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Assessing financial education methods: Principles vs. rules-of-thumb approaches

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ABSTRACT

Despite thousands of programs and tremendous public and private interest in improving financial decision-making, little is known about how best to teach financial education. Using an experimental approach, the authors estimated the effects of two different education methodologies (principles-based and rules-of-thumb) on the knowledge, self-assessed knowledge, financial self-efficacy, motivation to learn, willingness to seek advice, risk preferences, and time preferences of high-performing undergraduate students. They found both methods increased cognitive measures of knowledge and noncognitive measures of self-efficacy, motivation to learn, and willingness to take financial risks. They found few differences in the relative effectiveness of each method, although the principles methodology appears to generate larger gains in self-efficacy, while the rules-of-thumb method appears to reduce individuals' willingness to seek advice.

KEYWORDS

Financial education; financial learning assessment; financial literacy; heuristics; teaching methodologies

JEL CODES

A22; D14; H52; J24

Motivation

The most recent and widely cited reviews of the financial education literature provide lukewarm support for its general efficacy and leave open the question of optimal teaching methods. While some studies suggest little reason for optimism (Fernandes, Lynch, and Netemeyer 2014; Hastings, Madrian, and Skimmyhorn 2013), others suggest that education can positively impact select behaviors (Miller et al. 2015). A more recent review (Lusardi and Mitchell 2014) suggested previous nonfindings are unsurprising if financial literacy is a human capital investment with groups naturally differing in their optimal decisions. Unfortunately, none of these reviews evaluates the impact of different financial education methods. They are, however, united in their calls for more experimental work and better program evaluations.

A few recent studies suggested some promise for financial education. Experimental work in the developing world suggested that financial education can improve the accounting behaviors of microentrepreneurs (Drexler, Fischer, and Schoar 2014) and rainfall insurance decisions of farmers (Gaurav, Cole, and Tobacman 2011). In the United States, recent research by Lusardi and colleagues (2014) suggested several delivery mechanisms (e.g., brochures, narratives, and videos) that may be effective in improving confidence, self-efficacy, and financial literacy. Larger quasi-experimental studies also suggest that education may improve financial decision-making for high school students (Brown et al. 2015) and new military recruits (Skimmyhorn 2016). Importantly, while Lusardi and colleagues (2014) evaluated different delivery mechanisms, Drexler and colleagues (2014) demonstrated differential effects by course methodology (principles- or rules-of-thumb-based training). We build on their methodological evaluation using an experimental approach in a domestic setting of wide interest: undergraduate education.

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As an additional motivating factor for our work, economists appear divided on the utility of using heuristics (which we will equate with rules-of-thumb) for individual decisions. To date, there is substantial evidence that individuals use heuristics generally (Tversky and Kahneman 1974) and in financial decisions specifically (see Winter, Schlafmann, and Rodepeter 2012 for a review), and we are interested in whether encouraging their use via education might improve financial decision-making. While some suggest that simplifying financial topics may improve behavior (Drexler, Fischer, and Schoar 2014), others argue that employing rules-of-thumb in financial decisions might be costly because decisions are increasingly complex and highly individualized (Willis 2011). There may exist a tradeoff between simplifying information in order to increase learning and providing sufficiently complex information to prepare individuals for the variety of financial decisions they will make. Because the utility of rules-of-thumb education may vary according to individual abilities, assessing differential treatment effects is an especially important task. While some researchers (Love 2013; Cocco, Gomes, and Maenhout 2005) have developed improved rules-of-thumb, no research evaluates the effectiveness of teaching their heuristics. Our data also afford a more detailed look at the heterogeneous effects of two leading methods.

We estimate the effects of these two methodologies (principles-based and rules-of-thumb) using an experimental approach. While we are interested in actual behavioral outcomes, here we provide initial evidence on the programs using tests of knowledge and self-reports for several behaviors. We found that both methods increased cognitive measures of knowledge, noncognitive measures of self-efficacy, motivation to learn, and willingness to take financial risks relative to a control group. Relative to one another, we found that the principles methodology generates larger gains in self-efficacy, and the rules-of-thumb method reduces individuals' likeliness to seek advice.

