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# Financial literacy: profiling a successful high school outreach program

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**Abstract**

The CFA Society Pittsburgh launched a high school financial literacy campaign resulting in significant improvements in financial behavior, subjective and objective financial knowledge, and self-esteem. Before the campaign, male students and students with higher grade point averages (GPAs) show better objective knowledge. In addition, we find disconnect between actual and perceived financial knowledge. Students exhibited gains in all aspects after completing the program. The subcategories with the lowest pre-survey scores or female students show the greatest improvements in the post-survey. Students with lower GPAs experienced greater improvement in financial behavior and objective knowledge, while higher GPA students improved more in subjective knowledge. 

*JEL classifications:* G53

*Keywords*: Financial literacy; Survey; Outreach; Education

## 1. Introduction

Based on the results of multiple academic studies, a significant lack of financial literacy exists across nearly all demographics. While financial literacy statistics are important, the implications of a lack of financial literacy and numeracy are far reaching due to their impact on financial decisions. As a result, the potential implications of financial literacy and

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numeracy will be explored in depth. In this paper, we demonstrate the effectiveness of introducing a program to improve financial literacy and numeracy for high school students.

According to Remund (2010, p. 278), "Financial literacy is a measure of the degree to which one understands key financial concepts and possesses the ability and confidence to manage personal finances through appropriate, short-term decision-making and sound, long-range financial planning, while mindful of life events and changing economic conditions." To gauge financial literacy, studies use many different knowledge-based questions; however, the overall concepts remain relatively consistent across financial literacy surveys. Three common fundamental financial knowledge concepts include interest rates, inflation, and risk diversification.

Numeracy is an important component of financial literacy that literature often relates to financial behavior. Estrada-Mejia, de Vries, and Zeelenberg (2016, p. 53) define numeracy as "the ability to understand and use numerical information." Numeracy is closely related to multiple aspects of financial decision making.

This study extends prior research on the effectiveness of financial literacy education by providing direct evidence from a financial literacy campaign launched by the CFA Society Pittsburgh. The study is based upon data collected from a financial literacy campaign of 53 high schools, across seven states, during the 2017-2018 academic year. The financial literacy education campaign materials were created using the book *The Missing Semester* (Kabala & Natali, 2013) as the main resource and curriculum. Before starting the course, students were given a pre-survey to test their baseline in four major areas: subjective financial knowledge, financial behavior, objective financial knowledge, and financial self-esteem. Following the completion of the course, students were administered a post-survey to test changes in the four major areas. To anonymously track the progress of students, they were assigned a unique student ID code. The results display significant improvement in all areas of interest. Each area of interest improves at a statistically significant level of at least 5% after the financial literacy campaign, indicating an effective effort at improving financial literacy.

## 2. Literature review

Since the effects of financial literacy are evident and the high percentage of financial illiteracy has been proven, steps must be taken to improve financial literacy. Green and Riddell (2012) analyze data gathered from the Canadian component of the *International Adult Literacy and Life Skills Survey* (IALSS), which sought to measure the skills of adults in Canada. The survey asked skill-based questions that focused upon four cognitive skills: prose literacy, document literacy, numeracy, and problem solving. Regression analysis reveals an increase of 3.4% in literacy and numeracy scores for an additional year of schooling. They also find that completing an extra 4 years of education results in a 24% increase in literacy, which increases a person's literacy from the median to the 80th percentile.

Although understanding financial concepts is vital to financial behavior, possessing high financial self-esteem and confidence is an essential key to successful financial decisions. Using data collected on 12,686 individuals by the U.S. Bureau of Labor Statistics tracked over a 30-year period, Tang and Baker (2016) create four main variables: financial behavior,

self-esteem, objective, and subjective financial knowledge and covariates. Their results indicate a direct and indirect relationship of self-esteem on multiple financial behaviors. As a result, the effect of self-esteem is statistically significant; thus, self-esteem is a factor of financial behavior. Their results indicate that to improve financial behavior, subjective knowledge must be at least a portion of a financial education curriculum because objective knowledge by itself does not have a complete positive impact on financial behavior.

An important facet of self-esteem is the extent to which a person's confidence becomes greater than their actual knowledge. Overconfident individuals have the tendency to overestimate their own knowledge, leading to a higher risk of engaging in costly and risky financial behaviors (Asaad, 2015). Asaad discovers confidence is an important fragment of financial literacy, but also finds that perceived knowledge without actual knowledge increases the risk of suboptimal financial decisions. McCannon, Asaad, and Wilson (2016) conduct a study based on subjects playing an experimental trust game (Berg, Dickhaut, & McCabe, 1995) and completing a risk assessment, background questionnaire, and financial literacy quiz. Results of the risk assessment and financial literacy quiz were decomposed to generate overconfidence as a variable. They find a statistically significant relationship between overconfidence and trusting investments. Although the actual financial literacy in the United States has declined over the past 5 years, Lin, Bumcrot, Ulicny, Lusardi, Mottola, Kieffer, and Walsh (2016) find the percentage of U.S. citizens who have a high-self assessment has actually increased. Thus, efforts to improve financial behavior must address the going-concern of overconfidence.

Recent studies have identified the ability to increase financial literacy through education at the university level. Gerrans and Heaney (2019) study the effects of financial literacy following an undergraduate personal finance course at an Australian University. After completing the course, students showed improvements in both objective and subjective financial literacy.

### *2.1. Gender gap in financial literacy*

Several studies have found the existence of a financial literacy gender gap. In particular, Cupák, Fessler, Schneebaum, and Silgoner (2018) find that women score lower than men on financial literacy, with a more pronounced gap in developed countries. Additionally, Preston and Wright (2019) examine the financial literacy gap in Australia. While the "human capital variables" (age and education) were not significant in explaining the gap, "labor market variables" (including sector and occupation) were significant in explaining the gap. While these findings identify an initial gender gap in financial literacy, Gerrans and Heaney (2019) find female students benefit the greatest from financial literacy education.

## 3. Need for economic education

According to the 2015 National Report Card, financial literacy education in high school is insufficient. On a scale from "A" to "F," twenty-six states received grades of C, D, or F (Pelletier, 2015). An "A" grade (five states) requires the schools to offer a one-semester personal finance course as a graduation requirement. A "B" grade (20 states) requires the schools to include personal finance education within a required course, whether as a stand-

alone course or part of another course. A "C" grade (11 states) requires schools to offer personal finance topics in schools, but does not mandate students take the course. A "D" grade (three states) means that the state has a "modest levels" of personal finance in its academic standards. Finally, an "F" grade (12 states) goes to states with nearly no financial educational requirements, meaning that a student can graduate high school without an introduction to any financial literacy concepts. Because formal education has a statistically significant relationship with literacy and numeracy (Green & Riddell, 2012), the lack of high school financial education is a potential factor of low financial literacy scores.

Although the effects of financial literacy education are highly debated, research conducted by Filbeck and Zhao (2018) illustrates that financial literacy initiatives have a positive impact on both financial knowledge and behavior. They find that teaching financial concepts to high school students had a profound and statistically significant effect on both subjective financial knowledge and financial behavior for the students involved in the survey. Based upon previous research conducted, perceived knowledge may differ from actual knowledge (Asaad, 2015; Lin et al., 2016; McCannon et al., 2016). In addition, Tang and Baker (2016) prove that self-esteem and subjective knowledge have a statistically significant effect on financial behavior. As a result, further research could incorporate subjective education as a piece of the financial initiative, as well as financial knowledge questions that analyze both perceived and actual financial knowledge.

This article extends the work of Filbeck and Zhao by including objective assessments about acquisition of financial knowledge based on educational outreach. Our hypothesis is as follows:

*Hypothesis 1:* The financial literacy outreach program, which targets subjective financial knowledge, financial behavior, objective financial knowledge, and financial self-esteem, will result in statistically significant improvement for participating students.

In our article, we first analyze baseline pre-survey responses in financial behavior, subjective and objective financial knowledge, and self-esteem of high school students participating in a financial literacy outreach program developed by the CFA Society Pittsburgh. We use path analysis to assess the strength of direct and indirect links between these four aspects of financial literacy and other control variables. Next, by comparing matched pre- and post-survey results, we analyze the impact of the financial literacy outreach program in financial behavior, subjective and objective financial knowledge, and self-esteem. We first use a paired $t$ test to compare the matched pre- and post-survey results. Then, we use regression analysis to analyze how the improvements in these four aspects of financial literacy in the post-survey are impacted by control variables.

