Combining Financial Education With Mathematics Coursework: Findings From a Pilot Study

Philip Dituri,[a] *Andrew Davidson,*[b] *and Jack Marley-Payne*[c]

Recent research has shown that two forms of education intervention significantly improve financial outcomes: rigorous, in-depth personal finance courses and additional mathematics coursework. This suggests that a mathematics course that offered systematic, in-depth applications to personal finance could be particularly effective. In this article, we summarize the results from a pilot of such a course, and demonstrate how it is motivated by recent literature, despite being a type of course that has so far not been studied thoroughly. We then present the results of our preliminary impact assessment and show how financial knowledge and confidence improve significantly after taking the course. We discuss how this indicates that such an approach is a promising strategy for improving financial outcomes.

Keywords: financial education, financial literacy, financial outcomes, mathematics coursework, spreadsheets

Two forms of education intervention significantly improve financial outcomes: rigorous, in-depth personal finance courses, and additional mathematics coursework. This suggests that a mathematics course that offered systematic, in-depth applications to personal finance could be particularly effective. Surprisingly, there is little existing research on the effectiveness of such a course. Therefore, in this study we piloted a course combining personal finance with mathematics and explored its effectiveness. Our impact assessment suggests that students taking this course significantly improve their financial and mathematical knowledge.

Literature Review

Current research has demonstrated the precarious financial position of a large proportion of Americans, and the pressing need for improved financial decision making, particularly among young people. Young adults have especially low levels of financial literacy (Brown, Van der Klaauw, Wen, & Zafar, 2016; Lusardi, Mitchell, & Curto, 2010; Urban, Schmeiser, Collins, & Brown, 2015). Further, as a group, they are prone to engage in various financially detrimental behaviors surrounding credit. Some of these financially detrimental behaviors include using payday loans, paying interest on credit card balances, and accruing late fees (FINRA Investor Education Foundation, 2013). These results are not surprising given the fact that most high-school and undergraduate students fail basic financial literacy tests (Bowen, 2002; Hastings, Madrian, & Skimmyhorn, 2013; Markow & Bagnaschi, 2005; Shim, Barber, Card, Xiao, & Serido, 2010).

Relatedly, it is well-documented that a lack of financial knowledge—also known as "financial literacy"—is strongly correlated with poor financial decision making, and that improving a person's financial knowledge may improve his or her decision making. Specifically, individuals with lower levels of financial literacy tend to have lower levels of retirement planning and savings, less stock market exposure, and asset accumulation (Griesdorn, Lown, DeVaney, Cho, & Evans, 2014; Lusardi & Mitchell, 2011, 2014). In addition such individuals generally have higher levels of debt, and an increased likelihood of using alternative financial services or higher risk borrowing options, such as adjustable rate mortgages (Brown et al., 2016; Finke, Huston, Siman, & Corlija, 2005; Lusardi & Mitchell, 2014; Lusardi et al., 2010).

[a] *Visiting Professor, Graduate School of Education, Fordham University, 113 W 60th St, New York, NY 10023. E-mail: pdituri@fordham.edu*
[b] *Founder, Financial Life Cycle Education, 65 Bleecker Street, New York, NY 10012. E-mail: andy@ficycle.org*
[c] *Director of Research, Financial Life Cycle Education, 65 Bleecker Street, New York, NY 10012. E-mail: jack@ficycle.org*

http://dx.doi.org/10.1891/1052-3073.30.2.313

Conversely, there is a strong relationship between high levels of financial literacy and a higher probability that individuals will budget their spending appropriately, pay bills in full on time, track expenses, save each month, maintain an emergency fund, diversify investments, and set financial goals (Griesdorn et al., 2014; Hilgert, Hogarth, & Beverly, 2003; Lusardi & Mitchell, 2014). In general, there is a substantial body of knowledge linking high levels of financial literacy with various beneficial financial practices and behaviors, and low levels of financial literacy with detrimental practices and behaviors (Hastings et al., 2013). While many of these articles focus on the United States, a brief review of the research suggests this may not only be a domestic problem. For instance, Navickas, Gudaitis, and Krajnakova (2014) have found similarly troubling findings among young people in Lithuania.

In light of these findings, policy makers at the national, state, and local levels have pushed for a greater emphasis on financial literacy in compulsory education. The push for greater emphasis on financial literacy is done in hopes that providing more financial education will improve financial knowledge, and, in turn, improve financial outcomes. This has led to the growth of a range of financial education programs across the country: this includes state-mandated high school courses, on-the-job training sessions (Council for Economic Education, 2016), community-based education programs (Xu, 2018), and education for the incarcerated (Mielitz, MacDonald, & Lurtz, 2018). Despite this, the evidence in favor of financial education has been mixed.

