e.g., personal finance or an afterschool activity related to business, such as an entrepreneur club). All other teachers were categorized as nonbusiness. The distribution across the two levels is detailed in Table D27.

Table D27. In which subject do you teach The Stock Market Game?

	N	Percentage
Nonbusiness	2,652	56.5%
Business	2,039	42.4%

EXPERIENCE TEACHING

Teachers responded to the item "Including this year, how many years have you been a teacher?" Response options included *This is my first year teaching*, 2, 3, 4–5, 6–10, and 11+. Teachers were allowed to select one response option. To create categories for the analysis of variance, teachers were recategorized into three groups: 1–2 years, 3–5 years, and 6 years or more. The distribution across the three levels is detailed in Table D28.

Table D28. Including this year, how many years have you been a teacher?

	N	Percentage
1–2 years	212	5.1%
3–5 years	594	14.2%
6 years or more	3,371	80.7%

EXPERIENCE WITH THE PROGRAM

Teachers responded to the item "Including this year, how many times have you taught The Stock Market Game?" Response options included *this is my first year teaching The Stock Market Game*, 2–5, 6–10, and 11+. Teachers were allowed to select one response option. To create categories for the analysis of variance, teachers were recategorized into three

groups: first time teaching The Stock Market Game, 2–5 times, and 6 years or more. The distribution across the three levels is detailed in Table D29.

Table D29. Including this year, how many times have you taught The Stock Market Game?

	N	Percentage
First time	991	23.9%
2–5 times	1,959	47.3%
6 times or more	1,191	28.8%

SESSION LENGTH

Teachers responded to the item "How long was the most recent session of The Stock Market Game that you taught in your class?" Response options included *10 weeks*, *15 weeks*, *a full year*, and *other (please specify)*. Teachers were allowed to select one response option. The responses of teachers who selected *other* were reviewed, and teachers were categorized into the response option that was closest to length of their session. Teachers with session lengths of 12 weeks or fewer were categorized as *10 weeks*; teachers with session lengths of 13 weeks to 18 weeks were categorized as *15 weeks*; teachers with session lengths of 19 weeks or longer were categorized as *a full year*. The distribution across the three levels is detailed in Table D30.

Table D30. How long was the most recent session of The Stock Market Game that you taught in your class?

	N	Percentage
10 weeks	2,974	73.2%
15 weeks	888	21.9%
Full year	200	4.9%

LOCALE

Teachers responded to the item "How would you best characterize your school locale?" Response options included *rural*, *suburban*, and *urban*. Teachers were allowed to select one response option. The distribution across the three levels is detailed in Table D31.

Table D31. How would you best characterize your school locale?

	N	Percentage
Rural	1,188	28.4%
Suburban	2,034	48.6%
Urban	956	22.9%

Scale Scores

The means of the scale scores by teacher, classroom, and school characteristics are detailed in Tables D32 and D33.

Table D32. Implementation

		Activities in the Classroom		Materials Created by The Stock Market Game		Connections to Outside Resources		Overall Implementation	
	N	M	SD	M	SD	M	SD	M	SD
Grade Level									
Elementary (Grades 4–5)	674	46.98	11.37	52.17	19.08	52.07	11.37	50.88	9.21
Middle (Grades 6–8)	1,104	47.90	13.20	47.36	20.06	50.23	11.81	49.38	10.23
High (Grades 9–12)	222	51.51	12.23	46.89	20.88	49.81	11.36	50.20	9.79
Locale									
Rural	1,234	49.37	12.80	49.24	20.59	50.47	12.40	50.24	10.20
Suburban	2,021	48.92	12.45	45.96	19.98	50.10	10.93	49.33	9.43
Urban	937	51.52	12.52	50.46	20.82	50.89	11.83	51.48	10.14
Experience Teaching (Years)									
1–2	211	48.72	11.00	47.89	19.51	49.19	10.22	49.36	8.71
3–5	594	50.50	12.13	48.12	20.11	49.83	11.09	50.20	9.39
6 or more	9,971	49.55	12.79	47.89	20.58	50.55	11.70	50.10	10.00
Experience With Program (Times Teaching)									
First time teaching the game	991	46.39	12.72	49.46	19.88	48.89	11.25	48.96	9.62
2–5	1,959	49.72	12.66	48.51	20.32	50.38	11.42	50.26	9.90
6 or more	1,191	52.16	11.83	45.50	20.94	51.67	11.92	50.67	9.90
Subject									
Nonbusiness	2,144	47.21	13.03	48.46	20.28	50.34	11.87	49.49	10.08
Business	2,039	52.17	11.65	47.34	20.62	50.44	11.22	50.69	9.57
Session Length									
10 week	3,114	49.06	12.44	46.99	20.24	50.18	11.74	49.56	9.79
15 week	939	52.16	11.72	51.25	20.02	51.27	11.12	52.04	9.40
Full year	209	47.78	15.40	48.61	20.80	50.19	11.45	49.79	10.53

Table D33. Financial Practices

		Engaging in Financial Planning		Conducting Financial Research		Using Investment Products/ Services	
	N	M	SD	M	SD	M	SD
Grade Level							
Elementary (Grades 4–5)	622	49.90	9.72	50.04	9.79	50.04	10.02
Middle (Grades 6–8)	1,023	49.25	9.81	49.96	10.04	49.57	9.82
High (Grades 9–12)	2,106	50.39	10.13	50.03	10.02	50.19	10.06
Locale							
Rural	1,158	50.93	9.69	50.53	9.88	50.95	9.72
Suburban	1,895	48.89	9.98	49.54	9.95	48.96	9.94
Urban	872	51.20	10.23	50.29	10.16	50.96	10.20
Experience Teaching (Years)							
1–2	197	49.86	9.79	47.77	9.76	49.82	9.58
3–5	556	49.53	9.89	49.28	9.64	49.47	9.69
6 or more	3,162	50.12	10.04	50.26	10.04	50.11	10.06
Experience With Program (Times Teaching)							
First time teaching the game	907	50.03	9.85	48.65	9.91	49.54	9.88
2–5	1,856	49.72	9.80	49.63	9.86	49.62	9.76
6 or more	1,123	50.43	10.37	51.69	10.01	50.88	10.32
Subject							
Nonbusiness	1,975	49.50	9.78	49.80	9.89	49.74	9.86
Business	1,949	50.50	10.20	50.22	10.09	50.23	10.11
Session Length							
10 week	2,828	49.06	10.01	49.75	10.03	49.45	9.92
15 week	839	50.65	9.85	50.67	9.86	50.48	10.07
Full year	184	51.17	10.27	51.35	9.75	51.74	10.29

Analysis Results: Implementation

Using a one-way ANOVA method, teacher scale scores were analyzed to detect differences in implementation across groups based on teacher, classroom, and school characteristics. Significant findings (those with a *p* value of .05 or less) are reported in the body of the report. The full findings are detailed in Tables D34, D35, D36, D37, D38, and D39, which are organized by characteristics.

