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Financial literacy during a pandemic: Does modality matter?

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Abstract

We compare the performance of financial literacy programs launched by the CFA Society Pittsburgh in residential settings (2017–2019) with virtual/hybrid programs during the COVID-19 pandemic (2020-2021). Pretest baseline knowledge assessment shows that female students scored lower on subjective and objective financial knowledge questions and self-esteem. However, the global pandemic did not impact the effectiveness of programs based on modality. Students experienced a statistically significant improvement in all four assessment areas of financial literacy. The largest gains in subjective and financial knowledge center on retirement planning. Objective knowledge and self-esteem improvements occur most in credit and inflation. Female students experience more significant gains in subjective knowledge, objective knowledge, and self-esteem.

JEL classifications: G53

Keywords: Financial literacy; Survey; Outreach; Education; Teaching modality

1. Introduction

The state of financial literacy and numeracy worldwide is in distress. Academic studies affirm a significant lack of financial literacy exists across nearly all demographics. While financial literacy statistics are important, the implications of financial literacy and numeracy are far-reaching due to their impact on financial decisions. Financial literacy measures the degree to which one understands critical financial concepts and possesses the ability and

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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.

The COVID-19 pandemic dominated headlines throughout 2020 and into 2021. High school teachers had to rapidly transform in-class content delivery into modalities that included synchronous and asynchronous online instruction. At-risk students were most likely to have limited access to the internet and technology to participate fully. Many high schools with financial literacy components in their curriculum had to postpone such instruction to ensure coverage of the core subject matter. This study extends prior research on the effectiveness of financial literacy education by comparing the in-person effectiveness of a financial literacy campaign launched by the CFA Society Pittsburgh during 2017–2019 with online/hybrid instruction during 2020-2021. Online/hybrid programs are defined as those that contain at least some virtual learning component to those programs that are delivered completely in an in-person environment.

We conduct pretests to assess baseline knowledge for program participants before the program administration. Overall, pretest results from financial literacy programs before and during the pandemic show no overall differences regarding baseline financial literacy subjective knowledge. However, we observe gender differences across pre-surveys as female students scored lower than male students on subjective and objective financial knowledge. Females also exhibited lower self-esteem. Following the program administration, we conduct posttests to assess gains in financial literacy due to the program. Both male and female students experienced a statistically significant improvement in subjective and objective knowledge, behavior, and self-esteem. The most significant gains in subjective and financial knowledge center on retirement planning. Objective knowledge and self-esteem improvements occur most in credit and inflation. Female students experience greater gains in subjective and objective knowledge, and self-esteem than their male peers.

Students in both modalities experienced a statistically significant improvement in subjective and objective knowledge, behavior, and self-esteem. There is no statistical difference in improvements between modalities except in financial behavior. The following section outlines existing literature and our hypotheses, followed by sample and methodology, results, and conclusions.

2. Literature review

2.1. Financial literacy

Financial literacy is critical because the knowledge and skills enable the proper use, accumulation, increase, and management of incomes while directly affecting countries' economies. In context, financial literacy refers to the knowledge of financial concepts and applications that are vitally important in everyday life (Semercioglu & Akcay, 2016). Financial literacy programs primarily aim to understand individuals' financial knowledge

better. Semercioglu and Akcay conclude that low-level financial literacy across numerous countries is associated with a lack of financial training for individuals in their traditional education experience.

The United States offers an example of a financial literacy system needing improvement. Only 49% of Americans with a college education can answer basic questions regarding financial literacy (Faulkner, 2017). Faulkner believes that the observed lack of financial literacy is positively correlated because household spending in the United States has consistently ranked among the highest globally. Essentially, lower financial literacy contributes to the higher spending habits of individuals. Additionally, the average savings rate in the United States has hovered around 5%, while the recommended level according to the U.S. Bureau of Economic Analysis is often double this value (Faulkner, 2017).

Henager and Cude (2016) note increased academic research focusing on financial literacy and renewed interest in financial education and related policy since the mid-2000s driven by an increase in school-based financial education programs. In addition, an increase in state mandates for financial education in high schools and the creation of entities (e.g., the Financial Literacy and Education Commission and the Consumer Financial Protection Bureau) addressing financial literacy illustrate an increase in attention to improving financial literacy across the country. Henager and Cude consider how financial knowledge correlates with short-term and long-term behavior segmented by age group. They discovered a positive correlation between financial literacy and short-term and long-term financial behavior. An example of short-term financial behavior is paying your monthly bills on time, while long-term behavior could be saving for retirement. De Beckker, De Witte, and Van Campenhout (2021) note that financial education does not result in better customer choices, despite demonstrating improvements in financial literacy.

One purpose of implementing financial literacy programs across high schools is to increase students' knowledge of basic financial concepts and make smarter financial decisions as an adult. Brown, Grigsby, Van Der Klaauw, Wen, and Zafar (2016) consider the effects of exposure to financial training on early adults' debt outcomes based on their high school's inclusion of financial literacy training. Brown et al. analyze large-scale changes in financial training exposure using a sample of young Americans and their debt behaviors over the decade immediately following high school training to see if financial trading has had any positive impact on their behavior. They find that financial and quantitative education during high school has moderate implications for young adults' financial decisions aged 19 to 29.

Digital financial literacy (DFL), the education of financial literacy through digital platforms, is likely to become an increasingly important aspect of education, especially in a post-COVID-19 world. This transition means individuals can become more responsible for their financial planning, including retirement and other goals (Morgan, Huang, & Trinh, 2019) via a digital learning environment. Since the early 2000s, many technological advances have emerged across the globe that have impacted several countries' structures, yet various educational systems have not adequately adapted to a digital learning environment. Financial technology (fintech), using software, applications, and digital platforms to deliver financial services to consumers and businesses through digital devices such as smartphones, has become recognized as a promising tool to promote financial inclusion. Inclusion

involves necessary access to financial products and services provided to excluded households and small firms.

FinTech is revolutionizing the financial services industry at a very rapid pace. Views differ regarding the likely impact that FinTech is expected to have on personal financial planning, well-being, and societal welfare (Panos & Wilson, 2020). Many scholars have one question whether the implementation of FinTech in the high school curriculum will have a material effect on students' improvement of financial knowledge. They argue that financial literacy research should make financial education more effective through improved content design and delivery. The disadvantage of enabling a more user-friendly and easily accessible program online is that students might develop misconceptions of specific topics more often than if they were engaged in an in-person program. For instance, Panos & Wilson indicate that students had a persistent misunderstanding of the risk/reward tradeoff with derivatives, more so than any other topic due to the program's online nature. If enough student participants form this misconception, then a possibility exists that other misconceptions related to basic financial knowledge could emerge. However, van Alten, Phielix, Janssen, and Kester (2019) find that in flipped classroom settings in which students are required to watch online videos, students achieved significantly higher assessed learning outcomes than students in traditional classrooms, assuming face-to-face class time was not reduced compared to non-flipped classrooms. Their study did not have any direct evidence of differences. Noetel, Griffith, Delaney, Sanders, Parker, del Pozo Cruz, and Lonsdale (2020) find that substituting video for existing teaching methods leads to smaller improvements in student learning. In contrast, videos as a supplementary teaching tool led to stronger learning benefits.