While the aforementioned research has shown positive correlations between levels of *financial literacy* and beneficial financial outcomes, it has been challenging to show conclusively that *financial literacy education intervention* improves either financial literacy or financial outcomes. Fernandes, Lynch, and Netemeyer (2014) showed that measured financial literacy can make significant predictions regarding later financial behavior; however, they found that financial education interventions intended to improve later financial behavior were largely ineffective, with a statistically significant but minuscule effect. Cole, Paulson, and Shastry (2014) found similar results across a range of states

> [R]equiring high school students to take personal finance courses had no effect on investment or credit management outcomes, such as: probability of reporting any investment income, the level of investment income, credit score, credit card delinquency or the probability of bankruptcy or foreclosure. Nor do these mandates have a detectable effect on total financial assets or real estate equity. (p. 2)

Without conclusive research showing a causal relationship, it may be difficult for schools and policy makers to justify further increasing the amount of time schools devote to financial literacy, as there are significant opportunity costs in doing so (Fernandes et al., 2014). Providing financial literacy education and devoting school resources, teachers, and student class time to financial literacy requires that schools supplant other activities and courses (Brown, Collins, Schmeiser, & Urban, 2014).

This does not mean that expanding financial education is a misguided project. By creating a multidimensional model of financial literacy and financial behaviors, Xiao and O'Neill (2016) found a range of benefits when associated with taking financial education programs, and Xiao and Porto (2017) showed this extends to financial satisfaction. Further, not all financial education interventions are equally effective. Though much of the literature discusses financial education in general, the interventions used across the United States vary greatly: they range from weekend trainings to full-year academic courses. The effects of an 8-hour training program likely differ from the effects of a yearlong course (Brown et al., 2016; Hensley, 2015; Lyons, Chang, & Scherpf, 2006; McCormick, 2009; Schuchardt et al., 2009).

With new state-mandated high school courses being taught across the country, researchers have had the opportunity to begin to differentiate between interventions. By looking at different state programs individually, Urban et al. (2015) found that more rigorous state mandates for education in financial literacy had a greater effect on subsequent financial well-being. There were improved credit scores and reduced delinquency rates for young adults in states with rigorous mandates, relative to those states that had less rigorous mandates, or none at all. While there are conflicting findings regarding financial education in general, rigorous in-depth financial literacy courses have been shown to be effective in improving financial well-being (Brown et al., 2016; Hensley, 2015; McCormick, 2009; Schuchardt et al., 2009; Urban et al., 2015; Varcoe, Martin, Devitto, & Go, 2005).

In light of these findings, it is of particular note that the literature shows that additional courses in *mathematics* improve later financial outcomes. Such coursework has been shown to improve creditworthiness, decrease adverse financial outcomes, lead to significant positive impacts on issues related to student debt, increase the propensity to accumulate assets, increase the propensity to accumulate real estate equity, reduce credit card delinquency, and reduce the probability of experiencing foreclosure (Brown et al., 2016; Cole et al., 2014). This makes sense since, as Hastings et al. (2013) note, there is a well-documented relationship between numeracy, and related cognitive abilities, and financial outcomes. Individuals with such attributes tend to have higher levels of financial literacy (Banks & Oldfield, 2007; Gerardi, Goette, & Meier, 2010). Further, a study by Cole, Paulson, and Shastry (2016) found that "requiring students to take an additional high school math course increases the propensity to accumulate assets and the amount of real estate equity while reducing credit card delinquency and the probability of experiencing foreclosure" (p. 657–658).

It is also worth considering the importance of higher education in relation to financial outcomes, since mathematics proficiency is a key "gate-keeper" for such qualifications; that is, students who do possess sufficient math qualifications are ineligible to enroll in more advanced courses in any subject (Atanda, 1999; Bryk, & Treisman, 2010). Higher education levels are associated with increased financial satisfaction (Aboagye & Jung, 2018). In addition, when negative financial outcomes occur, such as shock healthcare costs, those with higher education levels adopt more effective strategies to mitigate the damage (Dong, 2018).

Given the need for improved financial decision making, particularly among young people, this research suggests that a rigorous course that combines personal finance and mathematics is a promising approach to financial education. The conceptual knowledge behind personal finance and the conceptual knowledge behind the related mathematics are mutually reinforcing.