Our research makes several unique contributions because it provides evidence on the general effectiveness of financial education and the relative effectiveness of different education methods. We studied the effects of financial education in a mandatory course, thereby eliminating pervasive concerns over selection into financial education programs or methodologies. The random assignment of students into courses and our ability to randomly assign teaching methods to instructors creates an appealing experimental context with a control and different treatment groups. We also collected data on several important outcomes (i.e., objective knowledge, self-reported knowledge, self-efficacy, motivation to learn, likeliness to seek advice, risk preferences, and time preferences) using a pre/post assessment. While ideally we would have observed actual financial decisions, we identified and observed a number of outcomes plausibly linked to financial decision-making. This approach enabled us to provide insight into the mechanisms under which financial education methods might affect decision-making. These outcomes also provide a more comprehensive look at the potential benefits of financial education than previously considered. Finally, our access to detailed administrative data enabled more precise estimation of the causal effects of education and the evaluation of potential heterogeneous treatment effects. In the next section, we describe the institutional setting and the data. We describe our identification strategy in the following section and present our results in the subsequent section. In the section after that, we briefly describe our robustness checks, and we discuss our results and conclude in final section.

Institutional setting and data

Background

The United States Military Academy at West Point is a highly selective (mean SAT in this sample is 1317) undergraduate liberal arts institution of moderate size (student population is approximately 4,500) with a robust core and a science, technology, engineering, and mathematics-focused (STEM) curriculum that results in a bachelor's of science degree for all graduates. The core curriculum includes a one-semester principles of economics course, typically taken during the sophomore year. As part of this semester-long course (40 × 55-minute lessons), students complete lab periods (4 × 2.0 hour) devoted to personal finance.[1] West Point requires completion of these labs to better prepare students for the financial challenges of military service (all graduates become lieutenants in the army) and to enable them to advise

and assist the soldiers they will lead. During the same year, students must also complete American Politics, a one-semester course with similar time requirements. Because the institution randomly assigned students to Principles of Economics or American Politics during the fall semester, we could evaluate the effects of financial education relative to a control group. We discuss the generalizability of our findings given this sample further in the final section.

Our treatment consisted of completion of the principles of economics course coupled with four 2-hour personal finance lab periods conducted using a principles-based (PB) or rules-of-thumb (ROT) methodology. The design enabled us to evaluate the general effectiveness of financial education and the relative effectiveness of the PB and ROT methodologies.

We used administrative data from the Academy that captures individual demographics (age, gender, race, and prior military service), SAT score,[2] and first-year academic GPA for members of the class of 2017 during the fall 2014 semester ($N = 986$).[3] We present summary statistics for these characteristics by control and treatment groups that demonstrate similar characteristics across all groups, and we discuss our experimental validity further in the next section.

Financial education methodologies

Students in both treatment methods covered the same topics and had the same course attendance requirements. Students completed the labs in a seminar format, with instructors presenting material via lecture, slides, videos, and handouts. Instructors assigned students practice exercises that required calculations by hand, using computers (e.g., Microsoft Excel), or using online calculators, and these exercises required students to implement and use unique concepts from each method. Class sizes were small (12 to 17 students, mean = 14.94), and included substantial interaction and active Q&A between the instructors and students. See table 1 for details on the topics covered in each lab period and the key differences by treatment method. Students had common reading assignments prior to each session from the *Guide to Personal Financial Planning for the Armed Forces* (Gayton and Handler 2012), and they completed the same capstone exercise, a personal financial plan consisting of goals and a detailed budget.[4]

We designed the PB method based on traditional personal finance instruction that teaches students general skills such as a financial planning process, evaluating the tradeoffs associated with different types of consumption, budgeting, and the time value of money. This method also covers specific topics such as emergency savings, investing, purchasing insurance, and the decision to buy/lease a car and buy/rent a home. Similar programs are used in a variety of settings including programs developed by national governments (e.g., the Federal Deposit Insurance Corporations' "Money Smart" program and the Australian Securities and Investments Commission's program of the same name), international organizations (e.g., UNICEF's Child Social and Financial Education Program), and nonprofit organizations (e.g., the National Endowment for Financial Education's "Smart About Money" and the Financial Industry Regulatory Authority Investor Education Foundation's "Love Your Money" program).