Wolla (2017) reports that FDIC research indicates that 80% of the states in the United States have currently adopted some form of personal finance education standard, up from 42% in 1998. While the numbers show an improvement, these states do not mandate financial education. With only 29.7% of schools offering financial education, the student's need for financial education is not adequately satisfied. Wolla, a member of the Federal Reserve Bank of St. Louis, notes that one of its resources, *Soar to Savings*, provides an online learning module that teaches essential personal finance and economics concepts. With a sample of 3,061 sets of pretest and post-test scores of students across 100 schools, Wolla concludes that a statistically significant improvement exists in scores from both the overall student results and the school results. Overall, the results confirm that the paired samples at both levels indicate that the *Soar to Savings* online module effectively increases financial knowledge among high school students.

Although traditional printed materials and in-person classroom-style workshops are most prevalent, technological advances have created online financial education opportunities in recent years (Kim, Russell, & Schroeder, 2017). Government studies, however, show that Wolla's (2017) findings are not broadly applied to all schools since most of the schools do not include online modules. While programs such as the *Soar to Savings* online module are gaining momentum in high schools, authors often omit relevant research and theoretical frameworks to develop such programs. Kim et al. show an imbalance of the benefits provided by online financial literacy programs.

While Wolla (2017) and Panos and Wilson (2020) show evidence in favor of students' increase in financial knowledge after financial literacy programs, other studies question the

methodological rigor and whether the "improvement" of student knowledge diminishes over time. Kim et al. (2017) argue that Wolla's findings that programs do not adequately measure the students' knowledge retention after the post-test was completed. A key implication described by Kim et al. is that many financial education programs, such as *Soar to Savings*, lack an explicit theory to frame information delivery. This lack of framework explains why students lose retention of learned financial concepts over time.

Technology is integrated into everyday life, and offering online financial education may offer alternative and innovative ways to reach broader audiences. However, this process requires more than just publishing previously printed materials online. Financial educators and practitioners should design effective and interactive online programs and tools that build knowledge, facilitate improved financial decision-making, and foster positive behavior change.

Kim et al. (2017) provide several recommendations to incorporate financial concepts into the school curriculum. First, teachers can use online tools and resources to extend in-person educational encounters by allowing for more flexibility and frequency between student and teacher. These digital resources can provide a more accessible way for students to get involved in the program. Educators can also create websites that offer tools, lectures, webinars, videos, downloadable documents, activities, worksheets, and other resources for "on-demand" learning, which would be especially useful for schools that offer financial education programs as an extracurricular activity. Second, standalone online educational programs should be tailored to specific financial behaviors and audiences. Targeted programs (e.g., programs derived from surveys of student populations or social media campaigns for specific user groups) may be more effective than general financial education. Third, multiple modalities such as blogs, online games, chatrooms, and smartphone apps could be employed by teachers to accommodate a range of various learning styles, which should increase students' overall engagement with the program. Fourth, educators should structure programs with reminders, alerts, and prompts to help students monitor their progress and keep them engaged throughout the program's entire duration.

Cameron, Calderwood, Cox, Lim, and Yamaoka (2014) suggest that younger generations are poorly prepared for making potentially life-changing financial decisions. The previous research provides multiple opportunities to enhance financial education programs to increase individuals' overall financial literacy knowledge. However, the most notable two findings are related to the modality (online/hybrid vs. in-person) and the program's length. First, assuming the research discussed remains true, individuals enrolled in more extended financial education programs tend to retain more concepts as time passes. Continual education improves students' cognitive understanding and increases their financial attitude and application of financial concepts with everyday life. Secondly, newer research conducted by Panos and Wilson (2020), Wolla (2017), and Kim et al. (2017) shows that online modules are effective in increasing students' short-term financial literacy. Although each question whether the modules have a lasting impact on their financial cognitive ability similar to what in-person education programs show. Therefore, creating more extended financial education programs with the flexibility of in-person or online modules can provide the most efficient form of increasing students' overall financial attitude, behavior, and literacy.

In this study, we investigate two issues: First, we compare the effectiveness of the CFA Society Pittsburgh's financial literacy program under a model of in-person instruction

(2017–2019) and virtual/hybrid instruction (2020-2021). Second, we explore whether gender differences exist in in-person versus virtual/hybrid instruction effectiveness. We create pre- and post-surveys to assess four key factors of financial success: self-esteem, perceived (subjective) knowledge, behavior, and objective numeracy. The surveys reflect the work of Filbeck, Zhao, and Pettner (2020), which were motivated by previous works by Lusardi and Mitchell (2008, 2011) and Lusardi, Mitchell, and Curto (2010).

The in-person instruction data are collected during 2017-2019, while the virtual/hybrid instruction data are during 2020-2021. This paper extends work done by Filbeck et al. (2020) by including a teacher survey to assess the modality of the courses taught in 2020-2021. Our hypotheses are as follows:

H1: The virtual/hybrid implementation of financial literacy education will significantly differ in students' performance compared to in-person learning.

H2A: Male students have better financial literacy in all four key areas before the survey in both modalities.

H2B: Female students will show a greater improvement in knowledge, at the statistically significant level, across both modalities than male students.

Based on the previous research, the first hypothesis statement should hold for the sample students in this survey. First, if the hypothesis holds true, in-person financial education programs will prove more efficient than a virtual/hybrid instruction mode. The hypothesis aligns with Amagir et al.'s (2018) research, which finds that person-to-person financial education is positively associated with higher financial knowledge scores from their survey. Additionally, Panos and Wilson (2020) find in their research that virtual/hybrid modes of financial education courses failed to teach students in certain financial topics, stating a lack of direct student-to-teacher contact as the vital reason. These financial topics test students in their objective and subjective financial knowledge.

Our hypothesis H2A builds on prior research that has found 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. One possible explanation for gender differences is how females respond to financial literacy questions compared to males. Lusardi and Mitchell (2014) indicate that females are disproportionately more likely than males to respond to a question with "I don't know." Bucher-Koenen, Lusardi, Alessie, and van Rooij (2017) find that females tend to give themselves lower scores in self-assessed knowledge. They conclude that "I don't know" reflects not simply the lack of knowledge but rather the lack of confidence in their possessed knowledge.

Riener and Wagner (2017) find that girls are more likely to skip questions ("I Don't Know") than boys if they deem them difficult. They find differences cease when extrinsic rewards are provided. They argue that their findings are consistent with a stereotype threat explanation. Support for a stereotype threat explanation hinges on the disappearance of the gender gap when the task's difficulty is made less salient. The quantitative nature of

financial literacy may also offer a possible explanation for females skipping questions. Saygin and Atwater (2021) find that female test-takers skip significantly more questions than males in quantitative areas, while no differences exist in nonquantitative areas. Overall, in-person classes would increase students' financial knowledge and behavior, ultimately improving financial success and responsibility.