The Course Design

The literature review suggests that the ideal form of financial education would be a mathematics course that provides systematic applications to the key topics in personal finance. This would leverage the financial benefits of additional mathematics coursework, while also delivering the kind of rigorous education in personal finance that has proved most effective. Such a course is analogous to a physics course that applies mathematics to scientific topics. It has the added benefit of reducing the opportunity cost identified by Fernandes et al. (2014). Alongside any financial benefits, students would be receiving education in Common Core State Standards aligned mathematics, which is independently beneficial and typically required in schools anyway (National Governors Association Center for Best Practices and Council of Chief State School Officers [NGA Center and CCSSO], 2010).

Surprisingly, there is little existing research on the effectiveness of a course that combines personal finance and mathematics. Therefore, we set out to design such a course ourselves and explore its effectiveness.

Since we set out to design a mathematics course, we first consulted the research surrounding recent trends, findings, and best practices in mathematics education. We determined that our course should be conceptually focused and project-based, make use of appropriate technology, make connections to the real-world, attend to the development of quantitative literacy, and be well-suited for delivery in a student-centered fashion (Lester, 2007; National Council of Teachers of Mathematics [NCTM], 2014; NGA Center and CCSSO, 2010). In addition, we determined it self-evident that the course should also deliver practical mathematical and personal finance skills.

In order to present the personal finance topics in a rigorous, conceptually focused manner, we structured the sequence of study around the idea of the "financial life cycle." This is the Nobel Prize winning theory that one's financial needs and abilities vary over the course of one's lifetime, and that one must plan for this when making financial decisions: this requires transferring consumption over time and managing risk (Deaton, 2005; Ibbotson, Milevsky, Chen, & Zhu, 2007). Fully exploring the concept of the financial life cycle requires working through the fundamental topics in personal finance (Jump$tart Coalition for Personal Financial Literacy, 2015) in a unified sequence that reveals their conceptual underpinnings. It also requires utilizing mathematical concepts and techniques of increasing complexity throughout the course to enrich student understanding of the financial topics.

We selected the mathematical content of the course specifically to support the personal finance content and covers topics from Common Core State Standards for Algebra, Statistics and Probability, and Modeling, but is primarily rooted in algebra (NGA Center and CCSSO, 2010).

Informed by best practices in mathematics education, the course is project-based with the aim of making students learn to apply the material in real life scenarios and use mathematics in combination with critical decision making. Each unit contains a final project as its primary summative assessment which requires students to exhibit both quantitative and financial literacy. Most projects in the course present a description of a character facing a particular financial problem. Students must analyze this situation and advise the character on what they should do, while making the necessary mathematical calculations to help formulate and back up their advice. The structure of the units is designed to build toward these final projects. There are few correct or incorrect answers; rather, students use mathematics and their knowledge of financial instruments to make informed decisions and give advice, using mathematics as their evidence.

The course contains six units:

- Unit 1: Financial Statements—Students learn about wealth by creating a balance sheet as well as a budget.
- Unit 2: Earning Interest—Students learn how transferring money to the future increases value through compounding.
- Unit 3: Regular Payments—Students learn the mathematics underlying regular cash flows such as mortgages and retirement savings.
- Unit 4: Insurance and Expected Value—Students are introduced to risk and making decisions in the face of uncertainty.
- Unit 5: Stocks and Risk—Students learn about the stock market, with a focus on the efficient market hypothesis and the statistics related to diversified and systematic risk.
- Unit 6: The Role of Government—Students gain an understanding of the government's role in shaping the environment in which individuals make financial decisions.

The identification of algebra as one of the primary mathematical topics addressed, and the practical skills required for effective financial decision making, led us to incorporate systematic use of spreadsheet software into the course. This technology is both a commonly employed in real-world financial work and well-suited to teaching algebra. Spreadsheets have long been seen as a valuable tool in mathematics education. As Friedlander (1998) articulates

> Spreadsheets build an ideal bridge between arithmetic and algebra and allow the student free movement between the two worlds. Students look for patterns, construct algebraic expressions, generalize concepts, justify conjectures, and establish the equivalence of two models as intrinsic and meaningful needs rather than as arbitrary requirements posed by the teacher. (p. 2)

Both the Common Core State Standards (NGA Center and CCSSO, 2010) and the National Council of Teachers of Mathematics (NCTM, 2014) advocate for the strategic use of technology in mathematics classrooms. NCTM (2014) cites the use of technology as providing "essential resources to help students learn and make sense of mathematics" (p. 78) specifically referencing spreadsheet software as a way to represent mathematical ideas in a different form.

Research backs up these recommendations, as it shows that strategic use of technology strengthens mathematics teaching and improves student learning (Dick & Hollebrands, 2011). Students who work with spreadsheets in mathematics activities have significantly higher self-efficacy for algebra than those who received conventional instruction, and we know that self-efficacy predicts academic achievement across all academic subjects and levels (Topcu, 2011).