## 4. Data sample

The CFA Society Pittsburgh has been active in financial literacy outreach since 2010. Over 50 individuals serve on the financial literacy committee, which directs curricular development and training efforts. Each year, representatives from the Society participate in Act

48 training sessions across the state of Pennsylvania as well as offering to provide an hour-long presentation on core financial literacy concepts on request. The number of high schools participating grew rapidly starting in 2015. In 2018, the State Treasurer of Pennsylvania endorsed the program and encouraged all Pennsylvania high schools to participate. That same year, representatives from the CFA Society Pittsburgh led a session for the National Association of State Treasurers in Providence, Rhode Island, in an effort to further expand outreach across more states. The CFA Society Pittsburgh provides participating schools with instructional materials for a semester-long equivalent course based on *The Missing Semester* (Kabala & Natali, 2012). Each school determines the best way to deliver their programs (e.g., weekly for a semester, or daily lessons over fewer weeks). Schools are supplied with PowerPoint resources to accompany the book, along with a web-based portal (available through CFA Society Pittsburgh website) of best practices and exercises, submitted from previous participating schools. In addition, members of the financial literacy committee extend an invitation to present to the students in the classroom for a day. The financial literacy member uses a PowerPoint presentation developed by the financial literacy committee, which gives a broad overview of the main topics discussed within the curriculum, while allowing students to ask questions relating to financial literacy subject material or real-world applications. Committee members and other teachers act as a resource for the participating schools throughout the semester, to provide any assistance or feedback about the curriculum.

For the 2018-2019 school year, a total of 78 high schools, spread across seven states (California, Michigan, New Jersey, Pennsylvania, West Virginia, Wisconsin, and Wyoming) with 173 classes/teachers, were invited to participate in both a pre- and post-survey to examine the effectiveness of financial literacy education. Through our partnership with the CFA Society Pittsburgh, ACT 48 training in Pennsylvania, multiple Intermediate Units, the Pennsylvania State Treasurer, and other connections with individual teachers, we established our subset of participating teachers. We offered each teacher financial literacy materials and access to the CFA Society Pittsburgh portal for free, in exchange for their participation in our survey. After gathering the list of enrolled teachers, we assigned each a unique class code. Links for a pre- and post-surveys were provided to the participating teachers. Within the introductory email, instructors were given directions to assign each student with a unique ID number, allowing pre- and post-surveys to be matched for analysis. Participating schools agreed to administer the presurvey before any instructional delivery. Post-surveys were to be completed within a week after completion of the last instructional unit on financial literacy.

The distributed survey was designed as an extension of the work conducted by Filbeck and Zhao (2018) with the addition of six objective financial knowledge questions. The full pre-survey and post-survey can be found in Appendixes A and B, respectively. Of the original population, 1,613 students from 31 participating schools and two states (Pennsylvania and New Jersey) completed pre-surveys. A total of 1,050 post-surveys were completed by students from 23 schools in Pennsylvania (91.2%) and New Jersey (8.8%).

Table 1 reports the descriptive statistics for the full sample and the test sample. The full sample consists of 1,613 students completing the pre-survey, while the matched test sample includes 829 students who submitted both a pre- and post-survey. The matched sample totals show attrition in the survey process of approximately one-half, despite attempts to minimize

Table 1 Sample description

| | Grade | | | | |
|---|---|---|---|---|---|
| | 9th | 10th | 11th | 12th | Total |
| Panel A. Whole sample | | | | | |
| Male | | | | | |
| English | 4 | 4 | 23 | 64 | 95 |
| Math | 18 | 13 | 59 | 171 | 261 |
| Science | 8 | 20 | 51 | 147 | 226 |
| Social Studies | 24 | 22 | 59 | 171 | 276 |
| Female | | | | | |
| English | 12 | 10 | 47 | 155 | 224 |
| Math | 9 | 14 | 43 | 116 | 182 |
| Science | 6 | 11 | 34 | 170 | 221 |
| Social Studies | 9 | 4 | 22 | 93 | 128 |
| Total | 90 | 98 | 338 | 1,087 | 1,613 |
| Panel B. Test sample | | | | | |
| Male | | | | | |
| English | 3 | 1 | 12 | 31 | 47 |
| Math | 11 | 7 | 33 | 75 | 126 |
| Science | 4 | 14 | 31 | 69 | 118 |
| Social Studies | 12 | 14 | 34 | 84 | 144 |
| Female | | | | | |
| English | 6 | 3 | 27 | 81 | 117 |
| Math | 6 | 8 | 27 | 61 | 102 |
| Science | 1 | 11 | 16 | 82 | 110 |
| Social Studies | 6 | 4 | 15 | 40 | 65 |
| Total | 49 | 62 | 195 | 523 | 829 |

Panel C. School district characteristics

| | | Standard | Percentile | | | | |
|---|---|---|---|---|---|---|---|
| | Mean | deviation | Min | 25 | 50 | 75 | Max |
| Population | 31,522.95 | 35,083 | 6,208 | 11,382 | 18,412 | 37,567 | 148,678 |
| Poverty | 9.6% | 5.9% | 3.3% | 5.9% | 8.2% | 11.3% | 25.8% |
| Pct_college | 29.5% | 14.8% | 11.2% | 16.3% | 29.8% | 41.2% | 57.8% |

*Note:* Number of students across different grade level and different favorite subjects for the whole sample (Panel A) and the test sample (Panel B). Panel C shows the school district characteristics: Population is the population in the school district. Poverty is the poverty rate in the school district. Pct_college is the percentage of residents who have attained bachelor degree or higher.

the loss through a series of six reminder emails to participating teachers during the period of the program. Based on feedback from teachers, failure of students to complete post-surveys were primarily associated with a failure of completion of the financial literary program or a failure of teachers to oversee students in the completion of the post-survey. We also had 221 instances of students filling out post-surveys who previously did not complete a pre-survey. Of the full sample, 1,425 (88%) students are in their junior or senior year; in the test sample, 718 (87%) students are in their junior or senior year. Female students account for approximately 47% in both the full sample and the test sample. Regarding their favorite subjects, students within the full sample favored science (28%) and math (27%), a trend which

continued to the test sample with math and science as the favorite subjects both at 27.5%. Favorite subject is included in our survey to determine whether academic interest area plays a significant role in financial literacy educational outreach.

Appendixes A and B show the pre- and post-survey questions addressed by program participants in order to assess financial knowledge (both objective and subjective questions), financial behavior, and self-esteem. Lusardi and Mitchell (2014) point out that a substantial mismatch exists between individual's self-assessed (subjective) financial knowledge and their actual knowledge. The survey design is consistent with Hastings, Madrian, and Skimmyhorn (2013), who argue that financial literacy should focus on competences that individuals need. The organization of the survey is constructed in a way that assesses the four major keys to financial success: financial self-esteem, perceived (subjective) financial knowledge, financial behavior, and objective financial knowledge with numeracy. The financial behavior and subjective financial knowledge test financial self-esteem and perceived financial knowledge by gauging the student's self-reported understanding.

Questions are broadly categorized into two types: financial knowledge (subjective and objective) and financial behavior. The only difference between pre- and post-survey questions are in the objective financial knowledge questions—the same concepts are tested with different questions. Objective financial knowledge questions are asked in a manner that contains a right or wrong answer. Each objective financial knowledge question contains at least one wrong answer and a choice of "I Don't Know." The questions are based upon five major categories of financial literacy: risk diversification, compound interest, credit, numeracy (interest), and inflation. The questions are analyzed using two methods: correctness and willingness to answer. The first method of correctness assigns a 1 for each correct answer and 0 for any other answer. The second method to measure willingness assigns a 1 for an answer of I Don't Know and 0 for any other answer. The second method is used to measure financial self-esteem as measured by the amount of questions answered with I Don't Know. Improved self-esteem occurs as students become less likely to answer I Don't Know and instead select an answer that could be correct or incorrect, showing greater confidence after completing financial literacy education.

