IS FINANCIAL LITERACY IMPROVED BY PARTICIPATING IN A STOCK MARKET GAME?

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Abstract

This study investigates the effectiveness of the Stock Market Game (SMG) in improving student scores on a general multiple-choice test covering basic financial concepts. Teachers in the test group used the Stock Market Game and a complementary curriculum in class while teachers in the control group did not. Students in both groups completed the same online pre- and post-tests, demographic surveys, and math aptitude tests. The results of ordinary least squares regression show that playing SMG along with teaching seven general lessons from the *Learning from the Market* curriculum improves student performance on the financial literacy assessment.

Key Words: Stock Market Game, financial literacy, student assessment

JEL Classification: A21

Introduction

The Stock Market Game (SMG) is a 30-year-old Foundation for Investor Education program that has been used by more than 10 million students in all 50 US states and worldwide. This simulation provides students an opportunity to invest a hypothetical $100,000 in a stock portfolio over a period of time. The program claims that students "think they're playing a game" while teachers "know they're learning economic and financial concepts they'll use for the rest of their lives" (www.stockmarketgame.org).

While there are limited statistical analyses on the impact of the SMG on students' knowledge, recent studies support the simulation as contributing positively to students' academic performance. Survey results collected and published by the Jump$tart Coalition for Personal Financial Literacy illustrate that "since 2000, the first year of the study, students who participated in SMG have consistently outperformed all other students who participated in all other forms of money management education" (DeStefano, 2008). Specifically, the 2006 Jump$tart Coalition Survey results showed that students who played a stock market game simulation performed better in terms of financial literacy than other students (www.jumpstart.org). Findings from the first National Assessment of Educational Progress in Economics show that students who participated in a stock market game simulation performed better in general economics (Walstad and Buckles, 2008, and DeStefano, 2008). A recent study of high school students' understanding of economics in Mississippi also found that participating in a stock market game simulation had a positive and significant effect on students' posttest scores on the general Test of Economic Literacy (Grimes, Millea, and Thomas, 2008).

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Given these results, a more direct evaluation of the effectiveness of the Stock Market Game on student achievement is timely. We constructed a study of the effectiveness of playing the Stock Market Game online, accompanied by a complementary curriculum, using a test group and a control group in the central and eastern parts of our state.

Our goal is to test the effectiveness of SMG. The teachers need to use some sort of curriculum with the game, however, and the teachers in the study had a wide range of abilities and experiences with SMG. At the game's web site (www.stockmarketgame.org), a Teacher Support Center offers many curricula and classroom helps. In order to minimize the effect of the accompanying curriculum, *Learning from the Market* was chosen because most of the lessons in the curriculum cover only basic content. Since we are primarily interested in the effectiveness of the game in improving student achievement, we felt that requiring only basic content to be covered would give the teachers the confidence they needed to implement SMG, while not providing too much content outside of the game.

Methodology and Analysis

During the spring of 2007, all of the high schools in a wide geographic region of the central and eastern parts of our state were identified. Initially, random sampling was contemplated, but the small number of participants led us to invite all of the teachers in the population to participate in our study. Stipends of $300 were offered to the test group participants and $150 to the control group participants in order to encourage participation. This resulted in 19 teachers in the test group and 20 teachers in the control group.

During the summer of 2007, we trained the teachers from the test group in the Stock Market Game and the *Learning from the Market* curriculum. The summer training was offered at two different times in two different locations so as to accommodate teachers' schedules and locations. The teachers were reimbursed for mileage and provided with breakfast and lunch on the training days. The teachers received online access to the required lessons and many other resources. They each received a folder containing instructions on how to access every necessary website and where to find every necessary assessment. All of the information was posted in a password-protected Blackboard website.

Each test group teacher was allowed up to five free teams to play SMG during the fall 2007 semester. They registered for and played SMG with students during that semester and also taught the required lessons (1 through 7) from *Learning from the Market*. After teaching the curriculum and after the students played the Stock Market Game, the teachers were asked to complete a survey containing questions about their demographic data, financial education and experience. The survey included questions about their assessment of the usefulness of the game and curriculum.