Our hypothesis H2B builds on the arguments that females and males would show a statistically significant difference in learning with virtual/hybrid courses than in-person, with females showing a more significant improvement in financial knowledge than males. Pangestu and Karnadi (2020) and Gerrans and Heaney (2019) support this hypothesis by concluding in their research that, since women are building from a lower financial literacy base, a more significant improvement is observed when compared to men's improvement.

3. Sample and methodology

The CFA Society Pittsburgh has been active in financial literacy outreach for over a decade, with a financial literacy committee charged with curricular development and training. Financial literacy leaders conduct Act 48 training sessions in several Pennsylvania locations and deliver hour-long presentations on core financial literacy concepts as requested. The CFA Society Pittsburgh provides participating high schools with instructional materials for a semester-long equivalent course based on *The Missing Semester* (Kabala & Natali 2012) and *The Missing Second Semester* (2020). Schools voluntarily participate and deliver their programs based on their schedule. Participating teachers are supplied with PowerPoint resources to accompany the book, along with a web-based portal (available through the CFA Society Pittsburgh website) of best practices and exercises submitted from previous participating schools. Program participation is open to any high school. Each school determines the nature of program delivery, which ranges from within the context of a subject class (such as math) or as a standalone unit. The teachers decide at what point in high school to offer the programs. In most cases, programs are delivered as for-credit courses.

After gathering the list of enrolled teachers, we assigned each a unique class code. Links for pre- and post-surveys were provided to the participating teachers. In the introductory email, instructors were given directions to assign each student a unique ID number, allowing pre- and post-surveys to be matched for analysis. Participating schools agreed to administer the pre-survey before any instructional delivery. Post-surveys were completed within a week after completing the last instructional unit on financial literacy.

The participants of surveys that study the effectiveness of financial literacy education consisted of 2,297 students (1,622 in 2017-2019 and 675 in 2020-2021) across 108 schools (79 in 2017-2019 and 29 in 2020-2021). This sample is labeled the "whole sample." A description of each survey follows:

- Pre-survey: Distributed to students at the beginning of the financial education program by teachers that measure students' initial financial knowledge in four main categories: subjective knowledge, objective knowledge, behavior, and self-esteem.

Table 1 Sample description

	Grade				
	9th	10th	11th	12th	Total
Panel A. Whole sample					
Year 2017–2019					
Female	36	39	147	536	758
Male	54	59	194	557	864
Year 2020–2021					
Female	11	4	200	105	320
Male	3	16	213	123	355
Total	104	118	754	1321	2297
Panel B. Test sample					
Year 2017–2019					
Female	19	26	85	264	394
Male	30	36	112	261	439
Year 2020–2021					
Female	1	1	106	52	160
Male	0	4	101	40	145
Total	50	67	404	617	1138

Note. Table 1 shows the number of students across different grade levels and favorite subjects for the whole sample (Panel A) and the test sample (Panel B).

- Post-survey: Distributed to students upon completion of the financial education program by teachers that measure the same four categories from the pre-survey to analyze. Different input variables are used for quantitative questions measuring objective knowledge.

We also conducted a teacher survey during 2020-2021 to obtain information about the individual financial education programs, including program length, modality, and resources used to teach the material. The surveys distributed were extensions of the work conducted by Filbeck, Zhao, and Pettner (2020). The three surveys can be found in Appendixes A, B, and C.

Table 1 reports the descriptive statistics for the pre-survey and post-survey samples. The pre-survey sample consists of 2,297 students completing the pre-survey, while the post-survey sample includes only 1,138 students who submitted both a pre- and post-survey.[1] Of the pre-survey sample, 2,075 (90.3%) students are in their junior or senior year; in the post-survey sample, 1,021 (89.7%) students are in their junior or senior year. Female students account for approximately 47.0% and 48.6%, respectively, in the pre-survey and post-survey samples. Additionally, students who participated during 2020-2021 make up 29.4% in the pre-survey sample and 26.8% in the post-survey sample. Moreover, of the pre-survey (post-survey) sample, 94.9% (98.0%) of students are in their junior or senior years participated during 2020-2021, while the corresponding number is 88.0% (86.7%). This finding suggests a higher percentage of students who participated during 2020-2021 with online/hybrid learning are in their junior or senior years.

3.1. Survey methodology

The surveys are modified based on Filbeck, Zhao, and Pettner (2020) based on the framework established by Tang and Baker (2016), using path models to analyze the relationship

between characteristics and four financial literacy measures. The model shows independent variables produce both direct and indirect effects on a dependent variable. Behavior (Subjective) is the total score for the questions in financial behavior (subjective financial knowledge) questions, while Objective (IDK) is the total scores for students who choose correct answers ("I Don't know" answers) for objective questions. We use financial behavior scores (Behavior), subjective financial knowledge scores (Subjective), correct answers in the objective questions (Objective), and "I don't know" answers in the objective questions (IDK) as dependent variables and test the effect of the financial literacy program. Detailed variable definitions can be found in Appendix D.

We introduce several control variables associated with our study. In all three path models, we include gender (Female), grade level (Sophomore, Junior, and Senior), favorite subject (English, Math, and Science), and GPA. Following Amagir et al. (2018), we also include learning method preferences (Learning by doing [LBD], Listening, Discussing, and Visual) as independent variables that may impact financial literacy program success.

Students' pre- and post-survey questions have been divided into two major categories: financial behavior and financial knowledge. Financial knowledge questions are further split into objective and subjective financial knowledge. The surveys consist of 21 questions: three financial behavior, six objective financial knowledge, and 12 subjective financial knowledge. Subjective financial knowledge and financial behavior questions are rated on a 5-point scale ranging from 1 = *strongly disagree* to 5 = *strongly agree*. The three 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," and "I have conversations with my parents regarding personal finance." Subjective financial knowledge questions involve a perceived understanding of financial concepts. They include questions such as "I understand how to establish a financial plan," or "I understand the process by which my parents/guardians make financial decisions."

Five broad categories of financial literacy make up the survey questions: interest (numeracy), compound interest, inflation, and credit. However, objective financial knowledge questions are conducted with "right" or "wrong" answers. Each objective financial knowledge question contains at least one wrong answer and the option to choose "I Don't Know." The questions are analyzed using two methods: willingness to answer and correctness. The first method, willingness to respond, assigns a score of 1 for an answer of "I Don't Know" and 0 for any other answer. Secondly, questions with the correctness method assign a score of 1 for each correct answer and 0 for any other answer.

The teacher survey comprises five informational questions regarding how the instructors teach financial literacy courses in their respective high schools. Of the five informative questions, two focus on the mode of instruction, while the other three focus on the program's duration. Questions regarding the mode include: "How are you teaching the material?" and "What methods did you use to teach the material?" Concerning durational questions, these include: "How many total contact hours will you spend teaching financial literacy?" "How often will students receive financial literacy instruction?" and "What best describes the total length of your financial literacy instruction program." For 2020-2021, according to the teacher's survey results, teachers conducted their programs in an online/hybrid mode (instruction occurring in a combination of virtual and in-person formats).