The survey consists of 21 overall questions: four financial behavior, six objective financial knowledge, and 11 subjective financial knowledge. Financial behavior and subjective financial knowledge questions are rated on a 5-point scale ranging from 1 = strongly disagree to 5 = strongly agree. The four financial behavior questions are "I like to save money more than I like to spend it," "I have a checking and/or a savings account," "I have conversations with my parents regarding personal finance," and "I think it is important to contribute to a retirement plan (ex: Roth IRA, 401k, etc.)". Subjective financial knowledge questions involve perceived understanding of financial concepts, and include questions such as "I understand how to establish a financial plan," "I think financial literacy is important for my future," and "I understand the process by which my parents/guardians make financial decisions." The final six objective knowledge questions test financial self-esteem and objective financial knowledge by assessing correctness of answers and willingness to select an answer other than I Don't Know.

## 5. Test results

First, *t* test and path analysis are used to analyze the pre-survey results of the full sample. Following the pre-survey analysis, we run *t* test and regressions to compare pre- and post-survey results within the test sample.

### *5.1. Pre-survey results*

For the *t* test of the pre-survey responses, two student characteristics are present: gender and GPA. Each characteristic divides the full sample into two groups. Gender is broken into a subgroup for females and males. The median GPA of the whole sample divides the students into a higher GPA or lower GPA group.

The response differences between groups are shown in Table 2. The average responses are compared with the individual subgroups of gender and GPA to determine if the characteristics exhibit a statistically significant effect. The gender characteristic identifies the effect of a student being a female versus a male (gender), as well as the effect of a student having a high GPA versus low GPA. The data shows no statistically significant effect of GPA on subjective financial knowledge. However, consistent with Cupák et al. (2018), female students tend to have lower subjective financial knowledge compared with male students (statistically significant at the 1% level). For financial behavior, students with a high GPA tend to be better financially behaved (statistically significant at the 1% level). In objective financial knowledge, females tend to score lower in correctness, while students with high GPAs tend to score higher in correctness (both significant at the 1% level). Similarly, for self-esteem, females tend to answer I Don't Know more often, while students with higher GPAs are less likely to select I Don't Know (both statistically significant at the 1% level).

### *5.2. Pearson correlation and path analysis*

Table 3 reports Pearson correlations between financial behavior and self-esteem (IDK), subjective, and objective financial knowledge. Financial behavior, objective and subjective knowledge are significantly correlated with each other. IDK is significantly negatively correlated with the other three measures of financial literacy, which indicates a positive correlation of self-esteem level and the other three measures of financial literacy. Naturally, due to the setup of the self-esteem measure, we find a $-0.77$ correlation between IDK answers and objective knowledge.

Next, following Tang and Baker (2016), we use path models to analyze the relationship between characteristics and four financial literacy measures. We choose path analysis, as it forces us to specify relationships among all of the independent variables. This results in a model showing causal mechanisms, through which independent variables produce both direct and indirect effects on a dependent variable. All causal relationships between variables must go in one direction only, for path models. To identify the impact, we assign the dependent variable as Behavior (Subjective, IDK), which is the total score for financial behavior questions (subjective questions, objective questions with I Don't Know answers).

Table 2 Differences based on student characteristics: Pre-survey results

| | Average response | Female | Higher GPA |
|---|---|---|---|
| Panel A. Subjective financial knowledge questions | | | |
| 2. I understand how to establish a financial plan. | 3.039 | −0.204*** | −0.023 |
| 3. I think financial literacy is important for my future. | 4.365 | 0.021 | 0.186*** |
| 6. I understand the process by which my parents/guardians make financial decisions. | 3.358 | −0.143*** | −0.093* |
| 7. I know how to determine the appropriate total costs associated with the colleges/universities I am interested in attending. | 3.086 | −0.066 | 0.144** |
| 8. I understand the process by which loan repayments take place including the impact of interest, delinquency and default. | 2.743 | −0.259*** | −0.160** |
| 9. I understand the process by which credit card charges and repayment schedules can impact the level of financial debt levels. | 3.428 | 0.001 | −0.053 |
| 10. When it comes to purchasing a car, I know how to determine how much of a car I can afford. | 3.287 | −0.284*** | −0.259*** |
| 11. I understand how to evaluate the cost-benefit analysis of training for the job I would like to perform after completing school. | 3.015 | −0.219*** | −0.123** |
| 12. I know what a Roth IRA is and how it works from a taxation standpoint. | 1.951 | −0.181*** | −0.095* |
| 13. I know how to create a savings plan based on the ability to estimate monthly living expenses. | 3.148 | −0.167*** | 0.005 |
| 14. I know how to plan financially for retirement. | 2.621 | −0.283*** | −0.050 |
| Total score for subjective financial knowledge | 33.893 | −1.622*** | −0.381 |
| Panel B. Financial behavior questions | | | |
| 1. I like to save money more than I like to spend it. | 3.505 | −0.013** | 0.219*** |
| 4. I have a checking and/or a savings account. | 4.381 | 0.034 | 0.186*** |
| 5. I have conversations with my parents regarding personal finance. | 3.418 | 0.012 | 0.283*** |
| 15. I think it is important to contribute to a retirement plan (ex: Roth IRA, 401k, etc.). | 4.083 | −0.010 | 0.318*** |
| Total score for financial behavior | 14.746 | 0.122 | 1.231*** |
| Panel C. Objective questions (Correct Answers)[a] | | | |
| 1. Is it safer to put your money into one investment or put your money into multiple investments? | 0.619 | −0.124*** | 0.094*** |
| 2. If you invest $100 in a Roth IRA and earn 10% per year for 3 years, how much would it be worth at the end of three years. | 0.289 | −0.108*** | 0.073*** |
| 3. If you use a credit card in January for a total of $300, which payment option will result in the lowest amount of overall interest paid. | 0.493 | −0.075*** | 0.135*** |
| 4. Suppose you decide to buy a BMW for $50,000. If you take out an auto loan for 5 years with 5% interest, how much total will you pay per year? | 0.429 | −0.142*** | 0.167*** |
| 5. In the future, the cost of things you buy doubles AND your income also doubles. How much will you be able to buy in the future in comparison to today? | 0.557 | −0.066*** | 0.173*** |
| 6. Suppose you have $30,000 in student loans. Which payment option would result in the lowest amount of overall interest paid? | 0.530 | −0.054** | 0.235*** |
| Total score for objective questions (Correct Answers) | 2.916 | −0.570*** | 0.877*** |

*(continued on next page)*

Table 2 (Continued)

| | Average response | Female | Higher GPA |
|---|---|---|---|
| Panel D. Objective questions ("I Don't Know" Answers)[b] | | | |
| 1. Is it safer to put your money into one investment or put your money into multiple investments? | 0.263 | 0.121*** | −0.012 |
| 2. If you invest $100 in a Roth IRA and earn 10% per year for 3 years, how much would it be worth at the end of three years. | 0.345 | 0.176*** | −0.086*** |
| 3. If you use a credit card in January for a total of $300, which payment option will result in the lowest amount of overall interest paid. | 0.340 | 0.040* | −0.065*** |
| 4. Suppose you decide to buy a BMW for $50,000. If you take out an auto loan for 5 years with 5% interest, how much total will you pay per year? | 0.295 | 0.137*** | −0.064*** |
| 5. In the future, the cost of things you buy doubles AND your income also doubles. How much will you be able to buy in the future in comparison to today? | 0.186 | 0.052*** | −0.071*** |
| 6. Suppose you have $30,000 in student loans. Which payment option would result in the lowest amount of overall interest paid? | 0.287 | 0.074*** | −0.123*** |
| Total score for objective questions ("I Don't Know" Answers) | 1.717 | 0.599*** | −0.421*** |

*Note:* Shows the differences of pre-survey student responses on financial knowledge and financial behavioral questions across different gender and GPA for the whole sample. Gender is broken into a Sub-group for females and males. The median GPA of the whole sample divides the students as a higher GPA or lower GPA group. The gender characteristic identifies the effect of a student being a female versus a male, as well as the effect of a student having a high GPA versus low GPA.