In the course, spreadsheets are used as a mechanism for demonstrating important mathematical concepts such as functions, recursion, and variables. In addition, use of spreadsheet software provides training in the application of spreadsheets to financial problems, which gives students an important skill for many careers, and for managing their own finances effectively.

We developed this as a mathematics course, to be taught by a mathematics teacher. We believed that a mathematics teacher would be best positioned to cover the

curriculum in the rigorous mathematically grounded way, which the research discussed earlier suggests is the most effective form of financial education. As the next section will discuss, the course materials were developed with this teaching context in mind.

Course Pilot

In the 2016 to 2017 school year, the course piloted in three urban New York City high schools. It was taught as a year-long mathematics elective for juniors and seniors. The students taking the course had all passed the New York State Algebra I Regents Exam and had some additional mathematical experience, but were not on the calculus track. The goal of the pilot was to observe the course materials in action, gather data, and get feedback from teachers and students in order to test our approach, improve the materials and expand our project. We aimed to see how teachers and students responded to the material and how they acquired the information necessary to plan for an expanded rollout.

We found the pilot schools through personal contacts and other educators we met while developing the course. The one stipulation we required from schools was that the course would be offered as a mathematics class and taught by a mathematics teacher. We worked with a small number of schools so that we could develop a personal relationship with the pilot teachers and gather both quantitative and qualitative data to help measure the effectiveness of the course and to aid us in making improvements and modifications for the future.

The three pilot schools' names have been omitted from this article, but we have provided accurate descriptions of three schools (further information is provided in Table 1).

- Pilot School #1: A public school that specializes in the arts. This school taught the course in 2–year-long classes, with 40 students in total. Students at this school were a mixture of juniors and seniors who had taken mathematics classes through Algebra 2.
- Pilot School #2: A public charter school in the Bronx. This school taught the course in 1-year-long class, with 13 students. Students at this school were a mixture of juniors and seniors who had taken Algebra I and Geometry.
- Pilot School #3: A public school in the Lower East Side of Manhattan. This school taught the course in two semester-long classes, with 35 students. Students at this school were a mixture of juniors and seniors who had taken Algebra I and Geometry.

As can be seen from Table 1, these schools have some idiosyncratic features, compared to the U.S. school population as whole. They are less male and less (non-Hispanic) White (NCES, 2017a); and, given the high percentage of students on free lunches, they are of lower socioeconomic status than the U.S. average (NCES, 2012). The ethnic and socioeconomic patterns are in line with New York City public school demographics. Previous research has shown that the groups over-represented in this study have tended to fare worse in tests of financial literacy (Lusardi & Mitchell, 2011). Therefore, the fact that this intervention has led to improvement in financial knowledge among these subgroups is especially significant. On the other hand, care must be taken when using the results of this study to draw conclusions about the U.S. population as a whole. Collecting data on demographic groups under-represented here is an important topic for further research. However, it is plausible to think that an intervention that is effective for the demographic groups that struggle most with financial literacy would be effective for other groups as well.

To assist teachers with taking on a new, unfamiliar course, we offered two full-day training sessions in the summer prior to the pilot, in line with best practices in finance education professional development (Hensley, Jurgenson, & Ferris, 2017). During this time, we introduced attendees to the broad outline of the course, the structure and location of the materials, and worked through key topics in the first two units. When creating the materials, we assumed the teachers had no prior financial knowledge and made sure to provide explanations of all financial topics and vocabulary that the course covered. We developed a teaching companion document, which was intended to introduce the teacher to the financial concepts covered in a given unit. We generally did not provide detailed instructional materials for the mathematics topics if they were covered in a typical high school curriculum, and instead relied on the teachers to develop classroom materials based upon their prior experience and the needs of their students. We did, however, provide instructional materials for mathematics topics that

TABLE 1. Demographic Information for Three Pilot Schools

Demographic Information	School 1	School 2	School 3
Class GPA	Not available	75, in line with school average	79, in line with school average
Class gender	65% F; 35% M	62% F, 38% M	69% F, 31% M
Class race/ethnicity	68% Black	62% Hispanic	34% Black
	22% Hispanic	38% Black	57% Hispanic
	10% White/Asian/Other		9% Asian
School free lunch	School 69%	School 94%	School 80%
School size	867	424	427
College readiness[a]	66%	38%	38%

[a]College readiness is defined as being ready to enroll in classes at City College of New York without needing to take remedial classes. Average college readiness level in New York City schools is 38%. Though not a precise comparison, the average college enrollment rate across the United States is 40% (Nation Center for Educational Statistics [NCES], 2017b).

might fall outside of typical Common Core aligned curriculums. For instance, we provided instructional materials for teaching the concept of expected value. We did not assume teachers had prior knowledge of spreadsheets, so we provided informational worksheets suitable for both teachers and students, introducing them to the relevant spreadsheet features.