4. Results

4.1. Pre-survey analysis

For the *t*-test of the pre-survey responses, two characteristics are analyzed: student gender and the delivery mode of content. Student gender is divided into subgroups (female or male), while the delivery mode is based on year: in-person (2017-2019) or virtual/hybrid (2020-2021). Table 2 lists the initial results of the pre-surveys submitted by students categorized by the four areas of financial knowledge tested: subjective knowledge, objective knowledge, financial behavior, and self-esteem. We only report the total scores for each area of financial knowledge in Table 2 as Cronbach's α for each area of financial literacy ranges between 0.71-0.88, which is at an acceptable level of reliability and suggests the category totals are consistent measures of each question responses in that category. The detailed responses for each question are reported in Appendix E: Table 2A.

The average responses are compared to the individual subgroups of gender and the courses' modality. Compared to the total average response score for subjective financial knowledge questions, female students scored lower than males (statistically significant at the 1% level). Students who learned virtually/hybrid in 2020-2021 show a slightly higher score than in-person learning, but the difference is not statistically significant. For financial behavior, students who partook in a virtual/hybrid format are better financially behaved (statistically significant at the 1% level), while no statistically significant differences exist based on

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

Question type	Average response	Gender		Modality	
		Male	Female	In-person	Online/hybrid
Panel A. Financial subjective knowledge questions					
Total score	33.928	34.571	33.196***	33.893	34.010
Panel B. Financial behavior questions					
Total score	14.895	14.835	14.964	14.746	15.254***
Panel C. Objective questions (correct answers)					
Total score	2.982	3.253	2.707***	2.934	3.100**
Panel D. Objective questions ("I don't know" answers)					
Total score	1.667	1.411	1.977***	1.717	1.545**

Note. Table 2 shows the differences of pre-survey student responses on financial knowledge, financial behavioral, and objective questions across different gender and GPAs for the whole sample. We only report total scores for each category as Cronbach's alpha for each category ranges between 0.71-0.88, which is at an acceptable level for internal consistency. Detailed responses for each question can be found in Appendix: Table 2A. Gender is identified as a dummy variable equal to 1 if the student is female and 0 otherwise. Modality is denoted as a dummy variable equal to one if the sample comes from an online/hybrid modality, the 2020-2021 sample, otherwise, the dummy variable is zero, indicating an in-person structure based on the sample from 2017 to 2019. We also conduct a *t*-test to test the differences in gender (i.e., male vs. female) and modality (in-person vs. online/hybrid). We use asterisks to show the significance of the *t*-test result.

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

gender. Females scored lower in correctness and self-esteem regarding objective financial knowledge, while virtually/hybrid trained students scored higher in correctness and self-esteem (statistically significant at the 1% level). This finding is consistent with our H2A in that male students have better baseline financial literacy than female students before the survey in all areas except for financial behavior. Our results are consistent with Riener and Wagner (2017) and Saygin and Atwater (2021) and may support the stereotype threat explanation. This explanation would argue the gender gap vanishes if the task's difficulty is made less salient (Riener & Wagner, 2017).

Table 3 reports Pearson correlations between financial behavior and self-esteem (IDK), subjective, and objective financial knowledge for both the whole sample and the two subsamples. 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 between self-esteem level and the other three measures of financial literacy. Naturally, because of the setup of the self-esteem measure, we find a negative correlation (−0.76) between IDK answers and objective knowledge. Comparing in-person and virtually/hybrid learning modality, we do not observe significant differences in correlations between these four variables during 2017-2019 and 2020-2021.

4.2. Post-survey analysis

The results of the pre- and post-surveys are compared using the post-survey sample of 833 students in 2017-2019 (in-person) and 305 students in 2020-2021 (virtual/hybrid). Improvement is defined in several ways. Gains from subjective financial knowledge, objective financial knowledge, and financial behavior are defined as the post-survey scores minus the pre-survey response scores. To gauge financial self-esteem, we define confidence gains as a decrease in "I Don't Know" responses in the post-survey minus the pre-survey. In other words, students exhibit better self-esteem when they have fewer "I Don't Know" answers in the post-survey compared to the pre-survey.

Table 4 illustrates the *t*-test results by question and overall score for each of the four items measured: subjective financial knowledge, financial behavior, objective financial knowledge, and financial self-esteem. We report results of total scores of each financial literacy category in Table 4 and detailed results for each question in Appendix F: Table 4A. Questions from subjective knowledge and financial behavior are assessed based on 1-5, 1 = *I highly disagree* and 5 = *I highly agree*. The results in Table 4 and Appendix F: Table 4A show improvements with nearly every question in all categories, per question and total. For example, the financial behavior question "I like to save money more than I like to spend it" had an average pre-survey score of 3.54 and a post-survey score of 3.81. The increase shows that, on average, students' preference for the balance between saving and spending improved, improving their overall financial behavior. Each of the improvements is statistically significant at the 1% level, except for one question in the financial behavior category "I have a checking and/or savings account." Given the COVID-19 pandemic that occurred in

Table 3 Correlation coefficients between financial behavior and self-esteem, objective and subjective financial knowledge

Question type	Subjective	Behavior	Objective	IDK answers
Panel A. Whole sample				
Subjective				
Corr	1.000			
p-value				
Behavior				
Corr	0.357***	1.000		
p-value	<.0001			
Objective				
Corr	0.286***	0.267***	1.000	
p-value	<.0001	<.0001		
IDK answers				
Corr	−0.364***	−0.267***	−0.759***	1.000
p-value	<.0001	<.0001	<.0001	
Panel B. Year 2017–2019				
Subjective				
Corr	1.000			
p-value				
Behavior				
Corr	0.349***	1.000		
p-value	<.0001			
Objective				
Corr	0.291***	0.255***	1.000	
p-value	<.0001	<.0001		
IDK answers				
Corr	−0.366***	−0.255***	−0.753***	1.000
p-value	<.0001	<.0001	<.0001	
Panel C. Year 2020–2021				
Subjective				
Corr	1.000			
p-value				
Behavior				
Corr	0.384***	1.000		
p-value	<.0001			
Objective				
Corr	0.276***	0.293***	1.000	
p-value	<.0001	<.0001		
IDK answers				
Corr	−0.359***	−0.292***	−0.774***	1.000
p-value	<.0001	<.0001	<.0001	

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

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

2020-2021, the result for this question is reasonable given the reduction of in-person banking services.

The most significant improvement of student responses to questions related to subjective financial knowledge comes from understanding Roth IRA (a gain of 1.653) and retirement (an increase of 1.376). All subjective financial knowledge questions are statistically

Table 4 *t*-test results between pre- and post-survey

Question type	Pre	Post	Diff	T-stat
Panel A. Financial subjective knowledge questions				
Total score	33.839	43.963	10.125	36.38***
Panel B. Financial behavior questions				
Total score	14.944	16.365	1.421	15.11***
Panel C. Objective questions (correct answers)				
Total score	2.970	3.979	1.009	18.55***
Panel D. Objective questions ("I don't know" answers)				
Total score	1.690	0.482	−1.209	−22.43***

Note. Table 4 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.

significant at the 1% level. Further analyzing the financial behavior questions' responses, the biggest gain derives from the importance of contributing to a retirement plan (an increase of 0.402). All questions are statistically significant at least the 5% level.

