FINRA Investor Education FOUNDATION | NORC at the University of Chicago | FICYCLE

Insights: Financial Capability

June 2023

Authors:

Jack Marley-Payne, Ph.D.
Financial Life Cycle Education

Olivia Valdes, Ph.D. & Gary Mottola, Ph.D.
FINRA Investor Education Foundation

Angela Fontes, Ph.D.
Fontes Research, LLC

What's inside

They Just Add Up: Combined Math and Financial Knowledge Tied to Better Financial Outcomes

Summary

Improving knowledge is a valuable strategy for bolstering U.S. adults' financial outcomes. Which kinds of knowledge most impact financial outcomes, however, remains unclear. Prior work has identified two key knowledge areas: personal finance and math. Yet, the effects of math and financial knowledge have mostly been studied separately. We do not know if or to what extent the two areas work together—either reinforcing each other or acting as substitutes.

Using data from 1,680 adults collected in a nationally representative survey, via a probability-based online panel, this research examines the combined and independent roles of financial and math knowledge in adults' positive and negative financial behaviors. To examine the roles of math and financial knowledge, we divided participants into four categories: (1) those with low math and financial knowledge (Low Scorers), (2) those with low math knowledge but high financial knowledge (Finance Savvy), (3) those with high math knowledge but low financial knowledge (Math Savvy), and those with both high math and financial knowledge (High Scorers). See Appendix 1 for the demographic characteristics of the four knowledge groups.

Four Groups of Knowledge

		Math Knowledge	
		Low	**High**
Financial Knowledge	**Low**	Low Scorers (15%)	Math Savvy (10%)
	High	Finance Savvy (22%)	High Scorers (53%)

We used these groups to assess the relation between knowledge and financial behavior. We found that in all cases, greater financial and math knowledge was associated with better financial behaviors. Notably, respondents with a high level of both math and financial knowledge were more likely to engage in positive financial behaviors and less likely to engage in negative financial behaviors than those with high knowledge of only one area. That is, higher levels of both financial and math knowledge were strongly related to optimal financial decision making. These findings have significant implications for efforts to improve and support financial health as they seek to incorporate a more well-rounded and systematic educational strategy; such programs may benefit from fostering both fundamental math and financial knowledge.

Background

Many U.S. adults experience financial difficulties, including a lack of adequate emergency or retirement savings, and a large number do not engage in strategies that could potentially address these difficulties, such as implementing a savings plan or avoiding costly financial products and fees (Hasler et al., 2018). Although there are multiple reasons, including limited access to key financial services and products, systemic racism and sexism, sub-optimal decision making may be partly responsible.

Improving financial knowledge is often touted as a means to address poor financial outcomes, as higher levels of financial knowledge are associated with better financial outcomes (Lusardi & Mitchell, 2014). Math is another research area believed to be important for financial outcomes, as there is a well-documented relationship between numeracy and financial outcomes (Hastings et al., 2013). Further, individuals with greater math abilities tend to have higher levels of financial literacy (Banks & Oldfield, 2007)—an association that has been documented worldwide.

However, few studies have investigated the *combined* effects of financial and math knowledge on financial outcomes. While the two are often pitted against each other—with financial education skeptics arguing that bolstering math knowledge is a superior alternative (Ogden, 2019) and financial education proponents focused solely on improving financial knowledge as their preferred solution—little empirical evidence exists to denote a clear winner. One possibility is that math and financial knowledge are two components of an optimal solution to improving financial outcomes, rather than mutually exclusive alternatives.

Recent research by Marley-Payne et al. (2022) provides initial findings that indicate receiving financial education and confidence in one's math abilities are each independently associated with better financial behaviors. However, the role of math *knowledge*, a central factor in potential interventions, has yet to be examined.