For each unit, we provided teachers with the following materials

- **Outline:** Provides a scope and sequence, essential questions, and Common Core State Standards for the unit.
- **Teaching Companion**: Explains the material for each unit, with examples, suitable for teachers unfamiliar with finance.
- **Topic Quiz**: Questions that assess essential knowledge for each topic.
- **Mathematics Worksheet**: Worksheets that remediate and assess the mathematics component of each unit.
- **Spreadsheet Worksheets**: Explains how to use the relevant spreadsheet tools for each unit.
- **Additional Instructional Materials:** Additional practice questions for difficult topics, games, and activities for the classroom.
- **Project:** An end of unit take-home project that requires analysis of a realistic financial scenario.

We also provided additional support, visiting each class approximately once a month and maintaining email contact to answer any questions in the interim. Two of the classes (from Pilot School #1 and Pilot School #2) visited us at the Andrew Davidson & Co. office, our founder's financial analytics firm. Students were given the opportunity to talk to staff about their work in the financial sector, as well as give presentations of their own. Many of the students had not previously seen this type of work environment. We hope to find similar ways to engage students as the program expands. We would also like to establish an afterschool session with parents to complement the course.

Findings

To assess the pilot, we created a survey that students completed before and after taking the course. The survey was available online or in printed format. The survey contained 15 multiple choice questions that tested financial literacy, and 9 questions on mathematics and financial mathematics. It also asked students to rate their confidence in addressing six financial issues and asked them to reflect and comment on the course. We included questions on confidence, since research shows that increased confidence in one's financial prospects leads to improved financial outcomes (Szendrey & Fiala, 2018). The presurvey was completed by 65 students while the postsurvey was completed by 62 students.

Across the schools, and the three types of questions, the results were reasonably consistent, displaying improvement from the beginning to the end of the course across the board. At the start of the course, the average (mean) percentage of questions the students answered correctly was 38% of the questions. At the end of the course this had increased by 26% from 38% to 48%. For self-assessments of confidence,

TABLE 2. Regression Results

	Course Effect	School 1	School 2	School 3	Grade
Total score	3.7***	−0.79	2.85	2.87	−0.85
Big 5 score	0.59***	0.05	0.8	1.28**	−1.00***
Confidence score	0.61*	−1	0.67	−1.11	1.52***

Note. Course effect, school, and grade were treated as dummy variables: for course effect, the variable had value 0 for the pretest and 1 for the posttest; for school x, the variable had value 1 for attendees of school x and 0 otherwise; for grade the variable had value 1 for seniors and 0 otherwise.
We use the typical significance terminology: *significant at 10%; **significant at 5%; ***significant at 1%.

the highest degree of confidence was the "correct" answer. Numerically, the mean number of correct answers increased from 11.4 to 14.9, a 3.5-point improvement. To check for statistical significance, we performed a regression analysis controlling for school attended and grade level. The improvement was significant at the 1% level. Details on all regression results are presented in Table 2.

To get a sense of how the improvements were distributed, Figure 1 shows the percentage of students getting at least the number of correct answers shown on the *x*-axis. While just over 50% of the students had 12 correct answers on the initial survey, over 80% of the students had 12 correct answers on the ending survey. Similarly, the percentage of students who had half of the 30 questions correct more than doubled from 25% before exposure to the curriculum to 56% after exposure to the curriculum.

Included in our survey were the five questions used in the U.S. Financial Capability Study (FINRA Investor Education Foundation, 2016). These are often taken as the standard measure of financial literacy and are sometimes referred to as the "big 5" (Lusardi, 2011). Before exposure to the curriculum, students got an average of 1.66 questions correct. After exposure to the curriculum, students got an average of 2.18 questions correct—an improvement of 31%. Regression analysis, controlling for school attended and grade level, showed this improvement was significant at the 1% level.

We also asked students to rate their confidence in performing financial tasks and engaging in financial discussions. The number of students expressing high confidence increased from 36% to 46%. Again, regression analysis, controlling for school attended and grade level, showed this improvement was significant at the 10% level. While these results are preliminary, in that there were a relatively small number of students represented in the data, they are still promising.

The survey also allowed space for students to comment on the course, and these comments were overwhelmingly positive: 90% of students said they would recommend this course to a friend. Many commented that it made them appreciate the importance of mathematics and that taking the course would help them in the future. About two-thirds of the students reported specific financial actions that they had taken as a result of the course. These included opening bank accounts, saving money, and having financial discussions with family members.