The results link confidence to answer a question (self-esteem) and correctness (objective financial knowledge). Meanwhile, the most significant improvements seen from objective financial knowledge regarding questions involving credit, the concept of an agreement to purchase a product or service with the express promise to pay for it later (a gain of 0.251), and knowledge of inflation rate (a gain of 0.200). The largest increase in correct responses between pre- and post-surveys comes from self-esteem questions (how often students answered "I Don't Know" on the objective financial questions). These two questions also show the greatest improvement in students' self-esteem. That is, fewer students answered "I Don't Know" with those two questions than any other between the pre- and post-surveys.

Next, we test H1 and H2B with subgroup results. Table 5 reports the *t*-test results for different subgroups. Panel A reports the subgroups by gender. The statistically significant improvement across all subgroups at the 1% level for both male and female groups indicates a significant improvement after completing the financial literacy program for both males and females. *t*-test results on the differences of improvements between males and females suggest that female students experience more significant improvements in financial behavior, objective knowledge, and self-esteem than their male peers. This finding is consistent with Gerrans and Heaney (2019) and H2B.

Panel B of Table 5 reports the subgroup results by modality (in person, 2017-2019 vs. online/hybrid, 2020-2021). The statistically significant differences between pre- and post-survey in all areas of financial literacy and both modalities show that students have significant improvements after the literacy program in both modalities. These findings reject H1 and are consistent with Wolla's (2017) finding that online learning effectively increases financial knowledge among high school students. Further, students' financial behavior gains are statistically significantly higher in 2020-2021 than the gains experienced during 2017-2019. However, this result should be interpreted with caution as the sample has a potential attrition issue because of COVID-19 and will be tested with more robustness checks.

Next, we run regression analysis to examine how student characteristics and other control variables affect their knowledge and behavior gains. Table 6 reports the regression results.

Table 5 *t*-test Results between pre- and post-survey for different subsamples

Subsample type	Financial behavior			Subjective questions			Objective questions			Self esteem		
	Pre	Post	Post - Pre	Pre	Post	Post - Pre	Pre	Post	Post - Pre	Pre	Post	Post - Pre
Panel A. Subsamples by gender												
Male (1)	34.464	43.602	9.138***	14.901	16.270	1.369***	3.215	4.072	0.857***	1.410	0.425	−0.985***
Female (2)	33.177	44.345	11.168***	14.989	16.466	2.711***	3.881	3.881	1.170***	1.987	0.542	−1.446***
(1) − (2)			−2.030***			−0.108			−0.313***			0.461***
Panel B. Subsamples by year												
Year 2017-2019 (3)	33.780	43.677	9.897***	14.795	16.334	1.539***	2.936	3.944	1.007***	1.770	0.555	−1.215***
Year 2020- 2021 (4)	33.997	44.739	10.743***	15.349	16.450	1.101***	3.062	4.075	1.013***	1.476	0.283	−1.192***
(3) − (4)			−0.553***			0.438			−0.006			−0.023

Note. Table 5 shows the *t*-test results of student responses to self-esteem, 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.

Table 6 Regression results

	Model (1)		Model (2)		Model (3)		Model (4)	
	Dep. Var.: Diff_BEHAV		Dep. Var.: Diff_KNOW		Dep. Var: Diff_OBJ		Dep. Var.: Diff_IDK	
	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
Panel A. OLS regression results on student and school district characteristics								
Intercept	6.740	0.46	−20.697	−0.47	16.818	1.91*	−8.520	−1.01
Year 2020	−0.036	−0.13	2.945	3.61***	0.311	1.89*	−0.351	−2.23**
Female	0.022	0.10	1.537	2.28**	0.274	2.02**	−0.460	−3.53***
Upperclass	−0.286	−0.76	1.606	1.45	−0.071	−0.32	0.120	0.56
GPA	−0.162	−1.01	0.190	0.40	−0.149	−1.55	0.280	3.03***
Log (Population)	−1.225	−4.42***	−6.492	−7.89***	−0.822	−4.96***	0.741	4.66***
Log (Household_ Income)	0.611	0.42	7.633	1.78*	−0.695	−0.80	0.000	0.00
Poverty	−0.510	−0.05	31.186	1.09	−3.677	−0.64	−0.908	−0.16
Pct_College	2.788	1.89*	11.935	2.73***	2.369	2.69***	−1.949	−2.31**

	Model (1)		Model (2)		Model (3)		Model (4)	
	Dep. Var.: Diff_BEHAV		Dep. Var.: Diff_KNOW		Dep. Var: Diff_OBJ		Dep. Var.: Diff_IDK	
	Coefficient	Z-stat	Coefficient	Z-stat	Coefficient	Z-stat	Coefficient	Z-stat
Panel B. GLM regression results after controlling for fixed effect of classes, with standard error clustered at the class level								
Intercept	3.087	4.17***	7.549	3.71***	1.091	2.57**	−1.662	−3.18***
Year 2020	−0.782	−2.02**	−1.062	−0.60	−0.055	−0.18	0.189	0.66
Female	0.169	1.07	2.313	3.66***	0.397	3.09***	−0.526	−4.71***
Upperclass	−0.359	−1.14	1.377	0.94	0.044	0.17	−0.020	−0.08
GPA	−0.238	−1.69*	0.402	0.92	−0.073	−0.76	0.158	1.85*
English	0.014	0.05	−1.250	−2.20**	−0.231	−2.33**	0.071	0.54
Math	−0.082	−0.26	−0.138	−0.15	−0.247	−1.50	0.170	1.44
Science	0.119	0.33	−0.582	−0.78	−0.248	−1.97**	0.184	1.67*
LBD	−0.207	−1.11	0.628	1.64	0.218	2.00**	−0.116	−0.86
Listening	−0.271	−1.17	−1.638	−1.83*	−0.236	−1.50	0.300	1.94*
Discussing	−0.125	−0.35	−1.424	−1.54	−0.101	−0.55	0.143	0.98
Visual	−0.196	−1.13	0.675	1.04	0.209	1.39	−0.142	−1.10

Note. Table 6 shows the regression results of the test sample. Panel A reports the OLS regression results on student and school district characteristics. Panel B reports the regression results on student characteristics after controlling for fixed effect of classes, with standard errors clustered at the class level. 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. Year2020 is a dummy variable equal to 1 if it belongs to the 2020-2021 sample. Female is a dummy variable equal to 1 if the student is a female student and 0 otherwise. Upperclass is a dummy variable equal to 1 if the student is a junior or senior and 0 otherwise. English (Math, Science) is a dummy variable equal to 1 if the student's favorite subject is English (math, science) and 0 otherwise. LBD (Listening, Discussing, and Visual) is a dummy variable equal to 1 if the student chooses learning by doing (listening, discussing with peers, and features visual support) as a 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. Log(Household_Income) is the log of the median household income in the school district. Poverty is the poverty rate in the school district. Pct_College is the percentage of students with parents/guardians who have attained a bachelor's degree or higher.

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

Panel A reports the regression results on student characteristics and school district characteristics. 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 listed in Appendix D. The results show that students who participated in virtually/hybrid format and female students gained most in all areas except financial behavior.