We designed the ROT method using the latest financial education curriculum of the nonprofit organization Moneythink.[5] We adapted their ROT and some specific examples to the topics we developed for our course. The ROT did not attempt to develop financial planning experts. Instead, this method attempted to simplify the presentation of information, avoided lengthy discussions of the theory or detailed calculations behind decisions, and most importantly, provided students with heuristics (17 in total) designed to simplify complex decisions and enable students to make good decisions. See table 1 for the ROT corresponding to each personal finance session topic.

We provide two examples to highlight the differences in the treatment arms. First, to teach the time value of money (TVM), the PB course introduced the content, provided visual demonstrations of the effects of compound interest (i.e., graphs), and had students complete (using by-hand calculators and Excel) a variety of exercises to emphasize the effects of changes in the parameters in the basic TVM formula: $FV = PV(1 + i)^n$. In the ROT course, instructors provided similar visual demonstrations of the effects of compound interest and provided students with online tools (e.g., calculators) to determine the present and/or future values of different cash flows. The ROT method briefly showed students the

Table 1. Personal finance curriculum and methods.

Lesson	Subject	PB methodology	ROT methodology		Applicable ROT	Hours
1	Personal finance for service members	Goal setting: Group brainstorming exercise	Goal setting: Group brainstorming exercise to develop SMART goals	1.1	Develop SMART goals and track your progress	2
		Net worth: PowerPoint presentation of equation	Net worth exercise: Online calculator	1.2	Net worth equals assets minus liabilities	
		Taxes: PPT and board work to calculate marginal vs. average tax rates	Taxes: PPT showing where to find taxes on pay stub		None	
		Budgeting: Group brainstorming exercise	Budgeting: 20/50/30 brainstorming worksheet	1.3	Pay yourself first	
				1.4	Do not spend more than you make	
				1.5	Create a budget using the 20/50/30 rule	
2	Personal finance basics/Major financial decisions	TVM: Excel-based exercise with explanation of equations; Example board problems using equations	TVM: Online calculator exercise with explanation of equations; Example board problems using online calculators	2.1	A dollar today is worth more than a dollar tomorrow	2
		Credit card balance example using Excel-based equation	Credit card balance example using online calculator	2.2	Always pay your bills on time	
				2.3	Always pay off your credit card balance	
		Pay day loan example using Excel-based equation	Pay day loan example using online calculator		None	
		New versus used car: Excel-based exercise with NPV equations	New versus used car: Online calculator-based exercise without providing NPV equations	2.4	An automobile costs $10,000 a year	
		Rent vs. buy exercise: Online calculator	Rent vs. buy exercise: Online calculator	2.5	Do not purchase a home for more than 2.5 times your annual income	
3	Investing for your future	Diversification exercise: Excel-based efficient portfolio presentation and online calculator-based exercise	Diversification exercise: Online calculator-based exercise	3.1	Do not put all your eggs in one basket	2
				3.2	Invest in low-fee Index Funds	
		DCA exercise: Excel-based equations	DCA exercise: Online calculator	3.3	Keep it simple by investing monthly and being disciplined	
		Emergency fund exercise: Excel-based equations	Emergency fund exercise: Online calculator	3.4	Build an emergency fund	
				3.5	Inflation will erode your purchasing power	
4	Retirement & insurance	Traditional vs. Roth IRA exercise: Excel-based	Traditional vs. Roth IRA exercise: Online calculator	4.1	Minimize taxes by investing within a tax-sheltered account	2
		Insurance needs exercise: Excel-based	Insurance needs exercise: Online calculator	4.2	Always carry the appropriate insurance	
					TOTAL	8

TVM formula but it did not encourage its use during practical exercises. As a result, the courses may vary slightly in their content (primarily the same topics but different examples), but especially in the problem-solving methods students were required to employ.

Second, when teaching students how to calculate their after-tax income, the PB approach covered all the intermediate calculations in determining a student's total tax liability, which included calculating adjusted gross income, determining deductions and credits, and subtracting FICA Social Security and Medicare taxes from their taxable income. The ROT course, on the other hand, simply highlighted these components and did not take time to show each individual calculation. In both courses, instructors emphasized the importance of understanding the difference between average and marginal tax rates, but in the ROT course, students were taught to determine their after-tax pay by simply referencing their military pay stub. Additionally, students enrolled in the ROT course were required to list only their total after-tax income when completing their budget exercise, while those enrolled in the PB course were required to list each individual component of their tax liability.