Results

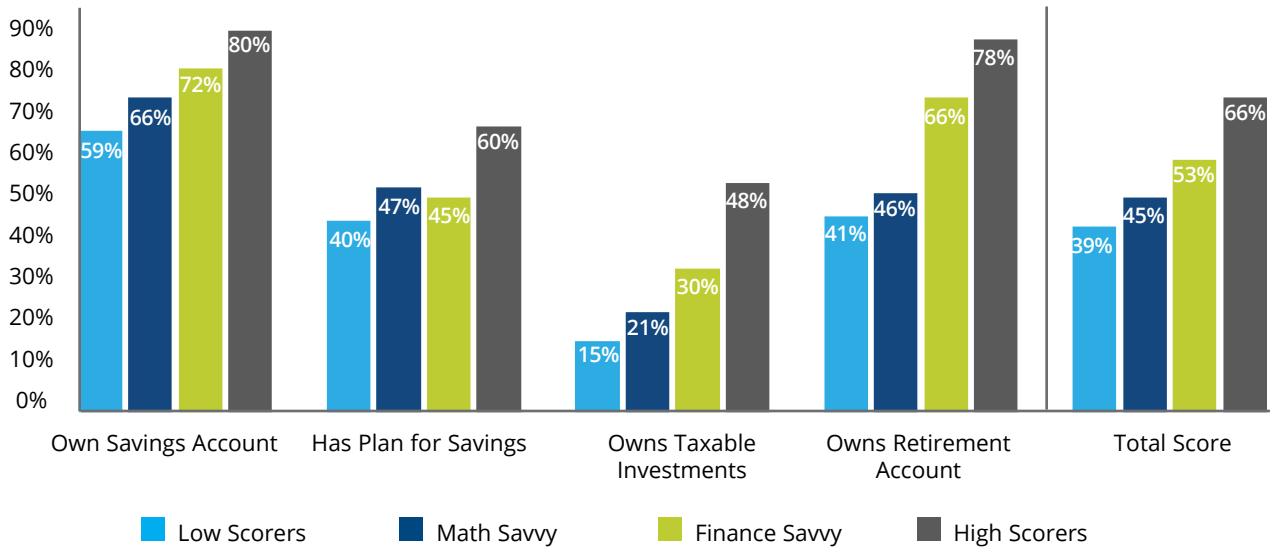
Financial and Math Knowledge and Positive Financial Outcomes

We examined how math and financial knowledge jointly and separately are associated with engaging in positive financial behaviors (*see* Figure 1). Across all positive financial outcomes studied (owning a savings account, having a plan for saving, owning a taxable investment account and owning a retirement account), respondents displaying high levels of math *and* financial knowledge (that is, High Scorers) reported positive financial outcomes more often than those with high levels of only math knowledge (that is, Math Savvy respondents) *or* financial knowledge (that is, Finance Savvy respondents). However, respondents who displayed high knowledge in just one area fared better than those with low levels of both math and financial knowledge (that is, Low Scorers). Further, when comparing those with high levels of knowledge in only one area, high financial knowledge was associated with greater benefits than math knowledge.

High Scorers were much more likely than those in other groups to report engaging in positive financial behaviors—particularly Low Scorers. For instance, compared to Low Scorers, High Scorers were three times more likely to own a taxable investment and nearly twice as likely to own a retirement account. There were also some differences between Finance Savvy and Math Savvy respondents, with Financial Savvy respondents more likely to have a savings account and own retirement and taxable investments than their Math Savvy Counterparts.