Table D34. Grade Level

Construct	Factor	Comparison Group	Tukey's HSD Mean Difference	Sig.
Overall Implementation	Elementary (Grades 4–5)	Middle	1.50	.005
		High	.69	.252
	Middle (Grades 6–8)	Elementary	-1.50	.005
		High	-.82	.061
	High (Grades 9–12)	Elementary	-.69	.252
		Middle	.82	.061
Activities in the Classroom	Elementary (Grades 4–5)	Middle	-.92	.283
		High	-4.53	<.001
	Middle (Grades 6–8)	Elementary	.92	.283
		High	-3.61	<.001
	High (Grades 9–12)	Elementary	4.53	<.001
		Middle	3.61	<.001
Materials Created by The Stock Market Game	Elementary (Grades 4–5)	Middle	4.81	<.001
		High	5.28	<.001
	Middle (Grades 6–8)	Elementary	-4.81	<.001
		High	.47	.808
	High (Grades 9–12)	Elementary	-5.28	<.001
		Middle	-.47	.808
Connections to Outside Resources	Elementary (Grades 4–5)	Middle	1.83	.003
		High	2.25	<.001
	Middle (Grades 6–8)	Elementary	-1.83	.003
		High	.42	.586
	High (Grades 9–12)	Elementary	-2.25	<.001
		Middle	-.42	.586

Table D35. Experience Teaching (Years)

Construct	Factor	Comparison Group	Tukey's HSD Mean Difference	Sig.
Overall Implementation	1–2	3–5	-.847	.532
		6 or more	-.743	.537
	3–5	1–2	.847	.532
		6 or more	.103	.970
	6 or more	1–2	.743	.537
		3-5	-.103	.970
Activities in the Classroom	1–2	3–5	-1.778	.184
		6 or more	-.830	.623
	3–5	1–2	1.778	.184
		6 or more	.948	.209
	6 or more	1–2	.830	.623
		3–5	-.948	.209
Materials Created by The Stock Market Game	1–2	3–5	-.231	.989
		6 or more	-.005	1.000
	3–5	1–2	.231	.989
		6 or more	.226	.967
	6 or more	1–2	.005	1.000
		3–5	-.226	.967
Connections to Outside Resources	1–2	3–5	-.643	.766
		6 or more	-1.366	.218
	3–5	1–2	.643	.766
		6 or more	-.723	.337
	6 or more	1–2	1.366	.218
		3–5	.723	.337

Table D36. Experience With the Program (Times Teaching the Game)

Construct	Factor	Comparison Group	Tukey's HSD Mean Difference	Sig.
Overall Implementation	First time	2–5	-1.294	.002
		6 or more	-1.705	<.001
	2–5	First time	1.294	.002
		6 or more	-.411	.490
	6 or more	First time	1.705	<.001
		2–5	.411	.490
Activities in the Classroom	First time	2–5	-3.329	<.001
		6 or more	-5.768	<.001
	2–5	First time	3.329	<.001
		6 or more	-2.439	<.001
	6 or more	First time	5.768	<.001
		2–5	2.439	<.001
Materials Created by The Stock Market Game	First time	2–5	.951	.456
		6 or more	3.958	<.001
	2–5	First time	-.951	.456
		6 or more	3.007	<.001
	6 or more	First time	-3.958	<.001
		2–5	-3.007	<.001
Connections to Outside Resources	First time	2–5	-1.495	.003
		6 or more	-2.788	<.001
	2–5	First time	1.495	.003
		6 or more	-1.292	.007
	6 or more	First time	2.788	<.001
		2–5	1.292	.007

Table D37. Subject (Business or Nonbusiness)

Construct	*F*	Sig.	df between groups	df within groups
Overall Implementation	20.847	<.001	1	4,391
Activities in the Classroom	171.396	<.001	1	4,391
Materials Created by The Stock Market Game	2.594	.107	1	4,335
Connections to Outside Resources	.859	.354	1	4,390

Table D38. Session Length

Construct	Factor	Comparison Group	Tukey's HSD Mean Difference	Sig.
Overall Implementation	10 weeks	15 weeks	-2.477	<.001
		Full year	-0.233	.940
	15 weeks	10 weeks	2.477	<.001
		Full year	2.244	.007
	Full year	10 weeks	.233	.940
		15 weeks	-2.244	.007
Activities in the Classroom	10 weeks	15 weeks	-3.103	<.001
		Full year	1.278	.322
	15 weeks	10 weeks	3.103	<.001
		Full year	4.381	<.001
	Full year	10 weeks	-1.278	.322
		15 weeks	-4.380	<.001
Materials Created by The Stock Market Game	10 weeks	15 weeks	-4.277	<.001
		Full year	-1.626	.500
	15 weeks	10 weeks	4.268	<.001
		Full year	2.641	.205
	Full year	10 weeks	1.626	.500
		15 weeks	-2.641	.205
Connections to Outside Resources	10 weeks	15 weeks	-1.083	.032
		Full year	-.007	1.000
	15 weeks	10 weeks	1.083	.032
		Full year	1.076	.447
	Full year	10 weeks	.007	1.000
		15 weeks	-1.076	.447

Table D39. Locale

Construct	Factor	Comparison Group	Tukey's HSD Mean Difference	Sig.
Overall Implementation	Rural	Suburban	.905	.029
		Urban	-1.242	.010
	Suburban	Rural	-.905	.029
		Urban	-2.146	<.001
	Urban	Rural	1.242	.010
		Suburban	2.146	<.001
Activities in the Classroom	Rural	Suburban	.447	.587
		Urban	-2.152	<.001
	Suburban	Rural	-.447	.587
		Urban	-2.600	<.001
	Urban	Rural	2.152	<.001
		Suburban	2.600	<.001
Materials Created by The Stock Market Game	Rural	Suburban	3.277	<.001
		Urban	-1.219	.351
	Suburban	Rural	-3.277	<.001
		Urban	-4.500	<.001
	Urban	Rural	1.219	.351
		Suburban	4.500	<.001
Connections to Outside Resources	Rural	Suburban	.378	.638
		Urban	-.419	.681
	Suburban	Rural	-.378	.638
		Urban	-.800	.190
	Urban	Rural	.419	.681
		Suburban	.800	.190

Analysis Results: Financial Practices

Using a one-way ANOVA method, teacher scale scores were analyzed to detect differences in teachers' perceptions of program influence on financial practices across groups based on teacher, classroom, and school characteristics. Significant findings (those with a *p* value of .05 or less) are reported in the body of the report. The full findings are detailed in Tables D40, D41, D42, D43, D44, and D45, which are organized by characteristics.