Despite these differences in design, there were a number of commonalities between the two methods. As previously mentioned, both shared the same textbook and assigned readings. In addition, the culminating event for the personal finance labs was a personal finance exercise (PFX) completed by both treatment groups and graded on the same scale. While most PFX components were common across teaching methods, the ROT method prompted students to use specific rules in their budgeting efforts (e.g., the use of SMART goals [see table 1] and recommended budget allocations by category). For several concepts, the two methods shared the same examples or practical exercises, but they required students to solve these problems using different techniques. In addition, instructor reliance on common teaching examples (e.g., teaching compound interest with the rule of 72) exists to some extent. Finally, while the treatment groups differed in their personal finance methodologies, they completed the same principles of economics lessons, some of which provided instruction on topics that could have influenced students' learning about personal finance (e.g., lessons on inflation, taxes, and consumer choice). These factors serve to mitigate the actual differences in the two treatment groups but were accepted as important baseline requirements for the economics program.

Outcomes

Our assessment utilizes data on nine different outcomes likely to be related to financial decision-making but observable at the completion of our education. These outcomes reflect a number of channels through which financial education could affect financial behavior. See Appendix table A1 for a complete list of our assessment items by outcome. We collected data for all outcomes from online pre- and post-assessments (99 percent completion rate) required as part of the course. Instructors initiated the assessments using common scripts, encouraged students to complete the assessments to the best of their abilities, and incentivized students to perform using participation grades. All items are identical for both assessments with the exception of a final set of items (new knowledge) discussed below.

Our first two outcomes relate to financial knowledge, measured using multiple-choice questions, and our motivation is twofold. First, knowledge development is a primary goal of financial education (Hastings, Madrian, and Skimmyhorn 2013; Lusardi and Mitchell 2014) and an appropriate benchmark for financial educators. Second, financial knowledge is positively related to financial decision-making in a number of contexts, including risk diversification (Lusardi and Mitchell 2008); hypothetical choices by college students (Chen and Volpe 1998); credit management, saving, and investment (Hilgert, Hogarth, and Beverly 2003); avoiding high-cost borrowing (De Bassa Scheresberg 2013); and planning for retirement (De Bassa Scheresberg 2013; Van Rooij, Lusardi, and Alessi 2012). We measured topical financial knowledge using custom-designed questions that reflect the specific course topics, and we report the percentage of 20 items answered correctly. We also measured financial knowledge using the percentage of the standard five items (commonly known as the "Big 5") developed by Lusardi and Mitchell (2009) answered correctly.

We use self-assessed knowledge as our third outcome because perceptions of financial knowledge and capabilities also may affect financial decision-making (Allgood and Walstad 2016). Our fourth outcome

measures financial self-efficacy for handling day-to-day financial measures because prior research (Robb and Woodyard 2011; FDIC 2007) suggested that financial education might increase individuals' financial confidence.

In addition, because low financial literacy has been linked to a lack of motivation (Mandell and Klein 2007), we measured the effects of the courses on individuals' motivation to learn about financial topics with our fifth outcome. Sixth, because financial advice may serve as a substitute for financial knowledge (Collins 2012), we measured individuals' self-assessed likeliness to seek advice. To simplify our empirical framework and support the use of ordinary least squares (OLS) regressions, we converted the Likert scale (1 = Very Low to 10 = Very High) answers for outcomes three through six into indicator variables that reflect "High" levels of the attribute (i.e., = 1 for scale answers ≥ 7, = 0 otherwise).

Financial education also might affect decision-making by altering individuals' risk preferences. Grable (2000) suggested that individuals with more education and those with higher levels of financial knowledge demonstrate higher levels of risk tolerance. A likely explanation is that financial education alleviates individual concerns by demonstrating risk is common in financial markets and assumed by many participants, but these effects also might move in the opposite direction, increasing individual risk aversion by highlighting the potential for losses. Our seventh outcome measures individuals' self-assessed willingness to take risk, and we converted the Likert scale response to an indicator for high willingness to assume risk as above. Eighth, because financial education might affect time preferences (Meier and Sprenger 2013), we evaluated a measure of patience using the share of a hypothetical loan allocated to long-term savings goals (>10 years).[6]

The final outcome reflects objective knowledge measures of students' financial choices for new financial decisions that were neither covered in the course nor presented in the initial assessment. One potential advantage of a PB financial education is its ability to teach students skills that can be used in new contexts. Said differently, a ROT approach might make it more difficult for individuals to solve problems when faced with new circumstances (Drexler, Fischer, and Schoar 2014). We asked students to make decisions related to paying down debts with different interest rates using a windfall payment, select among tax-advantaged savings strategies for children's education, and compute the time required to double a planned down payment for a home. We combined these three items into a new problem-solving outcome and report the percentage answered correctly. For all nine outcomes, we report the summary statistics by assessment (pre vs. post) and group (control vs. PB vs. ROT) in the results section.