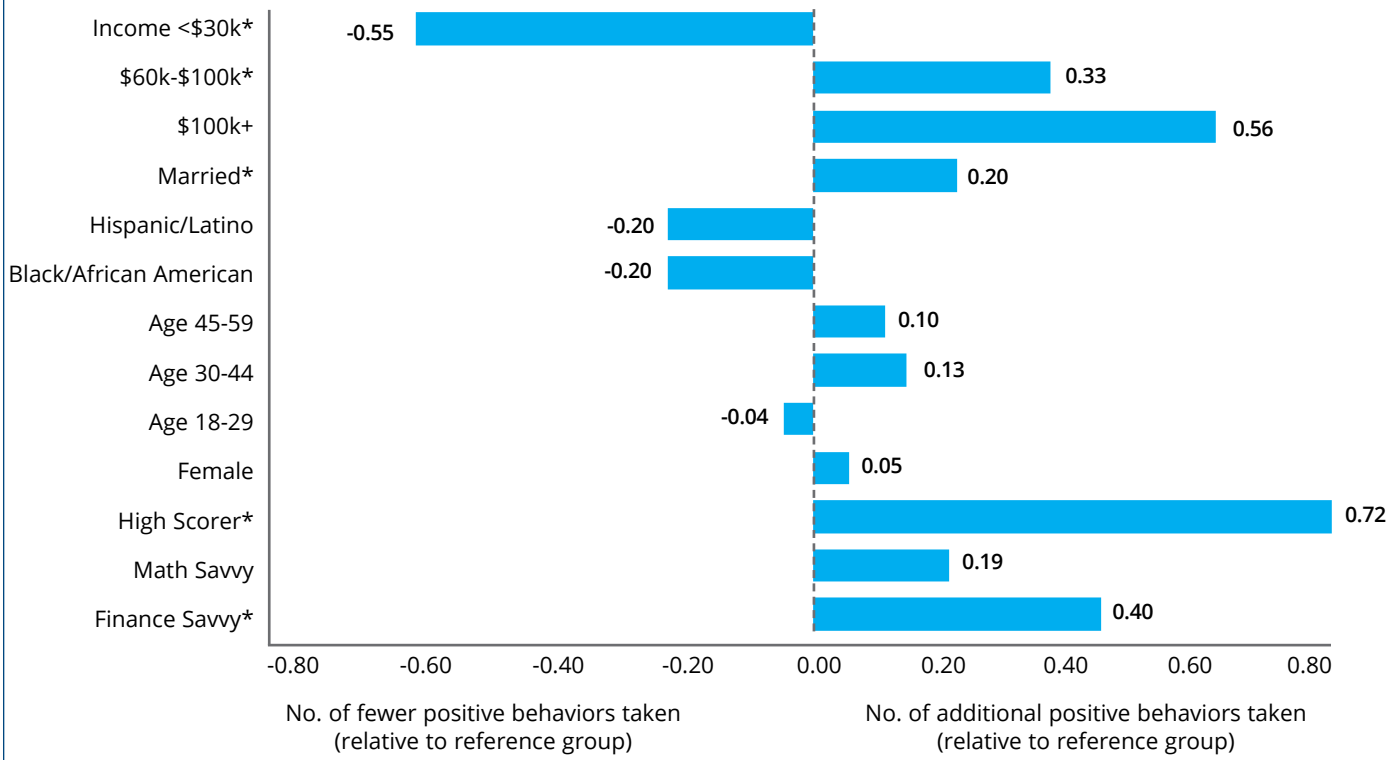
We also created an average percentage score of the total positive actions taken (out of four possible behaviors assessed) to examine whether the number of positive actions taken differs across knowledge groups (*see* final column on Figure 1). A score of 100 percent would mean a person took all four actions. On average, High Scorers took 66 percent of the possible positive actions, whereas Low Scorers took only 39 percent. Comparatively, Finance Savvy respondents took 53 percent of the positive actions and Math Savvy respondents took 45 percent.

Figure 1. Association Between Knowledge Level and Positive Behaviors



Before interpreting these results, we need to understand the role of key demographic variables like income, age and gender, which may be associated with both math and financial knowledge and financial outcomes. Therefore, to get a more complete picture, we created a statistical model examining the link between knowledge and total positive financial actions taken, when controlling for key sociodemographic factors (gender, race/ethnicity, age, income and geographic location), so that we could see the relative sizes of associations between all these factors, when considering them together. The results of this model are displayed in *Figure 2*. For these analyses, we examined the number of positive financial actions taken (out of 4 possible behaviors), with higher numbers indicating more positive behaviors were taken.

Figure 2. Key Factors Associated with Positive Behaviors Taken



** Indicates that the association is significant at the 5 percent level.*

Reference groups were $30k-$50k for income, non-married for marital status, white for race and ethnicity, ages 60+ years for age, male for gender, and Low Scorer for knowledge group membership. Due to small sample sizes, AAPI adults were omitted from analyses.

Notably, even when controlling for demographic factors, those with higher financial and math knowledge engaged in a greater number of positive financial behaviors. On average, High Scorers engaged in 0.72 more positive financial behaviors than Low Scorers. Math Savvy and Finance Savvy respondents engaged in 0.19 and 0.40 more positive actions than Low Scorers, respectively. In addition, the associations for High Scorers and Finance Savvy are statistically significant.