The control group teachers received no training. They were instructed to test their students at the beginning and end of the fall 2007 semester, and to teach economic and financial concepts as they normally would during that semester. They also completed a survey containing questions about their demographic data, financial education and experience, and also about what materials they used to teach economic and financial concepts during this semester.[2]

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[2] The control group teachers reported using the following materials: *Economics: Principles in Action* by Prentice-Hall, Econedlink, Banking & Financial Systems text, www.moneyskill.org, *Essentials of Marketing, Entrepreneurship, and Retailing*, National Endowment for Financial Education, Accounting and Finance 1 Curriculum by Kentucky Career and Technology Business Education Division, *Managing Your Personal Finances*,

The students in both the test group and the control group were given an online SMG pretest and posttest that we developed using questions from Jump$tart's survey and other sources. The test was intentionally broad so as not to test only knowledge about the stock market. Students also answered a demographic questionnaire to report gender, race, grade level, and parental academic achievement. Students also took an online multiple-choice math test to provide a proxy for general academic ability, since aptitude variables are consistently significant explanators of learning economics (Becker, 1997). Lacking data on other tests taken by our subjects, we chose a standardized math test, since such a test was shown to be a good predictor in past studies (Ballard and Johnson, 2004, and Harter and Harter, 2004).

We sent stipends of $300 to the test group teachers and $150 to the control group teachers who completed all of the requirements of the study. We also invited all of the control group teachers to take advantage of SMG training in early 2008 and offered up to five free teams for each teacher to play during spring 2008.

Results

Ten (10) teachers participated in the test group throughout the fall semester. When we discovered that a couple of the teachers had their students take the wrong assessments, we emailed them to correct this. One teacher was unable to fulfill the requirement to have her students take the correct SMG posttest, so she was not eligible for the stipend for completing the project. Nevertheless, she and her students did complete some of the assessments and questionnaires and are included in the descriptive data, but not in the statistical analyses.

Eleven (11) teachers were in the control group. When we discovered that some of the teachers did not have their students complete all of the online testing, we contacted them and requested that the students complete the assessments. Three of the teachers were not able to have their students complete all of the requirements. In some cases, it was only the demographic questionnaire that students did not complete. Since the teachers and students did complete some of the assessments and questionnaires, they are included in the descriptive data.

From Table 1, it is clear that most of the teachers in our study are female, white, and aged 35-49. The teachers in the test group have slightly more years of teaching experience and attendance at economics workshops. They have earned an average of more than 3 graduate credits in economics as compared to an average of 1.64 credits for the control group teachers.

PBS Series - Dollar$ & Sense: Fundamentals of Investing, Investing in Stocks, Investing in Mutual Funds, teacher-made PowerPoints, PNC bank-provided brochures, www.moneyinstructor.com

Table 1 – Descriptive Results for Teachers
Percentages by Category for Gender, Race, and Age
Mean Values for Others

Variable	Whole Group (21 Teachers)	Test Group (10 Teachers)	Control Group (11 Teachers)
Gender			
Female	0.81	0.90	0.72
Male	0.19	0.10	0.27
Race			
Black/African-Amer.	0.05	0.00	0.09
White	0.95	1.00	0.91
Age			
25-34	0.19	0.00	0.36
35-49	0.67	0.70	0.64
50 or above	0.14	0.30	0.00
Years of Teaching Experience	10.88	11.60	10.23
Years of Teaching Finance/Econ	5.86	6.40	5.36
Number of Econ. Workshops Attended	6.79	6.86	6.75
Graduate Credits Earned in Economics	2.43	3.30	1.64

In Table 2, we provide descriptive results for the student responses. There are 730 students in the data set with 395 students in the test group and 335 students in the control group. Not all of the students responded to all of the questions and assessments, so the total number of responses for each variable are listed in the column with the variable names. There are slightly more males than females in the study and most are white. Nearly 40% of the students are high school freshman, while about 35% are seniors. Most of the students live with both parents, and about one-third have neither mothers nor fathers who attended college. More than one-half of the students do not work and about two-thirds of the students report that they will definitely attend college. Less than one-third of the students think they probably will or definitely will invest in the stock market one day, while about 25% of the students in the test group report that they are more likely to invest after playing the Stock Market Game.

Table 2 – Descriptive Results for Students
Percentages by Category
(Non-responses are omitted.)