Empirical strategy

To identify the causal effects of financial education, we made use of the ability to randomly assign students and the ability to assess student outcomes at the beginning and end of the course. The institution randomly assigned students to the American Politics or Economics course prior to the semester. Then, the Economics course director, working with the research team, completed a balanced random assignment process prior to the semester wherein each instructor was assigned an equal number of PB and ROT sections. This effectively randomly assigned students to a treatment method. As a result of these assignments, we could compare the changes in individual outcomes by group assignments. While our assignment processes are plausibly random, we utilized the pre/post nature of our assessments in a differences in differences (DD) framework that requires only an assumption of parallel trends across the groups.

As a result, we compared the changes in outcomes for students enrolled in American Politics (control group, $N = 422$) with the changes in outcomes for students enrolled in Economics overall (treatment group, $N = 574$), those Economics students assigned to the PB group ($N = 291$) or those assigned to the ROT group ($N = 283$) using the DD model specified in equation (1):

$$Y_{ist} = \beta_0 + \beta_1 Post_t + \beta_2 T_i + \beta_3 Post_t \times T_i + X_i'\gamma + \delta_s + \varepsilon_i \quad (1)$$

In this model, Y_{ist} is an outcome of interest (i.e., objective knowledge, self-reported knowledge, financial self-efficacy, motivation to learn, likeliness to seek advice, risk preference, time preference, and new knowledge) for individual i in period t in section s. $Post_t$ is an indicator that equals 1 for a student's end

of course (post) assessment and equals 0 for the initial (pre) assessment. T_i is an indicator that equals 1 for students assigned to the treatment group (PB or ROT) and equals 0 otherwise. X_i' is a vector of individual characteristics potentially related to student outcomes that includes age, gender, race, SAT scores, first-year GPA, and an indicator for prior military service. δ_s is a vector of section fixed effects (the course is offered during one of four standard times). We clustered our standard errors at the instructor level to capture unobserved correlations in the error terms.

We completed four different comparisons. To evaluate the overall efficacy of financial education, we compared the combined treatment group ($T_i = 1$) versus the control group ($T_i = 0$). Next, to evaluate the effectiveness of each method independently, we compared the PB treatment group ($T_i = 1$) to the control group and the ROT treatment group ($T_i = 1$) to the control group separately. Finally, to compare the two education methods, we compared the ROT treatment group to the PB treatment group. In each case, β_3 is the DD coefficient of interest and reflects the causal effects of an economics course and 6- to 8-hour financial education course relative to the control group (in comparisons 1 through 3), and the causal effects of a ROT course relative to the PB course (in comparison 4). The identifying assumption in this DD framework is parallel trends: we assume that the outcomes for the control group members would trend in the same manner as the outcomes for the members in a treatment group. The assumption seems plausible given the random assignment of students to the different courses (American Politics or Economics), the balanced random assignment (within instructor sections) of economics students to the PB and ROT methods, and the common sophomore student experiences at West Point. We provide additional evidence below.

For our final outcome (new financial problem-solving), we do not have a pre-treatment measure of individual decisions. As a result, we estimate the OLS regression in equation (2):

$$Y_i = \beta_0 + \beta_1 T_i + X_i'\gamma + \delta_s + \varepsilon_i \tag{2}$$

In this model, T_i is a binary treatment indicator, and the individual characteristics (X_i) and section fixed effects (δ_s) are the same as in equation (1). We clustered the standard errors at the instructor level and completed the same four comparisons described above.

In support of our identification assumptions, we completed two analyses. First, we compared individuals assigned to each group by all of our observable characteristics. In table 2, we provide summary statistics for each our experimental groups, and we compare them to the control group and to one another. The results reveal very few differences in the groups across a number of individual characteristics. The ROT group has a higher average SAT score and first-year GPA than the control group and a higher first-year GPA than the PB group. We controlled for these characteristics in our regressions, and we also completed a DD specification wherein the baseline differences do not undermine our identification.