Further, the findings also show being a High Scorer plays a greater role on positive financial behaviors than any other demographic factor we studied, including income or marital status. Compared to white respondents, Black and Hispanic/Latino respondents engaged in 0.20 fewer positive financial behaviors than white respondents. In addition, higher income levels were associated with more positive actions taken. When we created models to look at the associations between these factors and individual positive behaviors, the pattern was very similar. Therefore, the benefits associated with knowledge are uniform across the behaviors studied.

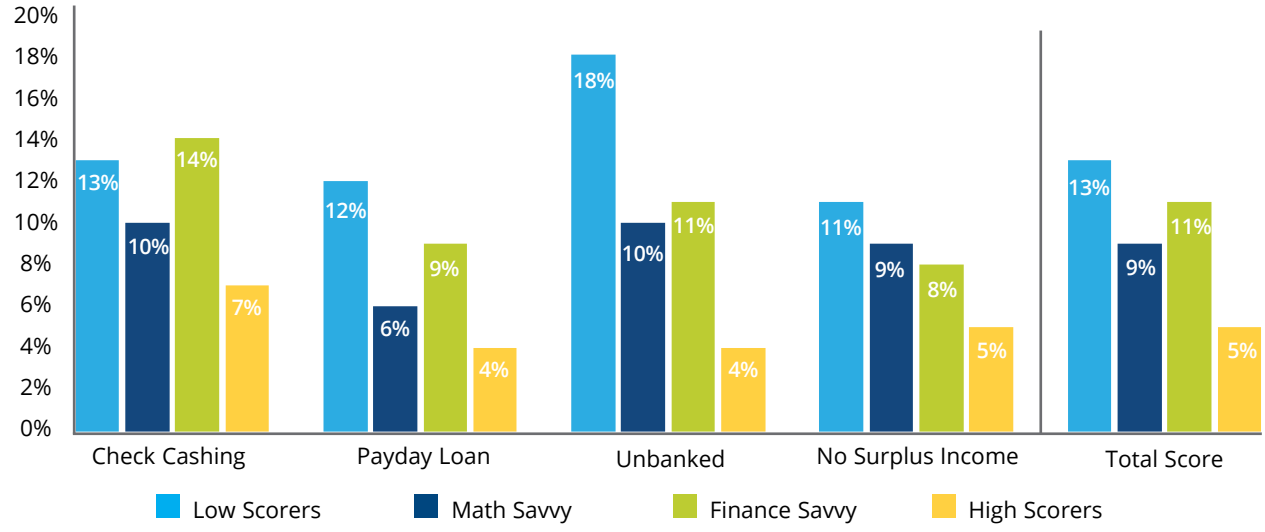
Financial and Math Knowledge and Negative Financial Behaviors

We also examined how math and financial knowledge are related to negative financial behaviors (check cashing, use of payday loans, unbanked status, lack of surplus income)—things that can often preclude financial wellness. Figure 3 shows the overall patterns are slightly different from those observed with the positive behaviors. While High Scorers engaged in negative behaviors less often than all other knowledge groups, the Finance Savvy did not display consistently better outcomes than the Math Savvy.

High Scorers were much less likely than any other group to report taking negative financial actions—particularly Low Scorers. Notably, High Scorers were four times less likely report being unbanked and three times less likely to use payday loans than Low Scorers. Differences between Finance Savvy and Math Savvy respondents were less pronounced. Although Finance Savvy respondents were somewhat more likely to report check cashing or use of payday loans than their Math Savvy counterparts, there were no other meaningful differences.