***, **, * indicate statistical significance at 0.01, 0.05, and 0.10 level, respectively.

[a] Improvement is indicated by a positive difference and *t*-stat (more people selecting the correct answer).

[b] Improvement is indicated by a negative difference and *t*-stat (less people selecting "I Don't Know").

Table 3 Shows the correlation coefficients between financial behavior and self-esteem (IDK answers), objective and subjective financial knowledge

| | Subjective | Behavior | Objective | IDK answers |
|---|---|---|---|---|
| Subjective | | | | |
| Corr | 1.000 | | | |
| *p*-value | | | | |
| Behavior | | | | |
| Corr | 0.334*** | 1.000 | | |
| *p*-value | <0.0001 | | | |
| Objective | | | | |
| Corr | 0.277*** | 0.245*** | 1.000 | |
| *p*-value | <0.0001 | <0.0001 | | |
| IDK answers | | | | |
| Corr | −0.361*** | −0.249*** | −0.771*** | 1.000 |
| *p*-value | <0.0001 | <0.0001 | <0.0001 | |

***, **, * indicate statistical significance at 0.01, 0.05 and 0.10 level, respectively.

Three path models are used to test the effect of financial behavior scores (Behavior), subjective financial knowledge scores (Subjective), and I Don't Know answers in the objective questions (IDK). In all three path models, we include gender (Female), grade level (Sophomore, Junior, and Senior), favorite subject (English, Math, and Science), GPA and favorite learning method (Learning by doing [LBD], Listening, Discussing, and Visual) as independent variables. Control variables LBD, Listening, Discussing, and Visual allow for direct testing of instructional preferences of students which may impact success of the financial literacy program (Amagir, Groot, van den Brink, & Wilschut 2018). Detailed definitions of variables are listed in Appendix C.

Also, to explore whether the school district of participating classes has any effect on the pre-survey results, we include three school district characteristics as control variables. Specifically, for each participating school, we collect its school district census data from https://censusreporter.org/. We exclude private schools, virtual, finance knowledge learning centers, and chartered schools from the whole sample as these schools are hard to determine their school districts. For each public high school, we collect its school district data on its population, poverty rate and percentage of residents who attained bachelor or higher degrees. Also, because the average number of students who participated in the pre-surveys from each school is 20 with a median value of one (ranges from 1 to 225 students per school), we removed school districts with less than 20 student participants. This process reduces our whole sample from 1,613 to 1,441 pre-surveys with available school district data. Summary statistics of school district data are reported in Panel C of Table 1.

Table 4 illustrates the results from these models. Path (1) uses Behavior as the dependent variable. The results show students of higher grade level (sophomore, junior, and senior), with high subjective financial knowledge, higher level of self-esteem, as well as a high GPA, have a higher probability to be better behaved financially. Both the subjective financial knowledge coefficient and self-esteem measure (IDK) are statistically significant at the 1% level, implying that a student who possesses more subjective knowledge and higher self-esteem are more likely to exhibit better financial behavior. On school district characteristics,

Table 4 Regressions on student characteristics: Pre-survey results

| | Path (1) | | Path (2) | | Path (3) | |
|---|---|---|---|---|---|---|
| | Dep. Var.: Behavior | | Dep. Var.: Subjective | | Dep. Var.: IDK | |
| | Coefficient | *t*-Value | Coefficient | *t*-Value | Coefficient | *t*-Value |
| IDK | −0.093 | −3.53*** | −0.330 | −13.43*** | | |
| Objective | 0.010 | 0.38 | 0.032 | 1.18 | | |
| Subjective | 0.296 | 11.91*** | | | | |
| Female | 0.042 | 1.59 | −0.035 | −1.28 | 0.172 | 6.38*** |
| Sophomore | 0.062 | 1.82* | −0.037 | −1.04 | −0.024 | −0.65 |
| Junior | 0.205 | 4.22*** | −0.066 | −1.31 | −0.043 | −0.82 |
| Senior | 0.294 | 5.66*** | −0.074 | −1.36 | −0.133 | −2.37** |
| GPA | 0.150 | 5.72*** | −0.046 | −1.68* | −0.142 | −5.18*** |
| English | −0.024 | −0.80 | 0.039 | 1.27 | 0.036 | 1.12 |
| Math | −0.015 | −0.51 | 0.015 | 0.49 | −0.025 | −0.78 |
| Science | −0.031 | −1.04 | 0.020 | 0.64 | −0.027 | −0.83 |
| LBD | 0.043 | 1.70* | 0.066 | 2.52** | −0.015 | −0.55 |
| Listening | −0.005 | −0.20 | 0.066 | 2.49** | −0.060 | −2.18** |
| Discussing | −0.005 | −0.20 | 0.059 | 2.29** | −0.008 | −0.28 |
| Visual | 0.047 | 1.86* | −0.029 | −1.09 | 0.048 | 1.77* |
| Log(Population) | 0.019 | 0.72 | 0.079 | 2.91*** | −0.038 | −1.34 |
| Poverty | −0.130 | −3.72*** | 0.034 | 0.92 | 0.065 | 1.74* |
| Pct_College | 0.041 | 1.22 | 0.008 | 0.24 | −0.029 | −0.80 |

*Note:* Table 4 Shows the regression results on student characteristics of the whole sample. Behavior (objective, subjective, IDK) is the total score for financial behavior questions (subjective questions, objective questions with correct answers, objective questions with "I Don't Know" answers). Female is a dummy variable that is equal to 1 if the student is a female student and 0 otherwise. Sophomore (junior, senior) is a dummy variable that is equal to 1 if the student is a sophomore (junior, senior), and 0 otherwise. English (math, science) is a dummy variable which is equal to 1 if the student's favorite subject is English (math, science), and 0 otherwise. LBD (listening, discussing, visual) is a dummy variable that is equal to 1 if the student chooses learning by doing (listening, discussing with peers, features visual support) as favorite instruction method, and 0 otherwise. GPA is a student's grade point average. Log(population) is the log of the population in the school district. Poverty is the poverty rate in the school district. Pct_college is the percentage of residents who have attained bachelor degree or higher.

***, **, * indicate statistical significance at 0.01, 0.05, and 0.10 level, respectively.

results show school districts with higher poverty rate are more likely to have worse financial behavior (statistically significant at the 1% level).

The second model (Path 2) uses Subjective (representing the measure for subjective knowledge) as the dependent variable. The results show female students with low GPAs are more likely to have lower subjective financial knowledge. Additionally, students who prefer the learning styles of learning by doing (LBD), listening, or discussing are more likely to exhibit greater subjective financial knowledge (all statistically significant at the 5% level). The negative coefficient of IDK (statistically significant at the 1% level) shows that a student who has higher level of self-esteem is also more likely to be subjectively knowledgeable in finance. The insignificant coefficient of Objective (representing the measure for objective knowledge) shows the positive linkage between subjective and objective financial knowledge, which is consistent to the results of Tang and Baker (2016) who find disconnect between subjective and objective knowledge when comparing actual and perceived financial

knowledge. Students in larger school district are more likely to be more subjectively knowledgeable in finance (statistically significant at the 1% level). One possible explanation for this finding is that students who live in larger school districts may be exposed to more financial knowledge/concepts.

The third model (Path 3) uses IDK (representing the measure of self-esteem) as the dependent variable. Female students exhibit lower self-esteem scores, while junior or senior students who prefer learning by listening are more likely to have higher self-esteem. On school district characteristics, results show school districts with high poverty rate are more likely to have lower level of self-esteem (statistically significant at the 10% level).

Overall, our results are consistent with Tang and Baker (2016) and suggest that self-esteem plays a statistically significant role in each of the remaining three variables being studied: objective knowledge, subjective knowledge, and financial behavior.

The results in Table 4 need to be interpreted with caution due to the possible endogeneity issues among four financial literacy measures and omitted variable problem. We cannot completely rule out the broader theoretical concern of a reverse causality among these variables although our Hausman test statistics for endogeneity cannot reject the null hypothesis of no measurement error. As for omitted variable bias issue, some variables such as subjective knowledge and self-esteem measure may potentially cause omitted variable bias. Future studies can test and expand upon our results by incorporating additional control variables when data are available.