Table D40. Grade Level

Construct	Factor	Comparison Group	Tukey's HSD mean difference	Sig.
Engaging in Financial Planning	Elementary (Grades 4–5)	Middle	.654	.401
		High	-.492	.527
	Middle (Grades 6–8)	Elementary	-.654	.401
		High	-1.146	.007
	High (Grades 9–12)	Elementary	.492	.527
		Middle	1.146	.007
Conducting Financial Research	Elementary (Grades 4–5)	Middle	.082	.986
		High	.013	1.000
	Middle (Grades 6–8)	Elementary	-.082	.986
		High	-.069	.982
	High (Grades 9–12)	Elementary	-.013	1.000
		Middle	.069	.982
Using Investment Products/ Services	Elementary (Grades 4–5)	Middle	.476	.644
		High	-.146	.949
	Middle (Grades 6–8)	Elementary	-.476	.644
		High	-.622	.260
	High (Grades 9–12)	Elementary	.146	.949
		Middle	.622	.260

Table D41. Experience Teaching (Years)

Construct	Factor	Comparison Group	Tukey's HSD Mean Difference	Sig.
Engaging in Financial Planning	1–2	3–5	.329	.917
		6 or more	-.267	.930
	3–5	1–2	-.329	.917
		6 or more	-.596	.398
	6 or more	1–2	.267	.930
		3–5	.596	.398
Conducting Financial Research	1–2	3–5	-1.505	.170
		6 or more	-2.493	.002
	3–5	1–2	1.505	.170
		6 or more	-.988	.079
	6 or more	1–2	2.493	.002
		3–5	.988	.079
Using Investment Products/Services	1–2	3–5	.350	.917
		6 or more	-.294	.926
	3–5	1–2	-.350	.917
		6 or more	-.644	.373
	6 or more	1–2	.294	.926
		3–5	.644	.373

Table D42. Experience With the Program (Times Teaching the Game)

Construct	Factor	Comparison Group	Tukey's HSD Mean Difference	Sig.
Engaging in Financial Planning	First time	2–5	.308	.727
		6 or more	-.409	.629
	2–5	First time	-.308	.727
		6 or more	-.717	.139
	6 or more	First time	.409	.629
		2–5	.717	.139
Conducting Financial Research	First time	2–5	-.979	.040
		6 or more	-.3044	<.001
	2–5	First time	.979	.040
		6 or more	-2.065	<.001
	6 or more	First time	3.044	<.001
		2–5	2.065	<.001
Using Investment Products/Services	First time	2–5	-.084	.979
		6 or more	-1.347	.010
	2–5	First time	.084	.979
		6 or more	-1.263	.003
	6 or more	First time	1.347	.010
		2–5	1.263	.003

Table D43. Subject (Business or Nonbusiness)

Construct	*F*	Sig.	df Between Groups	df Within Groups
Engaging in Financial Planning	9.827	.002	1	3954
Conducting Financial Research	1.748	.186	1	3977
Using Investment Products/Services	2.121	.145	1	3647

Table D44. Session Length

Construct	Factor	Comparison Group	Tukey's HSD Mean Difference	Sig.
Engaging in Financial Planning	10 weeks	15 weeks	-.930	.047
		Full year	-1.453	.135
	15 weeks	10 weeks	.930	.047
		Full year	-0.523	.796
	Full year	10 weeks	1.453	.135
		15 weeks	.523	.796
Conducting Financial Research	10 weeks	15 weeks	-.889	.060
		Full year	-1.559	.100
	15 weeks	10 weeks	.889	.060
		Full year	.671	.687
	Full year	10 weeks	1.559	.100
		15 weeks	.671	.687
Using Investment Products/Services	10 weeks	15 weeks	-.725	.174
		Full year	-1.991	.032
	15 weeks	10 weeks	.725	.174
		Full year	-1.265	.293
	Full year	10 weeks	1.991	.032
		15 weeks	1.265	.293

Table D45. Locale

Construct	Factor	Comparison Group	Tukey's HSD Mean Difference	Sig.
Engaging in Financial Planning	Rural	Suburban	2.042	<.001
		Urban	-.263	.826
	Suburban	Rural	-2.042	<.001
		Urban	-2.305	<.001
	Urban	Rural	.263	.826
		Suburban	2.305	<.001
Conducting Financial Research	Rural	Suburban	.991	.021
		Urban	.236	.858
	Suburban	Rural	-.991	.021
		Urban	-.755	.152
	Urban	Rural	-.236	.858
		Suburban	.755	.152
Using Investment Products/Services	Rural	Suburban	1.983	<.001
		Urban	-.018	.999
	Suburban	Rural	-1.983	<.001
		Urban	-2.001	<.001
	Urban	Rural	.018	.999
		Suburban	2.001	<.001

APPENDIX E.
STUDENT SURVEY ANALYSIS

Appendix E describes our approaches to analyzing the student survey for The Stock Market Game. Analysis included two methods: (1) item-level descriptions of students' responses and (2) analysis of variance (ANOVA) in students' responses using Rasch-derived scale scores. The analyses were designed to measure students' experience of The Stock Market Game in terms of their engagement with the game, interactions with others, development of financial life skills, and applying or thinking about their learning from the game beyond the classroom.

Item-Level Analysis

The item-level analysis was intended to capture an overall picture of student experience while playing The Stock Market Game. This picture was formed through a student survey offered to all students in the RCT treatment group who played The Stock Market Game during the fall 2008 game sessions.

The student surveys consisted of 26 items that measured student experience captured in terms of four constructs: student engagement with the game, student interactions with others, student financial life skills, and students extending the game beyond the classroom. A four point agreement scale was used on both surveys, with slightly different wording for younger and older students. Items related to teamwork used the agreement scale as well as an option to indicate that students did not play on a team ("I did not play on a team").

Response options for students in Grades 4–6 were as follows:

- Really agree
- Agree
- Disagree
- Really disagree

Response options for students in Grades 7–10 were as follows:

- Strongly agree
- Agree
- Disagree
- Strongly disagree

The following sections describe the item-level analysis in terms of: (1) data collection, (2) characteristics of sample, and (3) analysis results regarding student experience.