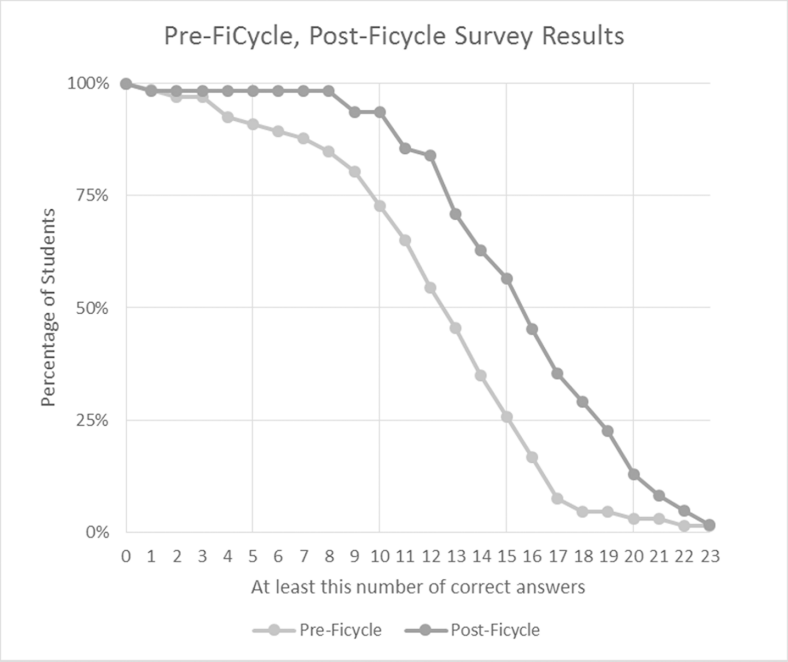
We also provided the teachers ($n = 3$) with an end of course survey, which was more exploratory in nature. One teacher wrote that the best part about teaching the curriculum was "instances of kids getting so engaged in the narrative and content." Another teacher wrote that "the best part of the course was the copious amount of relatable material for students to be interested in." The third teacher wrote that the best part was "the students told me they learned a lot and I also learned a lot too."

Perhaps, the most important marker of the success of our pilot project was that all three pilot schools decided to use the course again the following year, and two of them more than doubled their enrollment.

Summary, Conclusions, and Next Steps

Overall, the pilot study results were extremely promising. They support the findings of existing research we reviewed and confirm the value of combining mathematics and finance. Our results also suggest that the mathematics teachers are very capable of teaching a course in financial math, even if they have no prior knowledge of financial theory. Furthermore, they imply that high school students

Figure 1. Survey results.



are interested in taking such a course and are able to understand and engage with both the financial and mathematical content.

Encouraged by these results, we continued to offer the course for the following school year (2017–2018), and 8 schools, 12 teachers, and several hundred students enrolled in the course. We have edited our materials based on our findings, enhanced our professional development to accommodate this increased participation, and we will be tracking progress through surveys, e-mail contact, and classroom visits.

Alongside the expansion of our course, these results also suggest it would be worthwhile for other researchers to study the effects of courses that combine mathematics and personal finance. As a promising, but understudied approach to financial education, it deserves further investigation by independent researchers. We hope other financial educators will explore pursuing a similar approach. We are willing to share further information on our course, offer professional development, and share our impact assessment materials with such educators. By researching and perfecting the best practices in financial education, we believe that financial outcomes in the United States can be improved.

References

Aboagye, J., & Jung, J. Y. (2018). Debt holding, financial behavior, and financial satisfaction. *Journal of Financial Counseling and Planning*, *29*(2), 208–218. doi:10.1891/1052-3073.29.2.208

Atanda, R. (1999). Gatekeeper courses. *National Center for Education Statistics*, *1*(1), 33.

Banks, J., & Oldfield, Z. (2007). Understanding pensions: Cognitive function, numerical ability and retirement saving. *Fiscal Studies*, *28*(2), 143–170. doi:10.1111/j.1475-5890.2007.00052.x

Bowen, C. F. (2002). Financial knowledge of teens and their parents. *Journal of Financial Counseling and Planning*, *13*(2), 93–102.

Brown, A., Collins, J.M., Schmeiser, M.D., & Urban, C. (2014). State mandated financial education and the credit behavior of young adults. *FEDS Working Paper*, 2014–68.

Brown, M., Van der Klaauw, W., Wen, J., & Zafar, B. (2016). Financial education and the debt behavior of the young. *The Review of Financial Studies*, *29*(9), 2490–2522. doi:10.2139/ssrn.2334889

Bryk, A. S., & Treisman, U. (2010). Make math a gateway, not a gatekeeper. *Chronicle of Higher Education*, *56*(32), B19–B20.