### *5.3. Post-survey results*

We compare the results of the pre- and post-survey using our test sample of 829 matched students. We define improvement in several ways. For subjective financial knowledge and financial behavior, we define gains as the post-survey scores minus the pre-survey response scores. For objective financial knowledge questions, we define gains in financial knowledge as the difference between the post-survey scores and the pre-survey response. To gauge financial self-esteem, we define confidence gains as a decrease in the responses of I Don't Know in the post-survey minus the pre-survey. We run univariate tests on the gains in our test samples and subsamples.

Table 5 illustrates the *t* test results by question and overall score for each of the four characteristics measured: subjective financial knowledge, financial behavior, objective financial knowledge, and financial self-esteem. The results show a profound, statistically significant improvement across all areas measured, with 24 of 25 questions showing total score improvement as statistically significant at the 1% level. As a result, the data shows financial literacy educational efforts can lead to better student results in financial literacy understanding and behavior.

Within subjective financial knowledge, all questions result in statistically significant improvement at the 1% level. The biggest gains come from understanding of Roth IRA (gain of 1.682) and retirement (1.401). Seven of the 12 questions result in a greater than 25% improvement. The biggest gain in financial behavior derives from conversations with parents on personal finance (gain of 0.033). These results closely mirror the research of Filbeck and Zhao (2018), who find the largest growth within the same three questions.

Table 5 *T*-test results between pre- and post-survey

| | Pre | Post | Diff | *T*-stat |
|---|---|---|---|---|
| Panel A. Financial subjective knowledge questions | | | | |
| 2. I understand how to establish a financial plan. | 3.047 | 4.000 | 0.953 | 21.62*** |
| 3. I think financial literacy is important for my future. | 4.391 | 4.692 | 0.280 | 10.30*** |
| 6. I understand the process by which my parents/guardians make financial decisions. | 3.369 | 3.832 | 0.463 | 11.32*** |
| 7. I know how to determine the appropriate total costs associated with the colleges/universities I am interested in attending. | 3.119 | 3.865 | 0.745 | 16.35*** |
| 8. I understand the process by which loan repayments take place including the impact of interest, delinquency and default. | 2.723 | 3.832 | 1.109 | 23.76*** |
| 9. I understand the process by which credit card charges and repayment schedules can impact the level of financial debt levels. | 3.418 | 4.199 | 0.777 | 17.05*** |
| 10. When it comes to purchasing a car, I know how to determine how much of a car I can afford. | 3.258 | 4.150 | 0.893 | 19.83*** |
| 11. I understand how to evaluate the cost-benefit analysis of training for the job I would like to perform after completing school. | 2.998 | 3.877 | 0.878 | 19.25*** |
| 12. I know what a Roth IRA is and how it works from a taxation standpoint. | 1.875 | 3.555 | 1.682 | 32.35*** |
| 13. I know how to create a savings plan based on the ability to estimate monthly living expenses. | 3.110 | 4.148 | 1.036 | 22.41*** |
| 14. I know how to plan financially for retirement. | 2.555 | 3.950 | 1.401 | 28.28*** |
| Total score for financial subjective knowledge | 33.780 | 43.677 | 9.897 | 29.17*** |
| Panel B. Financial behavior questions | | | | |
| 1. I like to save money more than I like to spend it. | 3.531 | 3.809 | 0.279 | 6.97*** |
| 4. I have a checking and/or a savings account. | 4.380 | 4.268 | 0.043 | 1.06 |
| 5. I have conversations with my parents regarding personal finance. | 3.468 | 3.799 | 0.330 | 7.55*** |
| 15. I think it is important to contribute to a retirement plan (ex: Roth IRA, 401k, etc.) | 4.060 | 4.481 | 0.421 | 10.78*** |
| Total score for financial behavior | 14.795 | 16.334 | 1.539 | 13.41*** |
| Panel C. Objective questions (Correct Answers)[a] | | | | |
| 1. Is it safer to put your money into one investment or put your money into multiple investments? | 0.250 | 0.693 | 0.053 | 2.53** |
| 2. If you invest $100 in a Roth IRA and earn 5% per year for 3 years, how much would it be worth at the end of 3 years. | 0.367 | 0.487 | 0.202 | 10.03*** |
| 3. If you use a credit card in January for a total of $500, which payment option will result in the lowest amount of overall interest paid. | 0.351 | 0.729 | 0.245 | 12.55*** |
| 4. 4. Suppose you decide to buy an Audi for $50,000. If you take out an auto loan for 5 years with 5% interest, how much total will you pay per year? | 0.306 | 0.555 | 0.131 | 6.18*** |
| 5. In the future, the cost of things you buy doubles BUT your income remains the same. How much will you be able to buy in the future in comparison to today? | 0.190 | 0.766 | 0.194 | 9.92*** |
| 6. Suppose you have $40,000 in student debt. Which payment option will result in the lowest amount of overall interest paid? | 0.306 | 0.714 | 0.182 | 9.01*** |
| Total score for objective questions (Correct Answers) | 2.936 | 3.944 | 1.007 | 15.88*** |

*(continued on next page)*

Table 5 (Continued)

| | Pre | Post | Diff | *T*-stat |
|---|---|---|---|---|
| Panel D. Objective questions ("I Don't Know" Answers)[b] | | | | |
| 1. Is it safer to put your money into one investment or put your money into multiple investments? | 0.640 | 0.052 | −0.198 | −12.42*** |
| 2. If you invest $100 in a Roth IRA and earn 5% per year for 3 years, how much would it be worth at the end of 3 years. | 0.286 | 0.138 | −0.229 | −12.50*** |
| 3. If you use a credit card in January for a total of $500, which payment option will result in the lowest amount of overall interest paid. | 0.484 | 0.078 | −0.273 | −15.69*** |
| 4. Suppose you decide to buy an Audi for $50,000. If you take out an auto loan for 5 years with 5% interest, how much total will you pay per year? | 0.424 | 0.110 | −0.196 | −10.76*** |
| 5. In the future, the cost of things you buy doubles BUT your income remains the same. How much will you be able to buy in the future in comparison to today? | 0.571 | 0.072 | −0.118 | −7.93*** |
| 6. Suppose you have $40,000 in student debt. Which payment option will result in the lowest amount of overall interest paid? | 0.532 | 0.104 | −0.202 | −11.64*** |
| Total score for objective questions ("I Don't Know" answers) | 1.770 | 0.555 | −1.215 | −18.81*** |

*Note:* Table 5 Shows the *t*-test results of student responses to financial behavior and knowledge questions before and after the financial literacy educational efforts for the test sample.

***, **, * indicate statistical significance at 0.01, 0.05, and 0.10 level, respectively.

[a]Improvement is indicated by a positive difference and *t*-stat (more people selecting the correct answer).

[b]Improvement is indicated by a negative difference and *t*-stat (less people selecting "I Don't Know").