Second, we tested whether the individuals' observable characteristics are related to their assigned treatment condition using the covariate regressions specified in equation (3):

$$T_i = \alpha_0 + X_i'\sigma + \delta_s + \varepsilon_i \tag{3}$$

For each of our four cases, we regressed an indicator for the assigned treatment condition (Combined, PB_i, or ROT_i) on our observable characteristics (X_i) and the section fixed effects δ_s. We then evaluated the partial R-squared for the individual characteristics as suggested by Altonji, Elder, and Taber (2005) and tested the joint significance of the individual characteristics in predicting treatment assignment. We present the results of these tests in panel B of table 2. In all four cases, the individual characteristics explain only a tiny portion of the variation in treatment (0.017, 0.016, 0.024, and 0.020, respectively), and the observable characteristics are jointly unrelated to treatment (p-values equal .512, .861, .254, and .255, respectively). Because there appears to be substantial covariate balance by treatment condition (panel A), and the observable characteristics are jointly unrelated to treatment group assignments (panel B), we proceeded as if the unobservable characteristics are unrelated to treatment condition. This is even stronger evidence than was needed for our DD model, which required only that the groups would trend similarly between the pre- and post-assessment. It strongly suggests a valid experimental design. This evidence also supports our identification assumption for our ninth outcome (new problem-solving), which we collected only during the post-assessment.

Table 2. Summary statistics.

			Treatment group						
			Combined		PB		ROT		
	Full sample Mean (SD) (1)	Control group Mean (SD) (2)	Mean (SD) (3)	Diff. from control (4)	Mean (SD) (5)	Diff. from control (6)	Mean (SD) (7)	Diff. from control (8)	Diff. from PB (9)
Panel A. Individual characteristics									
Age	18.60	18.57	18.63	0.06	18.66	0.09	18.60	0.04	− 0.05
	(1.11)	(1.05)	(1.16)	[0.37]	(1.15)	[0.29]	(1.17)	[0.67]	[0.588]
Female	0.15	0.14	0.16	0.02	0.15	0.01	0.18	0.04	0.03
	(0.36)	(0.35)	(0.37)	[0.31]	(0.35)	[0.79]	(0.38)	[0.16]	[0.291]
Black	0.08	0.10	0.08	− 0.02	0.08	− 0.02	0.08	− 0.02	− 0.001
	(0.28)	(0.29)	(0.26)	[0.27]	(0.27)	[0.36]	(0.26)	[0.33]	[0.950]
Hispanic	0.12	0.11	0.12	0.01	0.15	0.04	0.10	− 0.01	− 0.05
	(0.32)	(0.31)	(0.33)	[0.50]	(0.35)	[0.14]	(0.30)	[0.63]	[0.071]
Other race	0.11	0.12	0.10	− 0.02	0.08	− 0.03	0.12	0.001	0.03
	(0.31)	(0.32)	(0.30)	[0.40]	(0.28)	[0.14]	(0.32)	[0.98]	[0.173]
White	0.69	0.68	0.70	0.02	0.69	0.02	0.71	0.03	0.02
	(0.46)	(0.47)	(0.46)	[0.44]	(0.46)	[0.67]	(0.45)	[0.38]	[0.672]
SAT score	1317	1304	1326	22.32	1318	14.12	1335	30.74	16.62
	(124.97)	(122.08)	(126.33)	[0.01]	(120.89)	[0.13]	(131.37)	[0.002]	[0.117]
Prior enlisted	0.21	0.22	0.20	− 0.01	0.20	− 0.01	0.20	− 0.02	− 0.005
	(0.41)	(0.41)	(0.40)	[0.62]	(0.40)	[0.74]	(0.40)	[0.62]	[0.886]
First-year GPA	2.98	2.92	3.03	0.11	2.97	0.05	3.09	0.17	0.12
	(0.59)	(0.58)	(0.59)	[0.003]	(0.53)	[0.21]	(0.63)	[0.0003]	[0.014]
Observations	991	422	569		289		280		
Classes (sections)	73	35	38		19		19		
Instructors	24	11	13		12		13		
Panel B. Covariate regression results									
Partial R^2 for indiv. char.				0.017		0.016		0.024	0.020
p-Value for *F*-Test of joint sig. of indiv. char.				0.512		0.861		0.254	0.255
Observations				986		706		698	568

Note: DOD data. The table presents summary statistics from administrative and baseline assessment data. Standard deviations of each variable appear in parentheses (), and *p*-values for the differences in means appear in brackets []. We describe the treatment groups in the second section. In panel B, the partial *R*-squared and *p*-values at the bottom of columns 4, 6, 8, and 9 report the results from equation (3). In all cases, the observable characteristics are unrelated to the assigned treatment conditions.