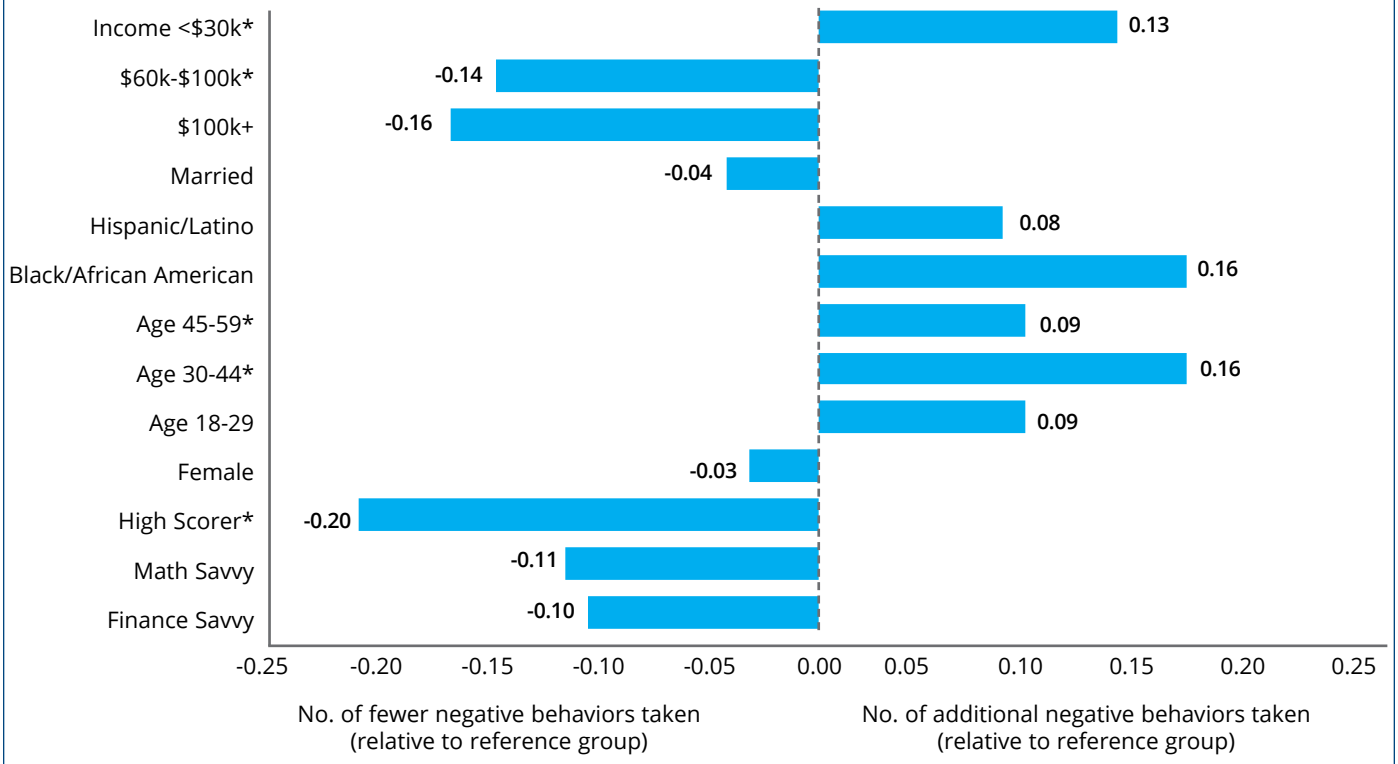
We also examined whether the average total negative actions taken (out of four possible) varied as a function of math knowledge. As with positive outcomes, we display the average negative actions out of four taken as a percentage. In this case, though, higher values indicate that more negative actions were taken. Thus lower values suggest higher finanical capability. Here, High Scorers had an average of 5 percent, Low Scorers 13 percent, Finance Savvy 11 percent and Math Savvy 9 percent.

Figure 3. Association Between Knowledge Level and Negative Behaviors



As with positive behaviors, we created a model to examine the specific association between math and financial knowledge and the number of negative financial behaviors taken, while also accounting for demographic factors. Results are displayed in Figure 4. For these analyses, we examined the number of negative financial actions taken (out of 4 possible behaviors), with higher numbers indicating more negative behaviors were taken.

Figure 4. Key Factors Associated with Negative Behaviors Taken



* Indicates that the association is significant at the 5 percent level.

Reference groups were $30k-$50k for income, non-married for marital status, white for race and ethnicity, ages 60+ years for age, male for gender, and Low Scorer for knowledge group membership. Due to small sample sizes, AAPI adults were omitted from analyses.

The results show that the associations between knowledge and negative financial behaviors remain when controlling for demographic factors, and again, being a High Scorer was associated with the least engagement in negative financial behaviors. In this case, being a High Scorer was associated with engaging in, on average, 0.20 fewer negative behaviors than Low Scorers. However, while being Finance Savvy or Math Savvy were respectively tied to engaging in 0.10 and 0.11 fewer negative financial behaviors than Low Scorers, these differences were not statistically significant.