Table 6 *T*-test results between pre- and post-survey for different subsamples

| | Financial behavior | | | Subjective questions | | | Objective questions | | |
|---|---|---|---|---|---|---|---|---|---|
| | Pre | Post | Diff | Pre | Post | Diff | Pre | Post | Diff |
| Panel A. Subsamples by gender | | | | | | | | | |
| Male | 14.797 | 16.246 | 1.449*** | 34.492 | 43.535 | 9.043*** | 3.173 | 4.041 | 0.868*** |
| Female | 14.792 | 16.431 | 1.640*** | 32.987 | 43.835 | 10.848*** | 2.673 | 3.835 | 1.162*** |
| Panel B. Subsamples by grade level | | | | | | | | | |
| Freshman | 14.143 | 15.918 | 1.776*** | 35.694 | 44.082 | 8.388*** | 2.878 | 3.980 | 1.102*** |
| Sophomore | 14.565 | 16.387 | 1.823*** | 34.903 | 43.774 | 8.871*** | 2.887 | 3.952 | 1.065*** |
| Junior | 14.340 | 16.294 | 1.954*** | 33.010 | 44.340 | 11.330*** | 2.782 | 3.970 | 1.188*** |
| Senior | 15.053 | 16.381 | 1.328*** | 33.758 | 43.379 | 9.621*** | 3.006 | 3.930 | 0.924*** |
| Panel C. Subsamples by GPA | | | | | | | | | |
| Lower than median GPA | 14.251 | 16.028 | 1.777*** | 33.749 | 43.375 | 9.625*** | 2.568 | 3.699 | 1.131*** |
| Higher than median GPA | 15.389 | 16.668 | 1.279*** | 33.814 | 44.008 | 10.193*** | 3.339 | 4.211 | 0.872*** |
| Panel D. Subsamples by preferred instructions methods | | | | | | | | | |
| Learning by doing | 14.956 | 16.491 | 1.535*** | 33.738 | 44.002 | 10.263*** | 2.969 | 4.044 | 1.075*** |
| Listening | 14.752 | 16.238 | 1.486*** | 34.227 | 43.467 | 9.240*** | 2.934 | 3.826 | 0.891*** |
| Discussing with peers | 14.756 | 16.261 | 1.505*** | 34.185 | 43.519 | 9.333*** | 2.919 | 3.878 | 0.959*** |
| Features visual support | 14.968 | 16.440 | 1.472*** | 33.680 | 43.984 | 10.305*** | 2.975 | 4.049 | 1.074*** |
| Interactive with websites | 14.667 | 16.262 | 1.596*** | 34.191 | 44.018 | 9.827*** | 3.218 | 4.040 | 0.822*** |
| Panel E. Subsamples by favorite subjects | | | | | | | | | |
| English | 14.494 | 16.165 | 1.671*** | 33.890 | 43.616 | 9.726*** | 2.451 | 3.506 | 1.055*** |
| Math | 15.140 | 16.654 | 1.513*** | 33.675 | 44.333 | 10.658*** | 3.175 | 4.053 | 0.877*** |
| Science | 14.596 | 16.136 | 1.539*** | 33.645 | 43.193 | 9.548*** | 3.061 | 4.013 | 0.952*** |
| Social studies | 14.866 | 16.373 | 1.507*** | 33.876 | 43.569 | 9.694*** | 2.919 | 4.086 | 1.167*** |

*Note:* Shows the *t*-test results of student responses to financial behavior, subjective and objective questions before and after the financial literacy educational efforts for different subsamples.

***, **, * indicate statistical significance at 0.01, 0.05 and 0.10 level, respectively.

Additionally, both objective financial knowledge and self-esteem exhibit statistically significant improvements across the board. The biggest gains from objective financial knowledge are credit (gain of 0.245) and compounding interest (gain of 0.202). The biggest improvements in self-esteem also stem from credit (0.273 improvement) and compounding interest (0.229 improvement). The results show a link between confidence to answer a question (self-esteem) and correctness (objective financial knowledge).

The *t* test analyzes hypotheses related to the objective financial knowledge questions. Students experienced a positive gain in correct responses of 1.007 (statistically significant at the 1% level), which represents an improvement of 34%. Furthermore, the mean total score for the test sample increased to almost four. At a statistically significance level of 1%, we reject null hypothesis and conclude that students are more likely to be more financially knowledgeable after completing financial literacy education.

Additionally, students experience an increase in financial self-esteem, as measured by the amount of questions answered with I Don't Know. Students experienced an improvement in the number of I Don't Know responses of 1.215 (statistically significant at the 1% level), representing an improvement in financial self-esteem to answer the question. As a result, we reject null hypothesis and conclude that students are less likely to answer I Don't Know and have greater confidence after completing financial literacy education.

Table 6 reports the *t* test results for different subgroups, which show statistically significant improvement across all subgroups at the 1% level, indicating a significant improvement after completing the financial literacy program. Within the objective knowledge category, female students and students with low GPAs exhibit greater improvement, a positive sign in learning potential, as these characteristics are more likely to lead to lower initial financial literacy (Tables 2 and 4 findings). Consistent with Gerrans and Heaney (2019), female students experience a greater improvement in financial behavior, financial knowledge, and objective knowledge in comparison to their male peers.

Next, we run regression analysis to examine how student characteristics and other control variables affect their knowledge and behavior gains. Table 7 reports the regression results. Panel A reports the regression results on student characteristics and school district characteristics after controlling for fixed effects of classes. Specifically, the class fixed effects allow the class dummy variable to differ for each class and control for the variations across classes. Because we include school district characteristics as control variables, and these data are the same in the same school district, we cluster the standard errors at the school district level. The dependent variable is Diff_BEHAV (Diff_SUBJ, Diff_OBJ, Diff_IDK), which is the difference between the students' pre- and post-study scores (post- minus pre-) for the financial behavior (subjective, objective) questions. All the other variables are defined the same as in Table 4 and listed in Appendix C. We also add Pre_BEHAV, Pre_SUBJ Pre_OBJ, and Pre_IDK in the regressions to test whether student gains in financial knowledge and behavior are affected by their presurvey knowledge and behavior. A negative coefficient for Diff_IDK indicates an improvement in self-esteem, as it means that students answer I Don't Know less in the post-survey and select more answers that are correct or incorrect. The results show that students who are less knowledgeable or exhibit inferior financial behavior gain most in the study. Similarly, students in school districts with higher poverty experience a statistically significant gain in financial behavior. This finding is encouraging as Kaiser and Menkhoff (2017) indicate that financial education is often less effective for lower (low and lower-middle) income clients (economics) due to lack of relatability to topics such as handling of debt, a fact also noted by Fernandes and Lynch (2014). Our differing results may be attributable to the manner in which the curriculum from the CFA Society Pittsburgh directly addresses relatability in the context of typical, high-school appropriate, smaller cost purchases. Such an approach is consistent with Stolper and Walter (2017) as they point out that the opportunity to relate financial literacy to various demographics in the context of their spending behavioral is key to program success. Female students improve by a greater amount in financial knowledge across both subjective and objective questions. Students in school districts with a higher poverty improve more in financial behavior. Female students are more likely to experience an increase in self-esteem (statistically significant at the 1% level). The improvement is consistent with our findings in Table 6 and the findings of Gerrans and Heaney (2019), which both find that female students benefit more from financial literacy education.

Next, we include other control variables such as favorite subjects and learning style and use fixed effect regressions controlling for classes differences. Because there are no school district data included in these regressions, we cluster standard errors at the class level. Panel B of Table 7 reports the regression results. We use the same dependent variables as in Panel