Data Collection

The survey was administered electronically through a secure website created by Learning Point Associates. All students in The Stock Market Game treatment group were asked to participate at the end of the fall 2008 game sessions. To appropriately address students at different developmental and intellectual stages, two versions of the survey were developed: one for younger students (Grades 4–6) and one for older students (Grades 7–10).

The teachers participating in the RCT were e-mailed to ask their students to take the survey and were provided with a Web link to the survey. Once at the site, students entered a unique student ID assigned by Learning Point Associates. Students entered their grade and then were directed to the appropriate version of the survey. The survey also included demographic items to capture student or class characteristics.

Table E1 shows the total number of students surveys collected and the number of valid student surveys used in the analyses. Student surveys that were started but were missing almost all student responses were removed from the analysis. In addition, students who indicated they were in Grades 11 and 12 also were removed from the analysis.

Table E1. Student Survey Responses

All Students	Younger Students (Grades 4–6)	Older Students (Grades 7–10)	Total
Collected student surveys	1,332	1,779	3,111
Removed student surveys	16	366	382
Student surveys included in analysis	1,316	1,413	2,729

Characteristics of the Sample

Students answered several demographic items about themselves and the classroom setting where they played The Stock Market Game. Students first selected their grade from a drop-down menu, which then branched to the age-appropriate version of the survey. Table E2 shows the student response rate for each individual grade.

Table E2. Grade

Grade	Younger Students (Grades 4–6)		Older Students (Grades 7–10)		Total	
	N	%	*N*	%	*N*	%
Grade 4	234	17.8	-	-	234	8.6
Grade 5	653	49.6	-	-	653	23.9
Grade 6	429	32.6	-	-	429	15.7
Grade 7	-	-	473	33.5	473	17.3
Grade 8	-	-	492	34.8	492	18.0
Grade 9	-	-	211	14.9	211	7.7
Grade 10	-	-	237	16.8	237	8.7
Total	1,316		1,413		2,729	

After completing the survey, students were asked to respond to the question "Did you play The Stock Market Game on a team?" Table E3 shows the results for the student responses related to whether they played on a team or played the game alone.

Table E3. Played The Stock Market Game on a Team

Played on team	Younger Students (Grades 4–6)		Older Students (Grades 7–10)		Total	
	N	%	*N*	%	*N*	%
Played the game with a team	1,240	94.7	1,317	93.4	2,557	94.0
Played the game alone	69	5.3	93	6.6	162	6.0
Total	1,309		1,410		2,719	

For the characteristic of gender, younger students were asked the question "Are you a boy or a girl?" and older students were asked "What is your gender?" Table E4 shows the distribution of gender on each survey.

Table E4. Gender

Gender	Younger Students (Grades 4–6)		Older Students (Grades 7–10)		Total	
	N	%	*N*	%	*N*	%
Male	656	50.2	749	53.2	1,405	51.8
Female	651	49.8	658	46.8	1,309	48.2
Total	1,307		1,407		2,714	

In order to ascertain whether students had played The Stock Market Game prior to the time of the study, a question was presented on the survey. The younger students were asked "Is this the first teacher you have played The Stock Market Game with?" and the older students were asked "Is this the first class in which you have played The Stock Market Game?" Table E5 shows the distribution of responses.

Table E5. First Time Playing The Stock Market Game

First Time Playing the Game	Younger Students (Grades 4–6)		Older Students (Grades 7–10)		Total	
	N	%	*N*	%	*N*	%
First time playing The Stock Market Game	1,188	91.2	1,267	90.2	2,455	90.7
Played The Stock Market Game before	115	8.8	138	9.8	253	9.3
Total	1,303		1,405		2,708	

The older students also were asked the question "In which class did you play The Stock Market Game?" and they could check all responses that applied. Students also could select the option of *Other, please specify*, in which they could write in the name of a class that was not already presented as an option. Within the *Other* category, the most frequently selected subjects were *Gifted*, *Computers/Technology*, and *Afterschool/Club*. The remaining *Other* responses are labeled as *Misc.* (Miscellaneous). Table E6 shows the distribution of student responses across all subject areas. Note that because students could select more than one response, the percentages do not equal 100.

Table E6. Class Where Students Played The Stock Market Game

	Older Students (Grades 7–10)	
Subject	*N*	%
Finance/Business/Economics	129	22.3
Mathematics	41	7.1
Social Studies	24	4.1
Other (Gifted)	162	28.0
Other (Computers/Technology)	160	27.7
Other (Afterschool/Club)	32	5.5
Other (Misc.)	102	17.6
Total	578	

The survey for older students also solicited a response about whether the students liked the class in which they played The Stock Market Game a lot or a little. This question was not included on the survey for the younger students, as noted in Table E7.

Table E7. Liked the Class

Liked Class	Older Students (Grades 7–10)	
	N	%
Liked class a lot	765	54.4
Liked class a little	641	45.6
Total	1,406	

To determine the school locale, students were matched to the original school information provided during the teacher sign-up process, based on teacher ID. Response options included rural, suburban, and urban. Table E8 shows the student locale distribution.

Table E8. Locale

Locale	Younger Students (Grades 4–6)		Older Students (Grades 7–10)		Total	
	N	%	*N*	%	*N*	%
Rural	222	16.9	326	23.1	548	20.1
Suburban	682	51.8	712	50.4	1,394	51.1
Urban	412	31.3	375	26.5	787	28.8
Total	1,316		1,413		2,729	

Students were also matched to the original school information from the teacher sign-up process to determine region. Based on the school address and state, four regions of the United States were determined: Northeast, Midwest, South, and West. Table E9 shows the regional distribution of students' schools.

Table E9. Region

Region	Younger Students (Grades 4–6)		Older Students (Grades 7–10)		Total	
	N	%	*N*	%	*N*	%
Northeast	295	22.4	293	20.7	588	21.5
Midwest	152	11.6	458	32.4	610	22.3
South	640	48.6	517	36.6	1,157	42.4
West	229	17.4	145	10.3	374	13.7
Total	1,316		1,413		2,729	

Analysis Results: Item-Level Responses

Survey items were analyzed individually to obtain basic descriptive statistics regarding the distribution of responses across response options. The results of the student survey for these items are detailed in the main body of the report. Percentages are reported for each item regarding all possible response options. Students were able to skip items, so the sample size for each item varied.

Analysis of Variance (ANOVA)

The ANOVA was intended to capture differences in student responses based on student and school characteristics, including gender, grade level, school locale, first time playing the game, playing on a team, and whether they liked the class. For example, a student who was playing The Stock Market Game for the first time could experience it differently than one who had played the game before.