The only statistically significant difference for the knowledge variables was between High Scorers and Low Scorers. Given that the potential consequences of engaging in negative financial behaviors are sizeable, it is noteworthy that this beneficial association was only for High Scorers. As with positive behaviors, the magnitude of the effect associated with being a High Scorer was greater than that associated with any of the demographic factors studied, including income or race/ethnicity. We saw a similar pattern of results when looking at the associations between knowledge and demographic factors and individual negative behaviors.

Discussion

The results suggest that there may be considerable benefit in having high levels of both financial and mathematical knowledge. We examined positive and negative financial behaviors and saw High Scorers (that is, those who exhibited high math and financial knowledge) were most likely to report positive behaviors and least likely to report negative ones. Although there appear to be benefits associated with financial knowledge alone for certain behaviors, we only saw consistent and statistically significant benefits for respondents who had both types of knowledge. Specifically, though Finance Savvy respondents (meaning those who exhibited high financial but low math knowledge) did well with regard to positive behaviors, this did not carry over to negative behaviors, notably using check cashing services and being unbanked. It is also notable that the benefits associated with being a High Scorer were greater than key demographic factors such as income level.

The findings are relevant to a wide range of decision makers. Financial education programs are continually expanding across the United States, particularly within high schools and colleges. However, the ways these are being implemented can vary widely. For example, some financial lessons are incorporated within social studies class, or, pertinently, as a math course. While more research is needed, the present study suggests there may be particular value to implementing these courses within a mathematical setting. At the very least, it suggests that replacing math coursework with a financial education class could be counterproductive.

Overall, though, these results are best interpreted constructively. They suggest that math and finance education may be complementary aspects of an overall system that best prepares students for future success.

Methodology

About the data

The analyses outlined in the brief use data collected between April 23 and May 14, 2021, through the AmeriSpeak® Panel. Funded and operated by NORC at the University of Chicago, AmeriSpeak is a probability-based panel designed to be representative of the U.S. household population. Randomly selected U.S. households are sampled using area probability and address-based sampling, with a known, non-zero probability of selection from the NORC National Sample Frame. These sampled households are then contacted by U.S. mail, telephone, and field interviewers (face to face). The panel provides sample coverage of approximately 97 percent of the U.S. household population. Those excluded from the sample include people with P.O. Box only addresses, some addresses not listed in the USPS Delivery Sequence File and some newly constructed dwellings. While most AmeriSpeak households participate in surveys by web, non-internet households can participate in AmeriSpeak surveys by telephone. Households without conventional internet access but that have web access via smartphones are allowed to participate in AmeriSpeak surveys by web. AmeriSpeak panelists participate in NORC studies or studies conducted by NORC on behalf of governmental agencies, academic researchers, and media and commercial organizations. 1,680 U.S. adults ages 18 and older participated in the study. The study was only fielded in English and was administered online. Respondents were considered eligible for the study if they were either the primary decision-maker or shared in the decision making related to finances in the household. Oversamples of African American and Hispanic/Latino respondents were collected. The survey completion rate was 26.7 percent. The final AAPOR response rate (RR3) for the study was

4.5 percent, and the margin of error was 3.33 percentage points. AmeriSpeak participants self-identified their age, sex, education, and race/Hispanic ethnicity.

About the Knowledge Variables

Math knowledge measured the ability to calculate probabilities, percentages and inputs into an algebraic equation using three questions. Those who correctly answered at least 2 of the 3 questions were classified as 'High math knowledge,' whereas those who could correctly answer fewer than 2 were classified as "Low math knowledge.' Financial knowledge measured an understanding of basic financial concepts using three well known financial literacy questions ("Big 3"; Lusardi & Mitchell, 2004). Those who correctly answered at least 2 of 3 questions were classified as "High financial knowledge," whereas those who could only answered fewer than 2 questions correctly were termed "low financial knowledge" (see Appendix 1 for the full set of questions).