Similarly, students in school districts with a smaller population and a higher percentage of parents/guardians with bachelor's degrees experience a statistically significant gain in financial behavior. This finding is encouraging, as Stolper and Walter (2017) point out that the opportunity to relate financial literacy to various demographics in the context of their spending behavior is key to program success. In financial knowledge, we find students coming from higher-income households perform better. These results echo the findings of Kaiser and Menkhoff (2017), who find that financial literacy programs are less effective for clients with lower incomes and from low- and lower-middle-income economies. In such environments, altering financial behaviors in debt handling may be less effective.

The results in Panel A may be misleading on the conclusion of modality because schools with less ability to conduct financial literacy programs during the COVID pandemic may not be participating in the 2020-2021 period. Students who participated in the 2020-2021 program may come from a school with better infrastructure to adapt to the challenges of online learning. Therefore, we need to control for school or class differences in our regressions. Next, we include other control variables such as favorite subjects and learning style and use fixed effect regressions controlling for class differences.

Specifically, the class fixed effects allow the class dummy variable to differ and control for the variations across classes. We also cluster standard errors at the class level. Table 1 shows a higher percentage of junior or senior students who participated in the 2020-2021 program. Therefore, we add Upperclass (i.e., a dummy variable equal to 1 if the student is a junior or senior) as an independent variable to control for grade level in the regression. Panel B of Table 6 reports the regression results. We use the same dependent variables as in Panel A. The results show no statistically significant improvements except for financial behavior for students who participated in virtually/hybrid learning programs. This finding is consistent with Table 5 and rejects H1. A trio of findings is notable for female students. First, female students whose favorite subject is not English tend to gain more subjective financial knowledge. In addition, female students whose favorite subject is not English or Science and who prefer more hands-on learning opportunities (learning by doing) gain more objective financial knowledge. Finally, female students with higher GPA experience the most significant self-esteem gain.

Results in Tables 4-6 use test samples (including pre- and post-survey results from students who participated in both pre- and post-survey) and test the improvements (i.e., differences from pre- to post-survey scores) in students' financial literacy. However, this setup may be subject to potential self-selection and attrition bias in our sample. Specifically, from Table 1, we can see that about 52% of female students and 51% of male students completed both pre- and post-survey during 2017-2019, while the corresponding numbers for the 2020-2021 sample are 50% and 41%, respectively. In other words, in the 2017-2019 sample, there

is roughly 51% to 52% attrition for both male and female students. While for the 2020-2021 sample, there is 50% attrition for female students, but about 59% attrition for male students.

Given that male students have higher baseline financial literacy and less scope for financial literacy improvement, this might bias the results of comparisons between the 2017-2019 sample and the 2020-2021 sample as presented in previous tables.[2] Also, the sample is subject to self-selection bias as schools with less ability to conduct financial literacy programs during the COVID pandemic may not be participating in the 2020-2021 period. Students who participated in the 2020-2021 program may come from a school with better infrastructure to adapt to the challenges of online learning.

To address this potential self-selection and attrition bias in our sample, we pool our whole pre-survey data (from all students who participated in pre-survey) and post-survey data. We use the standard diff-in-diff model and run regression models using outcome variables (i.e., Behavior, Subjective, Objective, and IDK) as dependent variables. We report the results in Table 7. In our regressions, we add Post, Post × Female, and Post × Year2020 as additional control variables. Post is a dummy variable that equals 1 if the data are post-survey results and 0 otherwise. Post × Female is an interaction term and captures the change in the outcome variable (i.e., Behavior, Subjective, Objective, and IDK) from the pre-survey period to the post-survey period for female students, relative to the change in outcome variable for male students. Similarly, Post × Year2020 is an interaction term that captures the change in outcome variables from the pre-survey period to the post-survey period for the 2020-2021 program, relative to the change in outcome variable for the 2017-2019 program. Other control variables are defined the same as in Table 6 and Appendix D. We also include student fixed effects to control student characteristics differences, with standard errors clustered at the student level.

The statistically significant coefficient on Post in Table 7 suggests that students show statistically significant improvements in all four financial literacy areas in virtually/hybrid learning and in-person programs after controlling for potential attrition bias. Moreover, the statistically insignificant regression coefficient on Post × Year2020 in Table 7 using Subjective, Objective, and IDK as dependent variable (i.e., Models 2-4) suggest that there are no statistically significant differences of improvements in students subjective knowledge, objective knowledge, and self-esteem in virtual/hybrid format compared with the in-person format. This finding is consistent with our previous results in Table 6 and rejects our H1. The statistically significant coefficients Female in Models 2-4 also confirm our previous results that male students have a higher level of financial literacy in all areas except for financial behavior than female students, which supports our H2A. More importantly, female students experienced the most gains in all financial literacy programs except for financial behavior, as evidenced by the statistically significant interaction term Post × Female. This supports our H2B.

5. Conclusions

This study's primary purpose is to investigate the effectiveness of high school financial literacy education programs in a virtual/hybrid environment instead of an in-person setting.

Table 7 Regression results: Difference-in-difference model

	Model (1)		Model (2)		Model (3)		Model (4)	
	Dep. Var.: Behavior		Dep. Var.: Subjective		Dep. Var: Objective		Dep. Var.: IDK	
	Coefficient	Z-Stat	Coefficient	Z-Stat	Coefficient	Z-Stat	Coefficient	Z-Stat
Intercept	11.2091	27.51***	32.725	32.43***	1.154	5.34***	2.694	13.18***
Year2020	0.702	3.34***	0.919	1.63	0.182	1.42	−0.217	−1.77*
Post	1.525	10.03***	8.853	21.70***	0.768	10.26***	−0.927	−14.25***
Post × Year2020	−0.472	−2.46**	0.714	1.36	−0.024	−0.21	−0.094	−1.01
Female	−0.047	−0.34	−1.462	−4.38***	−0.654	−8.44***	0.636	7.88***
Post × Female	0.064	0.35	2.146	4.19***	0.391	3.83***	−0.450	−4.67***
Upperclass	0.751	3.83***	−0.041	−0.09	0.168	1.61	−0.118	−1.13
GPA	0.760	9.37***	0.206	0.99	0.518	10.68***	−0.325	−7.04***
English	−0.374	−2.10**	−0.177	−0.41	−0.309	−3.03***	0.183	1.97**
Math	−0.227	−1.51	0.024	0.06	−0.062	−0.70	0.039	0.52
Science	−0.361	−2.36**	−0.143	−0.37	0.088	1.03	−0.059	−0.76
LBD	0.428	3.25***	0.874	2.65***	0.268	3.72***	−0.074	−1.16
Listening	0.061	0.46	0.677	1.99**	0.006	0.08	−0.101	−1.43
Discussing	0.077	0.55	0.595	1.69*	0.015	0.17	−0.012	−0.16
Visual	0.261	1.70*	−0.105	−0.27	0.087	0.95	0.036	0.42