Variable	Whole Group (730 Students)	Test Group (395 Students)	Control Group (335 Students)
Gender (n=545)			
Female	46.97	45.85	48.64
Male	53.03	54.15	51.36
Race (n=545)			
Am. Indian or Alaska Native	0.37	0.62	
Asian	0.73	0.62	0.91
Black/African-Amer.	2.20	3.08	0.91
Native Hawaiian or Other Pacific Islander	0.55	0.62	0.45
White	90.28	86.15	96.36
Some other race	5.87	8.92	1.36
Grade (n=545)			
9th	38.53	41.23	34.55
10th	17.43	23.38	8.64
11th	8.81	9.85	7.27
12th	35.05	25.23	49.55
Some other grade	0.18	0.31	
Live With (n=543)			
Both Parents	60.77	59.88	62.10
Mostly Mom	26.52	25.62	27.85
Mostly Dad	7.18	7.10	7.31
Neither Parent	5.52	7.41	2.74
Mother's Education (n=540)			
No College	31.85	32.09	31.51
Some College	17.04	15.26	19.63
College Graduate	18.89	18.69	19.18
Graduate Degree	14.63	13.08	16.89
Don't Know	17.59	20.87	12.79
Father's Education (n=543)			
No College	33.70	33.13	34.55
Some College	14.73	14.55	15.00
College Graduate	16.21	14.86	18.18
Graduate Degree	12.34	11.76	13.18
Don't Know	23.02	25.70	19.09

Help with SMG (n=323)			
None		77.40	
Some		20.74	
A lot		1.86	
Plans to go to College (n=544)			
Definitely not	1.10	1.54	0.45
Probably not	3.68	4.94	1.82
Undecided	6.99	8.95	4.09
Probably will	23.35	24.38	21.82
Definitely will	64.89	60.19	71.82
Do you work? (n=543)			
No	56.72	58.82	53.64
Yes, part-time	30.20	24.15	39.09
Yes, full-time	2.39	3.10	1.36
Yes, on occasion	10.68	13.93	5.91
Likely to invest in Stock Market (n=544)			
Definitely not	14.52	16.98	10.91
Probably not	24.45	23.77	25.45
Undecided	38.60	39.51	37.27
Probably will	17.10	14.81	20.45
Definitely will	5.33	4.94	5.91
Has SMG changed likelihood to invest? (n=323)			
No		38.39	
Yes, more likely		25.39	
Yes, less likely		6.19	
Undecided		29.72	
Did not play SMG		0.31	
Ever played SMG before this semester? (n=543)			
No			
Yes	86.37	88.24	83.64
	13.63	11.76	16.36
Was SMG better way to learn? (n=323)			
No, it was worse.		13.93	
Liked it the same.		26.93	
Yes, I liked it better.		59.13	

In Table 3, we report student scores on the assessments. The first test is a multiple-choice math test in which the questions were selected from an old version of the *Preliminary Scholastic Aptitude Test*. This score is a percentage of correct answers and is used as a proxy for students' general academic ability. The students in the control group have a higher average score on the math test (33.54) than the students in the test group (29.44). Using a difference-of-means test to determine whether this difference is statistically significant, we find a t-statistic of -1.69. Therefore, the difference is statistically significant only at the 0.10 level of significance.

Table 3
Mean Values for Student Test Scores
Standard Deviations in Parentheses

Variable	Whole Group (730 Students)	Test Group (395 Students)	Control Group (335 Students)	t-Statistic Comparing Means for Test Group and Control Group
Math Test	31.21 (18.44) n=609	29.44 (17.07) n=346	33.54 (19.91) n=263	-1.69*
SMG Pretest	42.49 (15.26) n=601	41.22 (14.61) n=342	44.18 (15.96) n=259	-1.67*
SMG Posttest	57.87 (22.02) n=572	64.36 (22.55) n=343	48.15 (17.12) n=229	6.49**
Subset Pretest	42.77 (20.15) n=600	41.23 (19.58) n=341	44.79 (20.75) n=259	-1.31
Subset Posttest	56.88 (24.47) n=571	61.78 (23.91) n=342	49.56 (23.49) n=229	3.30**

*Significant at the 0.10 level
**Significant at the 0.01 level

The scores on the SMG Pretest and the SMG Posttest are percentages of correct responses on a multiple-choice assessment constructed from Jump$tart's survey and other sources. The test was purposely made broad so as not only to test knowledge about the stock market, but to test knowledge of other financial concepts such as purchasing life insurance, buying a car, and using credit. The students in the control group had a slightly higher average score on the pretest (44.18) than the students in the test group (41.22). The t-statistic for a difference-of-means test of these scores is -1.67 which is statistically significant at the 0.10 level of significance.