Weighting

Statistical weights for the study-eligible respondents were calculated using panel-base sampling weights to start. The base sampling weights are further adjusted to account for unknown eligibility and nonresponse among eligible housing units. The household-level nonresponse adjusted weights are then post-stratified to external counts for number of households obtained from the Current Population Survey. Then, these household-level post-stratified weights are assigned to each eligible adult in every recruited household. Furthermore, a person-level nonresponse adjustment accounts for nonresponding adults within a recruited household. Finally, panel weights are raked to external population totals associated with age, sex, education, race/Hispanic ethnicity, housing tenure, telephone status and Census Division. The external population totals are obtained from the Current Population Survey. Study-specific base sampling weights are derived using a combination of the final panel weight and the probability of selection associated with the sampled panel member. The screener nonresponse adjusted weights for the study are adjusted via a raking ratio method to general population age 18 and older population totals associated with the following sociodemographic characteristics: age, sex, education, race/ Hispanic ethnicity and census division.

About FINRA and the FINRA Foundation

The Financial Industry Regulatory Authority (FINRA) is a not-for-profit organization dedicated to investor protection and market integrity. It regulates one critical part of the securities industry—brokerage firms doing business with the public in the United States. FINRA, overseen by the Securities and Exchange Commission, writes rules, examines for and enforces compliance with FINRA rules and federal securities laws, registers broker-dealer personnel and offers them education and training, and informs the investing public. In addition, FINRA provides surveillance and other regulatory services for equities and options markets, as well as trade reporting and other industry utilities. FINRA also administers a dispute resolution forum for investors and brokerage firms and their registered employees. For more information, visit www.FINRA.org. The FINRA Investor Education Foundation supports innovative research and educational projects that give underserved Americans the knowledge, skills and tools to make sound financial decisions throughout life. For more information about FINRA Foundation initiatives, visit www.FINRAFoundation.org.

About FiCycle

Financial Life Cycle Education Corp works with educators and organizations to equip all students with the mathematical and financial skills and understanding necessary to navigate their financial life cycle and meet and exceed state requirements in mathematics. We are committed to promoting best practices in education. Central to our mission, we undertake research into effective mathematics and finance education. Our research demonstrates the efficacy of teaching math and finance in an integrated curriculum. This guides us in the creation and implementation of our educational program.

About NORC at the University of Chicago

NORC at the University of Chicago conducts research and analysis that decision-makers trust. As a nonpartisan research organization and a pioneer in measuring and understanding the world, we have studied almost every aspect of the human experience and every major news event for more than eight decades. Today, we partner with government, corporate, and nonprofit clients around the world to provide the objectivity and expertise necessary to inform the critical decisions facing society. www.norc.org

References

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

Hasler, A., Lusardi, A., & Oggero, N. (2018). *Financial fragility in the US: Evidence and implications.* Global Financial Literacy Excellence Center, The George Washington University School of Business. https://gflec.org/wp-content/uploads/2018/04/Financial-Fragility-Research-Paper-04-16-2018-Final.pdf

Hastings, J., Madrian, B., & Skimmyhorn, W. (2012). *Financial literacy, financial education and economic outcomes* (18412). National Bureau of Economic Research. https://www.nber.org/system/files/working_papers/w18412/w18412.pdf

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

Marley-Payne, J., Dituri, P., & Davidson, A. (2022). Financial education, mathematical confidence, and financial behavior. *Journal of Financial Counseling and Planning, 33*(2), 194-204. https://doi.org/10.1891/JFCP-2021-0060

Ogden, T. (2019) More States are Forcing Students to Study Personal Finance: It's a Waste of Time. The Washington Post. https://www.washingtonpost.com/outlook/2019/04/23/more-states-are-forcing-students-study-personal-finance-its-waste-time/

Appendix

Table 1. Demographic characteristics of four knowledge groups

Percent	Low Scorers	Finance Savvy	Math Savvy	High Scorers	Overall Sample
Female	66%	61%	61%	46%	54%
18-29 yrs.	19%	7%	31%	12%	14%
30-44 yrs.	36%	20%	43%	30%	30%
45-59 yrs.	22%	29%	17%	24%	24%
60+ yrs.	24%	45%	9%	34%	32%
White	22%	41%	23%	61%	47%
Black/African American	41%	30%	28%	14%	23%
Hispanic/Latino	34%	26%	45%	18%	25%
Married	33%	47%	35%	56%	49%
High Income ($60k+)	25%	40%	32%	58%	47%

1735 K Street, NW
Washington, DC 20006-1506
www.finrafoundation.org

CCSD-4844—05/23