For this analysis, we used Rasch-derived scale scores[85] (also utilized for the impact analysis). Each student received a scale score for each construct; the higher the score, the higher the level of agreement the student had with the activities and behaviors represented by that construct. These scale scores were analyzed using a one-way ANOVA method to detect any significant differences in implementation across student groups based on the aforementioned characteristics.

The following sections describe the analysis of variance in terms of: (1) categorizing students based on characteristics, (2) scale score means, and (3) analysis results regarding student experience.

Categorizing Students

We collected data on six student and school characteristics: gender; grade level; school locale; whether it was their first time playing the game; whether they played on a team; and for the older students, whether they liked the class a lot or a little. All of these characteristics were captured in the student survey, with the exception of school locale. The distributions within these characteristics are detailed in Tables E11, E12, E13, and E14.

Grade Level. Grade level required combining response options to represent a range of students within each survey. To create categories for the ANOVA, students were recategorized into one of four levels: elementary (Grades 4–5), lower middle (Grade 6), upper middle (Grades 7–8), or high school (Grades 9–10). The distribution across the four grade levels is detailed in Table E10.

[85] See Appendix B for details on the Rasch modeling.

Table E10. Grade Level

Grade Level	Younger Students (Grades 4–6)		Older Students (Grades 7–10)		Total	
	N	%	*N*	%	*N*	%
Elementary (Grades 4–5)	887	67.4	-	-	887	32.5
Lower middle (Grades 6)	429	32.6	-	-	429	15.7
Upper middle (Grades 7–8)	-	-	965	68.3	965	35.4
High school (Grades 9–10)	-	-	448	31.7	448	16.4
Total	1,316		1,413		2,729	

Scale Score Means

The scale score means tables present the number of responses (*N*), means (M), and the standard deviations (SD) for each student group for both surveys. All student survey constructs were developed to have an overall mean of 50 and a standard deviation of 10. The means and standard deviations of each group are close to this mean. Information for each group is detailed in Table E11 and Table E12, organized by construct and student factor.

Table E11. Scale Score Means for Younger Student Surveys (Grades 4-6)

	N	Engagement With the Game		Interactions With Others		Beyond the Classroom	
		M	SD	M	SD	M	SD
Gender							
Male	656	50.86	10.52	49.90	9.94	49.99	10.51
Female	651	49.08	9.44	50.15	10.05	49.96	9.57
Grade level							
Elementary (Grades 4–5)	887	50.33	9.94	50.66	10.02	50.75	9.84
Lower middle (Grade 6)	429	49.24	10.16	48.71	9.80	48.39	10.20
Locale							
Rural	222	49.64	12.18	50.59	10.66	50.84	11.32
Suburban	682	50.07	9.78	49.74	9.79	49.64	9.42
Urban	412	50.00	9.13	50.17	9.95	50.08	10.23
First time playing the game							
First time playing the game	1,188	49.75	9.86	49.97	9.99	49.73	9.90
Played the game before	115	52.47	11.51	50.83	10.10	52.66	11.08
Played on a team							
Played the game on a team	1,240	50.17	9.90	50.35	9.69	50.02	10.01
Played the game alone	69	46.38	11.54	44.17	13.03	49.16	10.53

The student designed for the younger students did not contain enough items to capture a measurement of financial life skills at the construct level. Since the ANOVA analyses are based upon the construct scale scores, no differences between groups were determined for the younger students.

Table E12. Scale Score Means for Older Student Surveys (Grades 7–10)

		Engagement With the Game		Interactions With Others		Beyond the Classroom		Financial Life Skills	
	N	M	SD	M	SD	M	SD	M	SD
Gender									
Male	749	51.48	10.09	49.96	10.27	50.62	10.47	51.20	10.28
Female	658	48.55	9.33	50.60	9.69	49.09	9.48	49.03	9.46
Grade level									
Upper middle (Grades 7–8)	965	50.20	9.15	50.58	9.70	50.16	9.73	50.27	9.45
High school (Grades 9–10)	448	49.88	11.33	49.62	10.64	49.39	10.72	49.97	11.06
Locale									
Rural	326	50.95	12.22	50.56	11.34	50.85	10.94	50.54	12.05
Suburban	712	49.96	8.76	49.89	9.28	49.81	9.78	49.76	9.53
Urban	375	49.63	9.66	50.76	10.11	49.30	9.75	50.65	8.78
First time playing the game									
First time playing the game	1,267	50.12	9.98	50.31	10.11	49.97	10.00	50.23	10.00
Played the game before	138	49.84	9.34	49.84	9.15	49.35	10.80	49.51	9.99
Played on a team									
Played the game on a team	1,317	50.26	9.61	50.48	10.09	49.94	10.00	50.27	9.91
Played the game alone	93	47.82	13.12	47.28	8.38	49.50	11.11	48.74	11.14
Liked the class									
Liked class a lot	765	53.32	9.37	53.13	9.68	52.48	9.96	52.88	9.33
Liked class a little	641	46.33	9.14	46.95	9.31	46.94	9.29	47.01	9.79

Analysis Results: ANOVA Tables

Using a one-way ANOVA method, we analyzed the student scale scores to detect differences in implementation across groups based on student-level characteristics. The ANOVA results tables show the *F*-test statistic (*F*), the significance level (sig.) comparing the student groups, and the degrees of freedom (df) for between groups and within groups. The findings are detailed in Table E13 and Table E14, which are organized by construct and student factor.

Table E13. ANOVA Results for Younger Student Surveys (Grades 4–6)

Construct	Factor	*F*	Sig.	df Between Groups	df Within Groups
Engagement With the Game	Gender	10.28	.001	1	1,305
	Grade level	3.40	.066	1	1,314
	Locale	0.15	.860	2	1,313
	First time playing the game	7.74	.005	1	1,301
	Played the game on a team	9.40	.002	1	1,307
Interactions With Others	Gender	0.20	.656	1	1,305
	Grade level	11.10	.001	1	1,314
	Locale	0.67	.514	2	1,313
	First time playing the game	0.77	.380	1	1,301
	Played the game on a team	25.51	<.001	1	1,307
Beyond the Classroom	Gender	0.00	.969	1	1,305
	Grade level	16.34	<.001	1	1,314
	Locale	1.23	.292	2	1,313
	First time playing the game	8.98	.003	1	1,301
	Played the game on a team	0.48	.489	1	1,307

Table E14. ANOVA Results for Older Student Surveys (Grades 7–10)