Table 7 Shows the regression results of the test sample

| | Model (1) | | Model (2) | | Model (3) | | Model (4) | |
|---|---|---|---|---|---|---|---|---|
| | Dep. Var.: Diff_BEHAV | | Dep. Var.: Diff_SUBJ | | Dep. Var: Diff_OBJ | | Dep. Var.: Diff_IDK | |
| | Coefficient | Z-stat | Coefficient | Z-stat | Coefficient | Z-stat | Coefficient | Z-stat |
| Panel A. Regression Results after controlling for fixed effect of classes, with standard errors clustered at school district level | | | | | | | | |
| Intercept | 2.762 | 1.27 | 14.56 | 1.20 | 3.807 | 2.48** | −2.309 | −1.54 |
| Female | 0.341 | 1.57 | 1.812 | 2.10** | 0.287 | 1.66* | −0.435 | −3.01*** |
| Sophomore | 0.336 | 0.73 | 1.152 | 0.41 | 0.006 | 0.02 | −0.216 | −0.54 |
| Junior | 0.186 | 0.55 | 3.100 | 1.40 | 0.070 | 0.28 | −0.183 | −0.55 |
| Senior | −0.431 | −1.55 | 1.766 | 0.82 | −0.047 | −0.15 | −0.029 | −0.08 |
| GPA | −0.315 | −2.02** | 0.723 | 1.39 | −0.096 | −0.93 | 0.128 | 1.19 |
| Log(Population) | −0.153 | −0.79 | −1.147 | −0.77 | −0.245 | −1.55 | 0.093 | 0.53 |
| Poverty | 7.361 | 1.93* | 6.223 | 0.23 | −0.714 | −0.24 | −0.117 | −0.04 |
| Pct_College | 2.419 | 1.23 | 4.490 | 0.33 | −0.028 | −0.02 | 0.067 | 0.04 |
| Panel B. Regression results after controlling for fixed effect of classes, with standard error clustered at class level | | | | | | | | |
| Intercept | 10.349 | 10.40*** | 35.368 | 12.02*** | 2.130 | 5.96*** | 0.891 | 4.03*** |
| Pre_BEHAV | −0.688 | −12.80*** | | | | | | |
| Pre_SUBJ | | | −0.836 | −12.83*** | | | | |
| Pre_OBJ | | | | | −0.647 | −16.23*** | | |
| Pre_IDK | | | | | | | −0.818 | −25.49*** |
| Female | 0.151 | 0.94 | 0.660 | 0.97 | −0.001 | −0.01 | 0.068 | 1.19 |
| Sophomore | 0.538 | 1.16 | 0.074 | 0.04 | −0.031 | −0.10 | −0.307 | −1.39 |
| Junior | 0.360 | 0.66 | 0.846 | 0.59 | 0.099 | 0.51 | −0.116 | −0.63 |
| Senior | 0.254 | 0.56 | −0.222 | −0.16 | −0.036 | −0.18 | −0.056 | −0.30 |
| GPA | 0.256 | 1.87 | 0.444 | 1.44 | 0.199 | 2.00** | −0.173 | −3.73*** |
| English | −0.071 | −0.36 | −0.260 | −0.33 | −0.387 | −2.88*** | 0.297 | 2.08** |
| Math | 0.180 | 0.59 | 0.600 | 0.67 | −0.121 | −0.72 | 0.185 | 2.13** |
| Science | −0.150 | −0.63 | −0.356 | −0.44 | −0.094 | −0.57 | 0.117 | 1.05 |
| LBD | 0.305 | 1.37 | 1.089 | 2.10** | 0.303 | 3.00*** | −0.185 | −1.79* |
| Listening | −0.146 | −0.74 | −0.366 | −0.55 | −0.188 | −1.96** | 0.043 | 0.62 |
| Discussing | −0.111 | −0.45 | −0.351 | −0.51 | −0.105 | −0.78 | 0.083 | 0.99 |
| Visual | 0.107 | 0.61 | 0.821 | 1.45 | 0.250 | 2.24** | −0.116 | −1.39 |

*Note:* Panel a reports the regression results on student characteristics and school district characteristics after controlling for fixed effect of classes, with standard errors clustered at the school district level. Panel B reports the regression results on student characteristics after controlling for fixed effect of classes, with clustered standard errors. Pre_BEHAV (pre_SUBJ, pre_OBJ, pre_IDK) is the student's total score for the financial behavior (knowledge, objective) questions. Diff_BEHAV (diff_SUBJ, diff_OBJ, diff_IDK) is the difference between the student's pre- and post-survey scores for the financial behavior (knowledge, objective) questions. Female is a dummy variable which is equal to 1 if the student is a female student, and 0 otherwise. Sophomore (junior, senior) is a dummy variable which is equal to 1 if the student is a sophomore (junior, senior), and 0 otherwise. English (math, science) is a dummy variable which is equal to 1 if the student's favorite subject is English (math, science), and 0 otherwise. LBD (listening, discussing, visual) is a dummy variable which is equal to 1 if the student chooses learning by doing (listening, discussing with peers, features visual support) as favorite instruction method, and 0 otherwise. GPA is a student's grade point average. Log(population) is the log of the population in the school district. Poverty is the poverty rate in the school district. Pct_college is the percentage of residents who have attained bachelor degree or higher.

***, **, * indicate statistical significance at 0.01, 0.05 and 0.10 level, respectively.

A. We also add Pre_BEHAV, Pre_SUBJ Pre_OBJ, and Pre_IDK in the regressions to test whether student gains in financial knowledge and behavior are affected by their pre-survey knowledge and behavior. The results show that students who are less knowledgeable or exhibit inferior financial behavior gain most in the study. Students whose favorite instruction method is learning by doing tend to gain more in subjective financial knowledge. Students with a high GPA, whose favorite subject is not English, whose favorite instruction method is learning by doing or visual tend to gain more in objective financial knowledge. students with lower self-esteem gain the largest amount of self-esteem. Additionally, students with higher GPA and students that prefer learning by doing experience the largest self-esteem gain (statistically significant at the 1% and 10% level, respectively).

## 6. Conclusions

This research study investigates the effectiveness of a high school financial literacy campaign to significantly improve financial literacy in four areas: subjective financial knowledge, financial behavior, objective financial knowledge and self-esteem. The financial literacy campaigns within the study were launched by the CFA Society Pittsburgh based upon the book *The Missing Semester*.

Initially, the result of the pre-survey, taken by students before beginning the financial education program, are analyzed using a *t* test. The results show students with higher GPAs are more likely to display better financial behavior and objective financial knowledge than students with lower GPAs. Students with lower GPAs exhibit greater perceived knowledge (subjective financial knowledge) in the concepts of loans and cost-benefit analysis; however, the same students exhibit lower actual knowledge (objective financial knowledge) in the same categories. This finding is consistent with previous literature that shows a disconnect between actual and perceived knowledge, as well as a connection between poor financial understanding and negative debt implications (e.g., higher debt and higher borrowing costs). Similarly, male students are more likely to exhibit better objective financial knowledge, while female students are more likely to exhibit lower financial self-esteem.

Subsequently, logistic regressions test the relationship of subjective financial knowledge, financial behavior, and objective financial knowledge. The results further display the link between gender and initial financial knowledge, as females score lower on pre-survey objective and subjective financial knowledge. In addition, higher GPA has a statistically significant effect on better financial behavior and objective financial knowledge, but worse subjective knowledge, reinforcing the findings about the disconnect between actual and perceived knowledge. Furthermore, self-esteem is shown to play a statistically significant impact on both actual and perceived knowledge. Students with higher self-esteem exhibit higher financial behavior, subjective financial knowledge, and objective financial knowledge (significant at the 1% level), signifying that self-esteem is an important part of the financial literacy equation. Additionally, the initial positive link between objective and subjective financial knowledge is eliminated when we added the additional regression variable, self-esteem, which further emphasizing the importance of self-esteem. This finding is consistent

with Tang and Baker (2016), which introduces the importance of self-esteem on financial behavior. Students in school districts with lower income levels exhibit lower financial behavior and objective financial knowledge, while students in school districts with smaller populations score higher in subjective financial knowledge.

To test the effectiveness of the financial literacy program, we then conducted a *t* test between results of the pre- and post-survey, taken after completion of the course. The *t* test analyzes the four major topic areas previously listed. Total scores for financial behavior, subjective knowledge, objective knowledge, and self-esteem improve by 29.3%, 10.4%, 34.3%, and 68.6%, respectively. Students experience a statistically significant improvement of an average 35.7% in all four topic areas at the 1% level. Within subjective financial knowledge, the largest gains result from the concepts of Roth IRA and planning for retirement. Financial behavior shows the largest improvement in having personal finance conversations with parents. Objective financial knowledge and self-esteem improve the most for the concepts of compound interest and credit.

Overall, the characteristics with the lowest pre-survey scores show the greatest improvements in the post-survey scores. Within gender, females exhibit the highest improvement in all four of the categories. Also, students with lower GPAs experience greater improvement in financial behavior and objective knowledge, while students with higher GPAs improve more in subjective knowledge. Students who prefer learning by doing and visual support experience the most improvement, while students whose favorite subject is English or social studies experience the largest improvement.

Based upon the analysis, statistically significant gains in subjective financial knowledge, financial behavior, objective financial knowledge, and financial self-esteem lead us to the conclusion that the CFA Society Pittsburgh financial literacy program is successful at increasing students' chances of financial success. Therefore, the analysis shows the program continues to be successful at attempting to confront the financial literacy crisis. As the program continues to improve and expand, we look forward to expanding the sample size and reach of the financial literacy efforts, especially to states where students may receive no mandated financial education during high school. As financial analysts, society will increasingly be looking to our profession to reduce the impact of financial illiteracy and to make a positive difference in our fiduciary duties for investor education.