Note that the students in the test group performed much better on the SMG Posttest than the students in the control group. The test group average is 64.36 while the control group

average is 48.15. The t-statistic for a difference-of-means test of these scores is 6.49 which is statistically significant at the 0.01 level of significance. This suggests that playing the SMG and using the *Learning from the Market* curriculum improved student performance on the assessment.

To investigate this issue further, the ten questions on the SMG Assessment that were not specific to the stock market were isolated and the students' scores on this subset were determined. The pretest and posttest averages on the subset questions are provided in Table 3 and labeled as Subset Pretest and Subset Posttest. Students in the test group scored an average of 41.23 on the Subset Pretest while students in the control group scored an average of 44.79. The t-statistic for a difference-of-means test of these scores is not statistically significant. This suggests that neither group knew more or less than the other about financial concepts that are not related to the stock market at the beginning of the fall 2007 semester.

The posttest average scores, however, are very different for the two groups. The test group average is 61.78 while the control group average is 49.56. The t-statistic for a difference-of-means test of these scores is 3.30 which is statistically significant at the 0.01 level of significance. This suggests that playing the SMG and using the *Learning from the Market* curriculum improved student performance even on the assessment questions that were not related to the stock market.

To further analyze the effects of playing SMG on student assessment scores, an ordinary least squares regression was used. This method follows the work of others who have tested whether a particular teaching method or resource, such as new technology, is beneficial. For example, Agarwal and Day (1998) found that internet use had a positive effect on both TUCE III scores and final grades in introductory economics. Rankin and Hoaas (2001) studied whether computer-assisted instruction improved student performance, finding no such improvement. They also found no effect on student attitudes and teaching evaluations. Harter and Harter (2004) tested the effectiveness of online quizzes, finding no link between the use of the technology and student performance on examinations.

In the econometric model used here, the dependent variable is students' test scores and the independent variables initially included the following student characteristics:

- Gender
- Race
- Grade level
- Whether students live with both parents
- Whether each parent attended college
- Whether students report that they definitely will invest in the stock market
- Whether students report that they definitely will attend college
- Whether the students reported having played SMG prior to this semester
- Score on high school math multiple-choice test
- Whether the students were in a class that played SMG and used *Learning from the Market* during fall 2007 (the test group)

A dummy variable denoting that the teacher was 25-34 years of age as opposed to older was constructed on the hypothesis that a younger teacher could affect student performance. Whether this effect is positive or negative is not clear. Younger teachers might be technologically savvy and more comfortable playing the online simulation, contributing positively to student learning. Conversely, older teachers might have more experience teaching the content, and this might

contribute positively to student learning. The number of graduate credits in economics earned by the teachers were included, since teachers' graduate economics credits contribute positively to student performance (Watts, 2006). Due to lack of diversity in our group of teachers, variables describing teacher gender and race were not included.

A correlation analyses on the full set of variables revealed that the variable describing students' plans to attend college was highly correlated with a number of other variables (grade level, whether they live with both parents, parents' education levels, and whether they planned to invest in the stock market). The variable describing students' grade levels was highly correlated with investment and college plans and the father's education level. Having played SMG in a prior semester was highly correlated with students' plans to invest, and mothers' and fathers' educational attainment levels were highly correlated with each other. Consequently, college plans, grade level, having previously played SMG, and mother's education level were omitted from the regression.

Table 4
OLS Regression
Dependent Variable – SMG Posttest

Variable	Coefficient	t-Statistic	p-Value
FEMALE	1.543	0.800	0.424
WHITE	1.939	0.619	0.536
Live with BOTH Parents	3.728	1.906	0.057
DAD Did NOT Attend College	-4.114	-2.041	0.042
Will INVEST in Stock Market	4.977	1.200	0.231
MATH Score	0.423	8.254	<0.001
Played SMG	18.731	7.558	<0.001
Teacher Age < 35	6.573	1.816	0.070
Teacher's Graduate Credits in ECON	0.548	2.759	0.006
Constant	27.513	6.137	<0.001

n = 435
Adj. R-squared = 0.24

Table 4 gives the results of an ordinary least squares regression to investigate student scores on the whole SMG Posttest. Students' academic ability as measured by performance on the Math test and playing SMG are positive and significant. Living with both parents and having a younger teacher are also positive and significant at the 0.10 level of significance. The teacher's graduate credit hours in economics is positive and significant, while having a dad who attended no college as opposed to attending at least some college, graduating, or attending graduate school is a negative predictor of test score. None of these results are surprising, and they provide evidence that playing SMG and using the basic lessons from *Learning from the Market* does improve student performance.