Cole, S., Paulson, A., & Shastry, G. K. (2014). Smart money? The effect of education on financial outcomes. *The Review of Financial Studies*, *27*(7), 2022–2051. doi:10.1093/rfs/hhu012

Cole, S., Paulson, A., & Shastry, G. K. (2016). High school curriculum and financial outcomes: The impact of mandated personal finance and mathematics courses. *Journal of Human Resources*, *51*(3), 656–698. doi:10.3368/jhr.51.3.0113-5410r1

Council for Economic Education. (2016). *Survey of the States: Economic and personal finance education in our nation's schools*. New York, NY: Author.

Deaton, A. S. (2005). Franco Modigliani and the life cycle theory of consumption. *BNL Quarterly Review*, *58(233 –234)* , 91–107. doi:10.2139/ssrn.686475

Dick, T., & Hollebrands, K. (2011). *Focus in high school mathematics: Technology to support reasoning and sense making*. Reston, VA: National Council of Teachers of Mathematics.

Dong, G. N. (2018). Informal bankruptcy: Health expenditure shocks and financial distress avoidance. *Journal of Financial Counseling and Planning*, *29*(1), 45–59. doi:10.1891/1052-3073.29.1.45

Fernandes, D. S., Lynch, J. G., & Netemeyer, R. G. (2014). Financial literacy, financial education, and downstream financial behaviors. *Management Science*, *60*(8), 1861–1883. doi:10.1287/mnsc.2013.1849

Finke, M. S., Huston, S. J., Siman, E., & Corlija, M. (2005). Characteristics of recent adjustable-rate mortgage borrowers. *Journal of Financial Counseling and Planning*, *16*(2), 17–28.

FINRA Investor Education Foundation. (2013). *Financial capability in the United States: Report of the findings from the 2012 national financial capability study*. Washington, DC: Author.

FINRA Investor Education Foundation. (2016). *Financial capability in the United States: Report of the findings from the 2015 national financial capability study*. Washington, DC: Author.

Friedlander, A. (1998). An excellent bridge to algebra. *The Mathematics Teacher*, *91*(5), 382–383.

Gerardi, K. S., Goette, L. F., & Meier, S. (2010). Financial literacy and subprime mortgage delinquency: Evidence from a survey matched to administrative data. *Federal Reserve Bank of Atlanta Working Paper Series*, *2010-10* , 1–54. doi:10.2139/ssrn.1600905

Griesdorn, T., Lown, J. M., DeVaney, S. A., Cho, S. H., & Evans, D. (2014). Association between behavioral life-cycle constructs and financial risk tolerance of low- to moderate-income households. *Journal of Financial Counseling and Planning*, *25*(1), 27–40.

Hastings, J. S., Madrian, B. C., & Skimmyhorn, W. L. (2013). Financial literacy, financial education, and economic outcomes. *Annual Review of Economics*, *5*(1), 347–373. doi:10.1146/annurev-economics-082312-125807

Hensley, B. J. (2015). Enhancing links between research and practice to improve consumer financial education and well-being. *Journal of Financial Counseling and Planning*, *26*(1), 94–101. doi:10.1891/1052-3073.26.1.94

Hensley, B. J., Jurgenson, J., & Ferris, L. (2017). Combining adult education and professional development best practice to improve financial education teacher training. *Journal of Financial Counseling and Planning*, *28*(1), 33–48. doi:10.1891/1052-3073.28.1.33

Hilgert, M., Hogarth, J., & Beverly, S. (2003). Household financial management: The connection between knowledge and behavior. *Federal Reserve Bulletin*, *89*, 309–322.

Ibbotson, R. G., Milevsky, M., Chen, P., & Zhu, K. (2007). *Lifetime financial advice: Human capital, asset allocation, and insurance*. Charlottesville, VA: Research Foundation of DFA Institute.

Jump$tart Coalition for Personal Financial Literacy. (2015). *National standards in K-12 personal finance education*. Washington, DC: Author.

Lester, F. K. (Ed.). (2007). *Second handbook of research on mathematics teaching and learning: A project of the National Council of Teachers of Mathematics*. Washington, DC: *National Council of Teachers of Mathematics*.

Lusardi, A. (2011). *Americans' financial capability* (Working Paper No. 17103). National Bureau of Economic Research. doi:10.3386/w17103

Lusardi, A., & Mitchell, O. (2011). *Financial literacy and planning: Implications for retirement wellbeing* (Working Paper No. 17078). Cambridge, MA: National Bureau of Economic Research.