Our study has obvious limitations. First, we do not control for the manner in which content is presented in the classroom—does it make a difference whether the program is spread out over an entire system or conducted in longer sessions over a shorter time period. We also do not control for the number of hours spent delivering the content. Future research efforts will focus differences in program delivery. Additionally, we did not introduce a true control group for comparison, as we did not want to jeopardize the main purpose of our program, giving students the tools for a better financial future, just to provide a control group.

Our primary recommendation, based on the experience of CFA Society Pittsburgh, is for financial professionals to consider taking a more active role in financial literacy outreach. Who better to lead these efforts than those who are trained to understand its importance?

## Appendix A: Presurvey

State:
School:
Teacher:
Student ID:
Gender:
GPA:
Grade:

Favorite subject in school:

____ English
____ Math
____ Social Studies
____ Science

Questions:

1. I like to save money more than I like to spend it.
2. I understand how to establish a financial plan.
3. I think financial literacy is important for my future.
4. I have a checking and/or a savings account.
5. I have conversations with my parents regarding personal finance.
6. I understand the process by which my parents/guardians make financial decisions.
7. I know how to determine the appropriate total costs associated with the colleges/universities I am interested in attending.
8. I understand the process by which loan repayments take place including the impact of interest, delinquency and default.
9. I understand the process by which credit card charges and repayment schedules can impact the level of financial debt levels.
10. When it comes to purchasing a car, I know how to determine how much of a car I can afford.
11. I understand how to evaluate the cost-benefit analysis of training for the job I would like to perform after completing school.
12. I know what a Roth IRA is and how it works from a taxation standpoint.
13. I know how to create a savings plan based on the ability to estimate monthly living expenses.
14. I know how to plan financially for retirement.
15. I think it is important to contribute to a retirement plan (ex: Roth IRA, 401k, etc.)

Learning Preferences: I am able to master material when instruction includes:

1. Learning by doing/manipulating objects
2. Listening
3. Discussing with peers
4. Features visual support (e.g., powerpoint slides)
5. Interactive with websites

Objective Questions:

1. Is it safer to put your money into one investment or put your money into multiple investments?

   a. One Investment
   b. Multiple Investments
   c. I Don't Know*

2. If you invest $100 in a Roth IRA and earn 10% per year for 3 years, how much would it be worth at the end of three years.

   a. More than $130
   b. Exactly $130
   c. Less than $130
   d. I Don't Know*

3. If you use a credit card in January for a total of $300, which payment option will result in the lowest amount of overall interest paid.

   a. The Full Amount ($300)
   b. The Minimum Payment Required
   c. Paying nothing ($0)
   d. I Don't Know*

4. Suppose you decide to buy a BMW for $50,000. If you take out an auto loan for 5 years with 5% interest, how much total will you pay per year?

   a. More than $10,000
   b. Exactly $10,000
   c. Less than $10,000
   d. I Don't Know*

5. In the future, the cost of things you buy doubles AND your income also doubles. How much will you be able to buy in the future in comparison to today?

   a. Less
   b. The Same
   c. More
   d. I Don't Know*

6. Suppose you have $30,000 in student loans. Which payment option would result in the lowest amount of overall interest paid?

   a. 10 years at $350 per month

b. 15 years at $270 per month
c. 20 years at $230 per month
d. I Don't Know*

*Survey respondents were required to answer the question, so I Don't Know answer allows students to select non correct/incorrect answer

## Appendix B: Post-survey

State:
School:
Teacher:
Student ID:

Questions:

1. I like to save money more than I like to spend it.
2. I understand how to establish a financial plan.
3. I think financial literacy is important for my future.
4. I have a checking and/or a savings account.
5. I have conversations with my parents regarding personal finance.
6. I understand the process by which my parents/guardians make financial decisions.
7. I know how to determine the appropriate total costs associated with the colleges/universities I am interested in attending.
8. I understand the process by which loan repayments take place including the impact of interest, delinquency and default.
9. I understand the process by which credit card charges and repayment schedules can impact the level of financial debt levels.
10. When it comes to purchasing a car, I know how to determine how much of a car I can afford.
11. I understand how to evaluate the cost-benefit analysis of training for the job I would like to perform after completing school.
12. I know what a Roth IRA is and how it works from a taxation standpoint.
13. I know how to create a savings plan based on the ability to estimate monthly living expenses.
14. I know how to plan financially for retirement.
15. I think it is important to contribute to a retirement plan (ex: Roth IRA, 401k, etc.)

Learning Preferences: I am able to master material when instruction includes:

1. Learning by doing/manipulating objects
2. Listening
3. Discussing with peers
4. Features visual support (e.g., powerpoint slides)
5. Interactive with websites

Objective Questions:

1. Which is less risky: Investing your money into one investment or multiple investments?

   a. One Investment
   b. Multiple Investments
   c. I Don't Know*

2. If you invest $100 in a Roth IRA and earn 5% per year for 3 years, how much would it be worth at the end of three years.

   a. More than $115
   b. Exactly $115
   c. Less than $115
   d. I Don't Know*

3. If you use a credit card in January for a total of $500, which payment option will result in the lowest amount of overall interest paid.

   a. The Full Amount ($500)
   b. The Minimum Payment Required
   c. Paying nothing ($0)
   d. I Don't Know*

4. Suppose you decide to buy a Audi for $50,000. If you take out an auto loan for 5 years with 5% interest, how much total will you pay per year?

   a. More than $10,000
   b. Exactly $10,000
   c. Less than $10,000
   d. I Don't Know*

5. In the future, the cost of things you buy doubles BUT your income remains the same. How much will you be able to buy in the future in comparison to today?

   a. Less
   b. The Same
   c. More
   d. I Don't Know*

6. Suppose you have $40,000 in student debt. Which payment option will result in the lowest amount of overall interest paid?

   a. 10 years at $450 per month
   b. 15 years at $365 per month

c. 20 years at $315 per month
d. I Don't Know*

*Survey respondents were required to answer the question, so I Don't Know answer allows students to select non correct/incorrect answer

## Appendix C: Variable definitions

| | |
|---|---|
| Dependent variables | |
| Subjective | Total score for the financial subjective questions in the survey |
| Objective | Total score for the financial objective questions in the survey with correct answers |
| Behavior | Total score for the financial behavior questions in the survey |
| IDK | Total score for the financial objective questions in the survey with "I don't know" answers |
| Diff_Subj | The difference between the students' pre- and post-study scores (post minus pre) for the financial subjective questions. |
| Diff_Obj | The difference between the students' pre- and post-study scores (post minus pre) for the financial objective questions with correct answers. |
| Diff_Behav | The difference between the students' pre- and post-study scores (post minus pre) for the financial behavior questions. |
| Diff_IDK | The difference between the students' pre- and post-study scores (post minus pre) for the financial objective questions with "I don't know" answers. |
| Independent variables | |
| Gender: | |
| Female | A dummy variable which is equal to 1 if the student is a female, and 0 otherwise. |
| Grade level: | |
| Sophomore | A dummy variable which is equal to 1 if the student is a sophomore, and 0 otherwise. |
| Junior | A dummy variable which is equal to 1 if the student is a junior, and 0 otherwise. |
| Senior | A dummy variable which is equal to 1 if the student is a senior, and 0 otherwise. |
| Favorite subject: | |
| English | A dummy variable which is equal to 1 if the student's favorite is English, and 0 otherwise. |
| Math | A dummy variable which is equal to 1 if the student's favorite is Math, and 0 otherwise. |
| Science | A dummy variable which is equal to 1 if the student's favorite is Science, and 0 otherwise. |
| Favorite learning style: | |
| LBD | A dummy variable which is equal to 1 if the student's favorite learning style is learning by doing (LBD), and 0 otherwise. |
| Listening | A dummy variable which is equal to 1 if the student's favorite learning style is listening, and 0 otherwise. |
| Discussing | A dummy variable which is equal to 1 if the student's favorite learning style is discussion, and 0 otherwise. |
| Visual | A dummy variable which is equal to 1 if the student's favorite learning style is visualization, and 0 otherwise. |
| GPA: | |
| GPA: | A student's grade point average (GPA). |
| School district characteristics: | |
| Log(Population) | The log of the population in the school district. |
| Poverty | The poverty rate in the school district. |
| Pct_College | The percentage of residents who have attained bachelor degree or higher. |

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