Note. Table 7 shows the regression results using a diff-in-diff model. Specifically, we use outcome variables (i.e., Behavior, Subjective, Objective, and IDK) as dependent variables with pooled pre- and post-survey data. We report the regression results on student characteristics after controlling for fixed effect of students, with standard errors clustered at the student level. Behavior (Subjective, Objective, IDK) is the student's survey scores for the financial behavior (knowledge, objective) questions. Year2020 is a dummy variable equal to 1 if it belongs to the 2020-2021 sample. Post is a dummy variable equal to 1 if the survey score is from post-survey and 0 otherwise. Post × Year2020 is an interaction term of Post and Year2020. Female is a dummy variable equal to 1 if the student is a female student and 0 otherwise. Post x Female is an interaction term of Post and Female. Upperclass is a dummy variable equal to 1 if the student is a junior or senior and 0 otherwise. English (Math, Science) is a dummy variable equal to 1 if the student's favorite subject is English (math, science) and 0 otherwise. LBD (Listening, Discussing, and Visual) is a dummy variable equal to 1 if the student chooses learning by doing (listening, discussing with peers, and features visual support) as a 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. Log(Household_Income) is the log of the median household income in the school district. Poverty is the poverty rate in the school district. Pct_College is the percentage of students with parents/guardians who have attained a bachelor's degree or higher.

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

Financial literacy improvement is measured in four areas: subjective financial knowledge, financial behavior, objective financial knowledge, and self-esteem.

The pre-survey results taken by students before beginning the financial education program are initially analyzed using a *t*-test. Overall, the results show no statistical difference in pre-survey financial subjective knowledge between the two subperiods based on modality. Virtually/hybrid trained students scored higher in financial behavior, correctness, and self-esteem. However, female students scored lower on subjective and objective financial questions and exhibited lower self-esteem regarding objective financial knowledge. The only area in which females did not underperform males in the pre-survey was financial behavior.

To test the effectiveness of financial literacy programs, a *t*-test was implemented between the pre- and post-survey results taken after completion of the course. The *t*-test analyzes the four major topic areas listed above. Overall, male and female students experienced a statistically significant increase in all four topics. Interestingly, the one area in which no differences occurred was whether students have a checking account. Given the reduction in in-person banking during the pandemic, this finding is not surprising.

With the four areas studied, subjective financial knowledge gains center on retirement planning. Similarly, the greatest gains in financial behavioral questions are tied to the importance of contributing to a retirement plan. Objective knowledge improvements and self-esteem improvements occur most credit and inflation. While statistically, significant improvement occurred for both genders, female students experience a greater improvement in financial behavior, objective knowledge, and self-esteem than male peers.

Modality does not appear to impact the effectiveness of the financial literacy programs as all areas of financial literacy and in both modalities show that students have significant improvements. Thus, online learning is an effective tool for increasing financial literacy among high school students.

Students in school districts with smaller populations and a higher percentage of parents holding bachelor's degrees experience a statistically significant gain in financial behavior. Results should be interpreted with some caution as schools not participating in the financial literacy program during the pandemic may have been in more socioeconomically challenged areas than in more urban areas.

Based on the analysis extracted from the surveys, statistically, significant improvements in subjective financial knowledge, financial behavior, objective financial knowledge, and financial self-esteem lead us to conclude that the CFA Society Pittsburgh financial literacy program successfully increases students' chances of financial success. The analysis affirms that one area the pandemic failed to impact was the effectiveness of financial literacy programs as no statistical differences exist between improvements based on modality.

These findings add to the existing literature in financial literacy, demonstrating that educational techniques including online and hybrid learning, which were often required during the COVID-19 pandemic, do not diminish effectiveness when used for financial literacy programs. Based on these findings, we argue that school districts that currently do not require financial literacy components within their curriculum consider making changes based on the societal ramifications of such deficiencies and the significant improvements associated with successful financial literacy programs, such as the focus of our study.

Notes

1 To test whether there are selection biases between students who participated in both pre- and post-survey and students who participated only in pre-survey, we run T-test on the differences of students' pre-survey results between students who participated in the post-survey and students who participated in the pre-survey but not post-survey. We find no statistically significant differences in their financial behavior, subjective and objective financial knowledge, and self-esteem in the pre-survey results between these two groups. The results are available upon request.

2 We thank an anonymous referee for valuable comments and suggestions on this issue.

Appendix A

Pre-survey questions

Class Code:
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.

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)

Objective questions:

1. Is it safer to put your money into one investment or put your money into multiple investments?
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.
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.
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?
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?
6. Suppose you have $30,000 in student loans. Which payment option would result in the lowest amount of overall interest paid?

Appendix B

Post-survey questions

Class Code:
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)

Objective questions:

1. Which is less risky: Investing your money into one investment or multiple investments?
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.
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.
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?
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?
6. Suppose you have $40,000 in student debt. Which payment option would result in the lowest amount of overall interest paid?

Appendix C

Teacher survey questions

Class code:
Teacher ID:
Gender:

Questions:

1. How are you teaching the material?
2. How many total contact hours will you spend teaching financial literacy?
3. How often will students receive financial literacy instruction?
4. What best describes the total length of your financial literacy instruction program?
5. What methods did you use to teach the material? (Select all that apply).
6. Did you take a finance-related course in high school or college?
7. What subject do you teach?
8. What suggestions do you have about the program that we can improve next year?

Appendix D

Variable definitions

Dependent variables:	
Subjective	Total score for the subjective questions in the survey
Objective	Total score for the objective questions in the survey with correct answers
Behavior	Total score for the financial behavior questions in the survey
IDK	Total score for the 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 subjective questions.
Diff_Obj	The difference between the students' pre- and post-study scores (post minus pre) for the 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 objective questions with "I don't know" answers.
Independent variables:	
Post	A dummy variable that is equal to 1 if it is post-survey and 0 otherwise.
Post × Year2020	An interaction term of Post and Year2020 dummy variables.
Post × Female	An interaction term of Post and Female dummy variables.
Sample year:	
Year2020	A dummy variable that is equal to 1 if the survey is conducted in 2020-2021.
Gender:	
Female	A dummy variable that is equal to 1 if the student is a female and 0 otherwise.
Grade level:	
Upperclass	A dummy variable that is equal to 1 if the student is in grade 11 or 12 and 0 otherwise.
Favorite subject:	
English	A dummy variable that is equal to 1 if the student's favorite is English and 0 otherwise.
Math	A dummy variable that is equal to 1 if the student's favorite is Math and 0 otherwise.
Science	A dummy variable that is equal to 1 if the student's favorite is Science, and 0 otherwise.
Favorite learning style:	
LBD	A dummy variable that is equal to 1 if the student's favorite learning style is learning by doing (LBD) and 0 otherwise.
Listening	A dummy variable that is equal to 1 if the student's favorite learning style is listening and 0 otherwise.
Discussing	A dummy variable that is equal to 1 if the student's favorite learning style is discussion and 0 otherwise.
Visual	A dummy variable that 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.
Log (Household_Income)	The log of the median household income 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.