Lusardi, A., & Mitchell, O. (2014). The economic importance of financial literacy: Theory and evidence. *Journal of Economic Literature*, *52*(1), 5–44. doi:10.1257/jel.52.1.5

Lusardi, A., Mitchell, O., & Curto, V. (2010). *Financial literacy among the young: Evidence and implications for consumer policy* (Working Paper No. 15352). Cambridge, MA: National Bureau of Economic Research.

Lyons, A. C., Chang, Y., & Scherpf, E. (2006). Translating financial education into behavior change for low-income populations. *Journal of Financial Counseling and Planning*, *17*(2), 27–45.

Markow, D., & Bagnaschi, K. (2005). *What American teens and adults know about economics*. New York, NY: National Council on Economic Education.

McCormick, M. H. (2009). The effectiveness of youth financial education: A review of the literature. *Journal of Financial Counseling and Planning*, *20*(1), 70–83.

Mielitz, K. K. S., MacDonald, M., & Lurtz, M. (2018). Financial literacy education in a work release program for an incarcerated sample. *Journal of Financial Counseling and Planning*, *29*(2), 316–327. doi:10.1891/1052-3073.29.2.316

Nation Center for Educational Statistics. (2012). *Table 46, Number and percentage of public-school students eligible for free or reduced-price lunch, by state: Selected years, 2000-01 through 2010-11*. Retrieved from https://nces.ed.gov/programs/digest/d12/tables/dt12_046.asp

Nation Center for Educational Statistics. (2017a). *Indicator 6 elementary and secondary enrollment*. Retrieved from https://nces.ed.gov/programs/raceindicators/indicator_rbb.asp

Nation Center for Educational Statistics. (2017b). *Indicator 18 college participation rates*. Retrieved from https://nces.ed.gov/programs/raceindicators/indicator_rea.asp

National Council of Teachers of Mathematics. (2014). *Principles to actions: Ensuring mathematical success for all*. Reston, VA: Author.

National Governors Association Center for Best Practices. (2010). *Common core state standards*. Washington, DC: Author.

Navickas, M., Gudaitis, T., & Krajnakova, E. (2014). Influence of financial literacy on management of personal finances in a young household. *Business: Theory and Practice*, *15*(1), 32–40. doi:10.3846/btp.2014.04

Schuchardt, J., Hanna, S. D., Hira, T. K., Lyons, A. C., Palmer, L., & Xiao, J. J. (2009). Financial literacy and education research priorities. *Journal of Financial Counseling and Planning*, *20*(1), 84–95.

Shim, S., Barber, B., Card, N., Xiao, J., & Serido, J. (2010). Financial socialization of first year college students: The roles of parents, work, and education. *Journal of Youth and Adolescence*, *39*(12), 1457–1470. doi:10.1007/s10964-009-9432-x

Szendrey, J., & Fiala, L. (2018). "I think I can get ahead!" Perceived economic mobility, income, and financial behaviors of young adults. *Journal of Financial Counseling and Planning*, *29*(2), 290–303. doi:10.1891/1052-3073.29.2.290

Topcu, A. (2011). Effects of using spreadsheets on secondary school students' self-efficacy for algebra. *International Journal of Mathematical Education in Science and Technology*, *42*(5), 605–613. doi:10.1080/0020739X.2011.562311

Urban, C., Schmeiser, M., Collins, J. M., & Brown, A. (2015). *State financial education mandates: It's all in the implementation*. Washington, DC: FINRA Investor Education Foundation.

Varcoe, K., Martin, A., Devitto, Z., & Go, C. (2005). Using a financial education curriculum for teens. *Financial Counseling and Planning*, *16*(1), 63–71.

Xiao, J. J., & O'Neill, B. (2016). Consumer financial education and financial capability. *International Journal of Consumer Studies*, *40*(6), 712–721. doi:10.1111/ijcs.12285

Xiao, J. J., & Porto, N. (2017). Financial education and financial satisfaction: Financial literacy, behavior, and capability as mediators. *International Journal of Bank Marketing*, *35*(5), 805–817. doi:10.1108/IJBM-01-2016-0009

Xu, X. (2018). Assessing a community-based financial literacy program: A case study in California's Silicon Valley. *Journal of Financial Counseling and Planning*, *29*(1), 142–153. doi:10.1891/1052-3073.29.1.14

Disclosure. The study was funded by Financial Life Cycle Education Corp.

Acknowledgments. We would like to thank the following people for providing indispensable help in the creation of this study: Alysia DaSilva, Colin Healy, David Irwin, Karie Parker-Davidson, Karina Minchuk, Paul Gray, Photeine Anagnostopoulos.