Table 5 shows the results of an ordinary least squares investigation of determinants of scores on only the Subset Posttest (which includes only those ten assessment questions that are not specifically related to the stock market). Again, students' academic ability as measured by performance on the Math test and playing SMG are positive and significant, as is teacher's graduate credit hours in economics, and having a dad who attended no college is a negative and significant predictor of test score. Interestingly, being female and having definite plans to invest in the stock market are positive and significant predictors of this test score.

Table 5
OLS Regression
Dependent Variable – Subset Posttest

Variable	Coefficient	t-Statistic	p-Value
FEMALE	4.104	1.868	0.062
WHITE	1.870	0.525	0.600
Live with BOTH Parents	2.934	1.317	0.188
DAD Attended College	-4.442	-1.935	0.054
Will INVEST in Stock Market	8.772	1.858	0.062
MATH Score	0.467	7.997	<0.001
Played SMG	13.823	4.898	<0.001
Teacher Age < 35	4.336	1.052	0.293
Teacher's Graduate Credits in ECON	0.949	4.199	<0.001
Constant	26.364	5.165	<0.001

n = 435
Adj. R-squared = 0.21

Conclusion

These results show that playing SMG along with teaching lessons 1-7 of *Learning from the Market* does improve student performance on an assessment about financial concepts. The NAEP results and results from the Mississippi study are reinforced here. An important point to note about this finding is that the teachers were required to use a combination of the basic content lessons and SMG. It is possible that using SMG without any content lessons may not improve performance on the assessment, even though the lessons were chosen specifically to minimize that possibility. Some definitions and structure are necessary to using the Stock Market Game in a class, and it seems unlikely a teacher would use SMG with less content than in the lessons drawn from *Learning from the Market*.

In order to follow up with the participants regarding these findings, we asked the teachers a few more questions during the summer of 2008, receiving responses from 60% of the participants. We asked if they planned to play SMG again and whether or not they would use the *Learning from the Market* lessons if they did play the game. We also asked if they looked at the assessment and made a concerted effort to cover the concepts from the SMG assessment.

We learned that all of the teachers liked the lessons and plan to use them again – even the one teacher who said that she or he does not plan to play SMG again. Of the six who responded, two reported looking at the tests, while the others said they concentrated on the content in the lessons and used other assessments as well as the online test. Hence, while there may be some "teaching to the test" effect that explains the higher posttest score for the test group, the entire effect could not be attributed to this.

Because the Teacher Support Center that is part of the online Stock Market Game contains so many different resources, testing the effectiveness of playing the game is a difficult undertaking. We provided our teachers with basic lessons in order to control what they were using in the classroom, but they could also use investment websites, economics texts, and other resources that would affect student learning. Some of the teachers in our study had their students participate in the InvestWrite competition while playing SMG. This is a teacher-designed writing competition in which students describe their investment strategies. Teachers are encouraged to have their students compete while playing SMG. The research and critical thinking skills used in this assignment could improve student knowledge of economics and financial literacy. Thus, it is difficult to isolate the factors driving the result.

There are several reasons that this study is important. It shows that playing SMG while covering basic content about the stock market improves student performance as compared to using other means to teach financial concepts. Advocates of financial literacy can use these results to support use of the SMG. Also, there is very little previous work on the efficacy of SMG, and this work helps to fill that void.

Untested subsidiary benefits of the study may include teachers' continuing use of the curriculum and SMG in the future, exposing more students to SMG than those involved in our study, and that students will make better financial decisions throughout their lifetimes. Teachers and students may become more comfortable with the concepts. As support for this speculation, we asked teachers in our study to use a scale of 1 to 4 to rate their level of satisfaction with the Stock Market Game and accompanying resources. A rating of 1 meant that they were not satisfied while a rating of 4 meant that they were very satisfied. The average rating of 3.5 for the test group teachers suggests that they did like the SMG and the lessons. We also asked them to use a scale of 1 to 4 to rate their level of satisfaction with the training they received. A rating of 1 meant that they were not satisfied while a rating of 4 meant that they were very satisfied. The average rating of 3.7 suggests that they were very satisfied with the training as well.

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