Construct	Factor	*F*	Sig.	df Between Groups	df Within Groups
Engagement With the Game	Gender	31.74	<.001	1	1,405
	Grade level	0.33	.563	1	1,411
	Locale	1.69	.185	2	1,410
	First time playing the game	0.10	.751	1	1,403
	Played the game on a team	5.30	.021	1	1,408
	Liked the class	198.77	<.001	1	1,404
Interactions With Others	Gender	1.46	.228	1	1,405
	Grade level	2.86	.091	1	1,411
	Locale	1.09	.336	2	1,410
	First time playing the game	0.27	.606	1	1,403
	Played the game on a team	8.94	.003	1	1,408
	Liked the class	147.15	<.001	1	1,404
Beyond the Classroom	Gender	8.18	.004	1	1,405
	Grade level	1.78	.183	1	1,411
	Locale	2.15	.117	2	1,410
	First time playing the game	0.47	.491	1	1,403
	Played the game on a team	0.17	.684	1	1,408
	Liked the class	114.52	<.001	1	1,404
Financial Life Skills	Gender	16.81	<.001	1	1,405
	Grade level	0.27	.603	1	1,411
	Locale	1.26	.283	2	1,410
	First time playing the game	0.65	.421	1	1,403
	Played the game on a team	2.04	.154	1	1,408
	Liked the class	132.20	<.001	1	1,404

APPENDIX F. ANALYSIS OF THE RELATIONSHIP BETWEEN TEACHER IMPLEMENTATION AND STUDENT EXPERIENCE

Appendix F describes our approaches to analyzing the relationship between teacher implementation and student experience of The Stock Market Game. Using a mixed-model analysis, scale scores from the teacher surveys were modeled with scale scores from the student surveys to determine if there was a significant relationship among any of the constructs.

Analytic Approach

The following sections describe the analysis in terms of (1) characteristics of the sample, (2) the models fit, and (3) results.

Characteristics of the Sample

Only teachers and students who were in the treatment group of the RCT study were used for this analysis. Only classrooms that submitted both teacher and students surveys were used in the analysis. Classrooms that submitted only a teacher survey or only student surveys were not used. This approach allowed us to nest student survey responses within the appropriate classroom.

Some teachers had students in multiple grades and, therefore, had both younger and older student surveys completed in their classrooms. For those teachers with multiple grades, the teacher survey data were used to model the responses of both the younger and older students. Table F1 shows the total number of teacher and student surveys used in the analyses.

Table F1. Teacher and Student Survey Data for Mixed-Model Analysis

All Surveys	Teacher Surveys (Treatment)	Younger Student Surveys (Grades 4–6)	Older Student Surveys (Grades 7–10)	Total Student Surveys
Valid surveys available for analysis	222	1,316	1,413	2,729
Surveys with no matching data	49	59	51	110
Surveys included in mixed-model analysis	**173**	**1,257**	**1,362**	**2,619**

Models

The results from the teacher-level surveys were matched with the student-level surveys, and multiple mixed-model analyses were performed to determine if there was a significant relationship between teacher implementation of The Stock Market Game and student experience.

Given the nested structure of the data (students are nested within classrooms), a mixed-model analysis was used to match the students with their teacher. This method provides a more accurate measure of the contribution of each of the teacher implementation scale scores in accounting for the variability in student scale scores than multiple linear regressions.

Student survey scale scores were used as the outcome measures with teacher survey scale scores as the predictors. Each student scale score was fit first with the overall implementation score, and a separate model was tested with the three other (subconstruct) teacher scale scores. For the first three scales scores listed in Table F2, there were two models first: one for the younger students' survey data and one for the older students' survey data.

Table F2. Scale Scores Used in the Analysis

Student Scale	Teacher Scale
Engagement with the game	Overall implementation
Interactions with others	The Stock Market Game lessons and materials
Beyond the classroom	Using The Stock Market Game in the classroom
Financial life skills (older students only)	Linking The Stock Market Game to outside resources

The general form of this model was as follows:

Level 1:

$$Student\_Scale_{ij} = \beta_{0j} + r_{ij}$$

Level 2:

$$\beta_{0j} = \gamma_{00} + \gamma_{01}(Teacher\_Scale_j) + u_{0j}$$

Analysis Results

The mixed-model tables show the test statistic *t* (for the coefficient), the significance level (sig.), the intercept, the coefficient value, standard error (S.E.), and degrees of freedom (df) associated with modeling the student and teacher scale scores.

The findings for the younger and older student surveys are detailed in Table F3 and Table F4, which are organized by student experience constructs and teacher predictor constructs.

Table F3. Results for Younger Student Surveys (Grades 4–6)

Student Construct	Teacher Predictor	Intercept	Coefficient	S.E.	DF	*t*	Sig.
Engagement With the Game	Overall implementation	46.53	0.07	0.05	82	1.48	0.143
	The Stock Market Game lessons and materials	45.41	-0.06	0.04	79	-1.79	0.078
	Using The Stock Market Game in the classroom	45.41	0.11	0.05	79	2.10	0.039
	Linking The Stock Market Game to outside resources	45.41	0.06	0.05	79	1.22	0.228
Interactions With Others	Overall implementation	49.91	0.01	0.05	82	0.14	0.891
	The Stock Market Game lessons and materials	48.28	-0.05	0.03	79	-1.48	0.143
	Using The Stock Market Game in the classroom	48.28	0.10	0.05	79	1.95	0.055
	Linking The Stock Market Game to outside resources	48.28	0.00	0.04	79	0.01	0.996
Beyond the Classroom	Overall implementation	43.82	0.13	0.05	82	2.76	0.007
	The Stock Market Game lessons and materials	43.14	-0.04	0.03	79	-1.26	0.211
	Using The Stock Market Game in the classroom	43.14	0.12	0.05	79	2.64	0.010
	Linking The Stock Market Game to outside resources	43.14	0.06	0.04	79	1.45	0.150

Table F4. Results for Older Student Surveys (Grades 7–10)

Student Construct	Teacher Predictor	Constant	Coefficient	S.E.	DF	*t*	Sig.
Engagement With the Game	Overall implementation	46.96	0.06	0.05	95	1.29	0.202
	The Stock Market Game lessons and materials	45.70	-0.02	0.03	93	-0.64	0.524
	Using The Stock Market Game in the classroom	45.70	0.05	0.05	93	1.06	0.291
	Linking The Stock Market Game to outside resources	45.70	0.05	0.05	93	0.95	0.342
Interactions With Others	Overall implementation	47.08	0.06	0.04	95	1.39	0.168
	The Stock Market Game lessons and materials	46.68	0.00	0.02	93	0.19	0.848
	Using The Stock Market Game in the classroom	46.68	0.02	0.04	93	0.50	0.615
	Linking The Stock Market Game to outside resources	46.68	0.04	0.05	93	0.85	0.398
Beyond the Classroom	Overall Implementation	46.22	0.07	0.04	95	1.70	0.092
	The Stock Market Game lessons and materials	44.10	-0.03	0.02	93	-1.38	0.170
	Using The Stock Market Game in the classroom	44.10	0.03	0.04	93	0.60	0.550
	Linking The Stock Market Game to outside resources	44.10	0.12	0.05	93	2.54	0.013
Financial Life Skills	Overall Implementation	46.26	0.07	0.04	95	1.65	0.102
	The Stock Market Game lessons and materials	44.62	-0.03	0.03	93	-1.07	0.287
	Using The Stock Market Game in the classroom	44.62	0.08	0.05	93	1.71	0.091
	Linking The Stock Market Game to outside resources	44.62	0.05	0.05	93	1.08	0.282