Appendix E

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

	Average response	Gender		Modality	
		Male	Female	In-person	Online/hybrid
Panel A. Financial subjective knowledge questions					
2. I understand how to establish a financial plan.	3.014	3.083	2.937***	3.039	2.956*
3. I think financial literacy is important for my future.	4.379	4.361	4.399	4.365	4.412
6. I understand the process by which my parents/guardians make financial decisions.	3.360	3.408	3.306**	3.358	3.366
7. I know how to determine the appropriate total costs associated with the colleges/universities I am interested in attending.	3.044	3.050	3.037	3.086	2.942***
8. I understand the process by which loan repayments take place including the impact of interest, delinquency and default.	2.758	2.879	2.620***	2.743	2.792
9. I understand the process by which credit card charges and repayment schedules can impact the level of financial debt levels.	3.425	3.430	3.419	3.428	3.418
10. When it comes to purchasing a car, I know how to determine how much of a car I can afford.	3.288	3.403	3.156***	3.287	3.290
11. I understand how to evaluate the cost-benefit analysis of training for the job I would like to perform after completing school.	3.022	3.115	2.917***	3.015	3.038
12. I know what a Roth IRA is and how it works from a taxation standpoint.	1.986	2.093	1.865***	1.951	2.072***
13. I know how to create a savings plan based on the ability to estimate monthly living expenses.	3.127	3.160	3.090	3.148	3.077
14. I know how to plan financially for retirement.	2.629	2.748	2.494***	2.621	2.647
Total score for financial subjective knowledge questions	33.928	34.571	33.196***	33.893	34.010
Panel B. Financial behavior questions					
1. I like to save money more than I like to spend it.	3.534	3.587	3.473***	3.505	3.603**
4. I have a checking and/or a savings account.	4.258	4.238	4.280	4.381	4.003***
5. I have conversations with my parents regarding personal finance.	3.460	3.444	3.479	3.418	3.560***
15. I think it is important to contribute to a retirement plan (ex: Roth IRA, 401k, etc.)	4.085	4.079	4.092	4.083	4.089
Total score for financial behavior	14.895	14.835	14.964	14.746	15.254***
Panel C. Objective questions (correct answers)					
1. Is it safer to put your money into one investment or put your money into multiple investments?	0.635	0.699	0.569***	0.622	0.665*
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.	0.298	0.352	0.238***	0.291	0.315
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.	0.501	0.533	0.469***	0.496	0.513

(continued on next page)

Table 2A (Continued)

	Average response	Gender		Modality	
		Male	Female	In-person	Online/hybrid
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?	0.439	0.500	0.375***	0.432	0.456
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?	0.567	0.602	0.534***	0.560	0.585
6. Suppose you have $30,000 in student loans. Which payment option would result in the lowest amount of overall interest paid?	0.543	0.567	0.521**	0.533	0.567
Total score for objective questions (Correct Answers)	2.982	3.253	2.707***	2.934	3.100**
Panel D. Objective questions ("I don't know" Answers)					
1. Is it safer to put your money into one investment or put your money into multiple investments?	0.251	0.191	0.322***	0.263	0.222**
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.	0.334	0.259	0.424***	0.345	0.307*
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.	0.337	0.321	0.358*	0.340	0.328
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?	0.290	0.226	0.366***	0.295	0.278
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?	0.176	0.161	0.194**	0.186	0.151**
6. Suppose you have $30,000 in student loans. Which payment option would result in the lowest amount of overall interest paid?	0.279	0.252	0.313***	0.287	0.260
Total score for objective questions ("I don't know" Answers)	1.667	1.411	1.977***	1.717	0.000 1.545**

Note. Table 2A shows the differences of pre-survey student responses on financial knowledge, financial behavioral, and objective questions across different gender and GPAs for the whole sample. Gender is identified as a dummy variable equal to 1 if the student is female and 0 otherwise. Modality is denoted as a dummy variable equal to one if the sample comes from an online/hybrid modality, the 2020-2021 sample, otherwise, the dummy variable is zero, indicating an in-person structure based on the sample from 2017 to 2019. We also conduct a *t*-test to test the differences in gender (i.e., male vs. female) and modality (in-person vs. online/hybrid). We use asterisks to show the significance of the *t*-test result.

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

Appendix F

Table 4A *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.	3.033	4.029	0.996	27.66***
3. I think financial literacy is important for my future.	4.416	4.660	0.227	9.89***
6. I understand the process by which my parents/guardians make financial decisions.	3.397	3.888	0.491	14.42***
7. I know how to determine the appropriate total costs associated with the colleges/universities I am interested in attending.	3.085	3.861	0.776	20.46***
8. I understand the process by which loan repayments take place, including the impact of interest, delinquency, and default.	2.716	3.864	1.148	28.88***
9. I understand the process by which credit card charges and repayment schedules can impact the level of financial debt levels.	3.406	4.199	0.792	20.53***
10. When it comes to purchasing a car, I know how to determine how much of a car I can afford.	3.258	4.197	0.940	24.74***
11. I understand how to evaluate the cost-benefit analysis of training for the job I would like to perform after completing school.	3.010	3.889	0.879	22.70***
12. I know what a Roth IRA is and how it works from a taxation standpoint.	1.909	3.562	1.653	38.31***
13. I know how to create a savings plan based on the ability to estimate monthly living expenses.	3.087	4.168	1.079	28.21***
14. I know how to plan financially for retirement.	2.581	3.953	1.376	33.45***
Total score for financial subjective knowledge questions	33.839	43.963	10.125	36.38***
Panel B. Financial behavior questions				
1. I like to save money more than I like to spend it.	3.540	3.810	0.269	8.09***
4. I have a checking and/or a savings account.	4.290	4.267	0.085	2.41**
5. I have conversations with my parents regarding personal finance.	3.511	3.839	0.328	9.01***
15. I think it is important to contribute to a retirement plan (ex: Roth IRA, 401k, etc.)	4.064	4.467	0.402	12.02***
Total score for financial behavior	14.944	16.365	1.421	15.11***
Panel C. Objective questions (correct answers)				
1. Is it safer to put your money into one investment or put your money into multiple investments?	0.634	0.691	0.057	3.21***
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.	0.294	0.481	0.187	10.58***
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.	0.489	0.740	0.251	14.90***
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?	0.438	0.578	0.140	7.65***
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?	0.573	0.773	0.200	12.07***
6. Suppose you have $40,000 in student debt. Which payment option will result in the lowest amount of overall interest paid?	0.542	0.716	0.174	10.05***

(continued on next page)

Table 4A (Continued)

	Pre	Post	Diff.	t-stat
Total score for objective questions (correct answers)	2.970	3.979	1.009	18.55***
Panel D. Objective questions ("I don't know" answers)				
1. Is it safer to put your money into one investment or put your money into multiple investments?	0.246	0.045	−0.201	−14.87***
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.	0.346	0.117	−0.230	−15.03***
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.	0.339	0.068	−0.270	−18.50***
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?	0.297	0.096	−0.201	−13.15***
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?	0.172	0.066	−0.106	−8.68***
6. Suppose you have $40,000 in student debt. Which payment option will result in the lowest amount of overall interest paid?	0.290	0.089	−0.201	−13.96***
Total score for objective questions ("I don't know" answers)	1.690	0.482	−1.209	−22.43***

Note. Table 4A 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.

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