APPENDIX G. STATISTICAL MODELING OF IMPLEMENTATION, STUDENT EXPERIENCES, AND STUDENT LEARNING

Statistical Methods

The relationships between teacher-reported implementation of The Stock Market Game, student experiences, and student learning were examined using a hierarchical linear modeling approach (also known as mixed-effects regression). These models were fit with a random classroom-level intercept to account for classroom-to-classroom differences in ability and the random variation of students within those classrooms. The models were fit using PROC MIXED available with the SAS9.1 software package.

For each of the outcome variables (mathematics and investor knowledge posttest scores at each of the student age groups), the following model selection routine was used:

1. Fit the full model including all variables and interactions. If none of the implementation (or student experiences) variables were significant (or approaching significant), no more modeling was conducted for the specific outcome and predictor variables.
2. Eliminate nonsignificant implementation (or student experiences) variables from the model. Nonsignificant main-effect terms were kept in the model when they were part of a significant interaction.
3. Eliminate student covariates with *p* values greater than 0.20. Nonsignificant main-effect terms were kept in the model when they were part of a significant interaction.
4. Fit the reduced model, and repeat steps 1 through 3 until a final model was reached. Models AIC and BIC were used to examine model fit in determining the best final model.

The impact of implementation was modeled from two perspectives. First, the impact of total teacher implementation of The Stock Market Game was analyzed to determine any relationship between teachers' ratings and students' learning. Second, the impact of the specific aspects of implementation (*classroom activities, lessons and materials,* and *connections to the outside world*) were modeled in relationship to student learning. For the models that examined the relationship between student experiences and student learning, no teacher-level variables were included (i.e., there was no interaction between implementation and student survey responses modeled in relation to student learning). Table G1 shows the models fit to the data for each of the assessments and the student and teacher variables considered in the initial model.

Table G1. Student Learning Models

Modeled Relationship	Student Variables	Teacher Variables
Overall teacher implementation on student learning	Pretest (Prescore)	Total Implementation scale score (Implementation)
	Gender (Female)	
	Played The Stock Market Game in another class (Different class)	
Specific aspects of implementation on student learning	Pretest (Prescore)	Lessons and materials scale score (L & M)
	Gender (Female)	Classroom activities scale score (Activities)
	Played The Stock Market Game in another class (Different class)	Connections to the outside world scale score (Connections)
Student perceptions on student learning	Pretest (Prescore)	No teacher-level variables were modeled.
	Gender (Female)	
	Played The Stock Market Game in another class (Different class)	
	Engagement scale score (Engagement)	
	Interactions scale score (Interactions)	
	Beyond the classroom scale score (Beyond)	

Teacher Implementation and Student Learning

Tables G2 through G11 present the final fixed-effects results from the hierarchical linear models fit to the test and teacher survey data.

Mathematics 4–6

Overall implementation was not significant for the Grade 4–6 mathematics test (Table G2). There was a significant positive interaction between lessons and materials and gender (Table G3).

Table G2. Mathematics 4–6 Total Implementation

Effect	Coefficient	S.E.	*t*-value	*p*-value
Intercept	522.2	5.60	93.3	< 0.001
Prescore	0.5	0.02	22.8	< 0.001
Female	−6.9	3.87	−1.8	0.074
Implementation	−0.2	0.57	−0.4	0.685
Implementation × female	0.6	0.38	1.5	0.137

Table G3. Mathematics 4–6 Implementation Subcomponents

Effect	Coefficient	S.E.	*t*-value	*p*-value
Intercept	522.1	5.66	92.3	<0.001
Prescore	0.5	0.02	22.9	<0.001
Female	−7.0	3.88	−1.8	0.072
L & M	−0.3	0.32	−0.8	0.439
L & M × female	0.5	0.22	2.1	0.039

Mathematics 7–10

Overall implementation was not significant for the mathematics 7–10 test (Table G4). Classroom activities had a significant relationship with student mathematics learning (Table G5).

Table G4. Mathematics 7–10 Total Implementation

Effect	Coefficient	S.E.	*t*-value	*p*-value
Intercept	511.2	3.24	157.9	<0.001
Prescore	0.7	0.02	31.4	<0.001
Female	5.1	3.66	1.4	0.163
Different class	16.5	6.24	2.6	0.008
Implementation	0.3	0.29	1.0	0.317
Implementation × different class	−0.9	0.58	−1.6	0.117

Table G5. Mathematics 7–10 Implementation Subcomponents

Effect	Coefficient	S.E.	*t*-value	*p*-value
Intercept	509.2	3.28	155.3	<0.001
Prescore	0.7	0.02	28.6	<0.001
Different class	16.9	6.22	2.7	0.007
Female	6.6	3.71	1.8	0.078
L & M	−0.3	0.18	−1.5	0.147
Connections	−0.2	0.32	−0.5	0.614
Activities	0.8	0.33	2.3	0.025
Connections × prescore	0.0	0.00	−3.4	0.001
Activities × prescore	0.0	0.00	3.2	0.001

Investor Knowledge—Elementary School

Overall implementation was not significant at the elementary school level. However, there was a significant negative interaction between implementation and prescore (Table G6). In addition, there was a significant negative interaction between the connections to the outside world construct and prescore (Table G7).

Table G6. Investor Knowledge Elementary Total Implementation

Effect	Coefficient	S.E.	*t*-value	*p*-value
Intercept	537.4	8.67	62.0	<0.001
Prescore	0.4	0.04	10.7	<0.001
Different class	13.9	10.20	1.4	0.174
Implementation	0.6	0.88	0.7	0.485
Implementation × prescore	0.0	0.00	−3.1	0.002

Table G7. Investor Knowledge Elementary Implementation Subcomponents

Effect	Coefficient	S.E.	*t*-value	*p*-value
Intercept	537.6	8.67	62.0	<0.001
Prescore	0.4	0.04	10.6	<0.001
Different class	14.1	10.13	1.4	0.165
Connections	1.2	0.70	1.6	0.106
Activities	−1.0	0.87	−1.1	0.268
Connections × prescore	0.0	0.00	−4.0	<0.001

Investor Knowledge—Middle School

Overall implementation had a significant relationship with student mathematics learning at the middle school level (Table G8). In addition, there was a significant relationship between the connections to the outside world subcomponent and student mathematics learning (Table G9).

Table G8. Investor Knowledge Middle School Total Implementation

Effect	Coefficient	S.E.	*t*-value	*p*-value
Intercept	520.9	5.41	96.2	<0.001
Prescore	0.6	0.03	18.9	<0.001
Implementation	1.0	0.51	2.0	0.046

Table G9. Investor Knowledge Middle School Implementation Subcomponents

Effect	Coefficient	S.E.	*t*-value	*p*-value
Intercept	520.7	5.37	96.9	<0.001
Prescore	0.6	0.03	18.8	<0.001
Female	−1.3	4.43	−0.3	0.766
Connections	0.9	0.40	2.3	0.024
Connections × female	0.5	0.29	1.9	0.062

Investor Knowledge—High School

Overall implementation did not have a significant relationship with student mathematics learning at the high school level (Table G10). However, there was a significant negative interaction between the lessons and materials subcomponent and the pretest. In addition, there was a significant positive interaction between the classroom activities subcomponent and the pretest (Table G11).

Table G10. Investor Knowledge High School Total Implementation

Effect	Coefficient	S.E.	*t*-value	*p*-value
Intercept	522.5	7.81	66.9	<0.001
Prescore	0.7	0.06	10.9	<0.001
Female	−17.8	8.11	−2.2	0.029
Different class	−4.9	14.11	−0.3	0.731
Implementation	0.9	0.77	1.1	0.275
Implementation × prescore	0.0	0.01	−0.7	0.480
Implementation × female	1.0	0.87	1.1	0.264
Implementation by different class	2.0	1.63	1.2	0.229

Table G11. Investor Knowledge High School Implementation Subcomponents

Effect	Coefficient	S.E.	*t*-value	*p*-value
Intercept	517.4	8.11	63.8	<0.001
Prescore	0.6	0.06	10.4	<0.001
Female	−12.5	7.98	−1.6	0.118
L & M	−0.2	0.39	−0.5	0.622
Activities	2.3	0.97	2.4	0.023
L & M × prescore	0.0	0.00	−3.9	< 0.001
Activities × prescore	0.0	0.01	3.4	0.001

Student Experiences and Student Learning

Tables G12 through G16 present the final fixed-effects results from the hierarchical linear models fit to the test and student survey data.

Mathematics 4–6

There were no significant main effects for student experiences in relation to student learning for Grades 4–6 mathematics. However, there was a significant negative interaction between engagement and the pretest. In addition, there was a significant positive interaction between the beyond the classroom construct and the pretest (Table G12).

Table G12. Mathematics 4–6 Student Experiences

Effect	Coefficient	S.E.	*t*-value	*p*-value
Intercept	525.6	4.79	109.8	<0.001
Prescore	0.6	0.03	22.3	<0.001
Engagement	−0.1	0.28	−0.2	0.817
Beyond	−0.3	0.28	−1.1	0.287
Engagement × prescore	0.0	0.00	−2.5	0.015
Beyond × prescore	0.0	0.00	3.3	0.001

Mathematics 7–10

There were no significant main effects or interactions for student experiences in relation to student learning for Grades 7–10 mathematics (Table G13).

Table G13. Mathematics 7–10 Student Experiences

Effect	Coefficient	S.E.	*t*-value	*p*-value
Intercept	515.8	3.29	157.0	<0.001
Prescore	0.7	0.02	29.0	<0.001
Female	5.2	4.14	1.3	0.208
Different class	17.3	6.97	2.5	0.013
Engagement	0.2	0.27	0.6	0.552
Beyond	−0.1	0.26	−0.5	0.638
Engagement × prescore	0.0	0.00	1.6	0.113
Beyond × prescore	0.0	0.00	−1.6	0.114

Investor Knowledge—Elementary School

There were no significant main effects or interactions for student experiences in relation to student learning for investor knowledge at the elementary school level (Table G14).

Table G14. Investor Knowledge Elementary Student Experiences

Effect	Coefficient	S.E.	*t*-value	*p*-value
Intercept	541.6	8.50	63.7	<0.001
Prescore	0.4	0.04	10.2	<0.001
Female	−0.8	5.10	−0.2	0.881
Different class	9.6	10.70	0.9	0.369
Engagement	0.6	0.38	1.7	0.090
Interactions	−0.4	0.34	−1.2	0.248
Beyond	−0.4	0.37	−1.1	0.290
Engagement × prescore	0.0	0.00	1.5	0.129
Interactions × prescore	0.0	0.01	−0.8	0.454
Beyond × prescore	0.0	0.01	−1.5	0.139
Engagement × interactions	0.0	0.03	−0.2	0.849
Engagement × beyond	0.0	0.03	−0.8	0.422
Interactions × beyond	0.0	0.03	0.2	0.816

Investor Knowledge—Middle School

Student engagement with the game was a significant predictor of student investor knowledge learning for middle school students. The effect for the interactions construct was approaching significance and was negative. In addition, there was a negative interaction between the student interactions construct and the pretest. There was also a significant positive interaction between the beyond the classroom construct and the pretest (Table G15).

Table G15. Investor Knowledge Middle School Student Experiences

Effect	Coefficient	S.E.	*t*-value	*p*-value
Intercept	525.4	5.77	91.1	<0.001
Prescore	0.6	0.04	17.5	<0.001
Engagement	1.2	0.33	3.6	<0.001
Interactions	−0.5	0.29	−1.8	0.066
Beyond	−0.5	0.30	−1.6	0.113
Interactions × prescore	0.0	0.00	−2.3	0.019
Beyond × prescore	0.0	0.00	2.3	0.025

Investor Knowledge—High School

Student engagement with the game was a significant predictor of student investor knowledge learning. On the other hand, higher scores on the interactions construct were a significant predictor of lower scores on the posttest. In addition, there was a positive interaction between the student engagement construct and the pretest (Table G16).

Table G16. Investor Knowledge High School Student Experiences

Effect	Coefficient	S.E.	*t*-value	*p*-value
Intercept	515.9	10.49	49.2	<0.001
Prescore	0.7	0.07	10.5	<0.001
Female	−12.4	8.49	−1.5	0.146
Engagement	2.0	0.50	4.1	<0.001
Interactions	−1.0	0.52	−2.0	0.050
Engagement × prescore	0.0	0.00	2.2	0.026