One additional concern for the DD estimation between the two treatment groups (PB vs. ROT) might be that common shocks or experiences exist between members of one group that could drive results (e.g., all the good instructors use the same personal finance education method). To address this concern, we balanced instructor assignments across treatment groups to ensure that all economics instructors taught both methods (e.g., instructors with four sections taught two PB sections and two ROT sections). We also clustered our standard errors at the instructor level.

Results

Summary statistics

In table 3, we present summary statistics for our outcomes by treatment assignment (control vs. PB vs. ROT) and assessment (pre vs. post). The control group statistics (panel A) reveal primarily stable mean outcome levels between the pre- and post-assessments, with small declines among a few variables. The panel B results suggest large increases in mean outcomes after the course within the PB group for several outcomes (topical knowledge, self-assessed knowledge, self-efficacy, and willingness to take risk), small changes in a few (Big 5 knowledge, motivation to learn, patience), and a small decline in likeliness to seek advice. Similarly, the panel C results suggest large increases in mean outcomes after the course within the

Table 3. Financial outcome summary statistics.

		Panel A. Control		Panel B. PB treatment		Panel C. ROT treatment	
Outcome	Description	Pre Mean (SD)	Post Mean (SD)	Pre Mean (SD)	Post Mean (SD)	Pre Mean (SD)	Post Mean (SD)
1	Topical knowledge, %	59.93 (14.84)	57.95 (17.14)	64.24 (12.06)	71.35 (12.63)	64.34 (11.63)	71.34 (13.11)
2	Big 5 knowledge, %	73.06 (21.20)	70.00 (22.47)	74.40 (16.65)	77.01 (15.78)	73.93 (16.90)	77.00 (17.17)
3	Pr (Self-assessed knowledge ≥ 7), %	22.97 (42.11)	20.33 (40.30)	19.72 (39.10)	41.73 (49.44)	20.71 (40.60)	41.43 (49.35)
4	Pr (Self-efficacy ≥ 7), %	54.07 (49.89)	50.96 (50.05)	51.76 (50.09)	64.08 (47.46)	53.57 (49.96)	62.14 (48.59)
5	Pr (Motivation to learn ≥ 7), %	78.71 (40.99)	71.53 (45.18)	82.57 (36.70)	83.80 (35.70)	81.07 (39.24)	82.50 (38.06)
6	Pr (Likeliness to seek advice ≥ 7), %	84.69 (36.05)	82.78 (37.80)	93.31 (26.61)	88.56 (28.71)	94.29 (23.25)	86.07 (34.69)
7	Pr (Willingness to take risk ≥ 7), %	44.74 (49.78)	44.98 (49.81)	38.20 (48.83)	52.99 (49.88)	37.50 (48.50)	51.43 (50.07)
8	Loan allocation to long-term savings, %	38.97 (24.77)	40.49 (23.50)	37.20 (22.09)	40.25 (20.79)	39.64 (24.12)	40.07 (20.76)
9	New problem-solving, %	— —	42.34 (32.09)	— —	59.98 (30.22)	— —	61.19 (30.82)

Note: DOD data. $N = 986$. Outcomes described in second section. The final outcome (new knowledge) was only collected during the post-assessment.

ROT group for several outcomes (topical knowledge, self-assessed knowledge, self-efficacy, and willingness to take risk), small changes in a few (Big 5 knowledge, motivation to learn), and a moderate decline in likeliness to seek advice. For the final outcome, both treatment groups appear to have higher mean levels of performance in solving new problems relative to the control group.

Main effects

In table 4, we report the OLS estimates for equations (1) and (2), restricting our attention to the main coefficients of interest (i.e., the DD coefficients for columns 1 through 8 and the OLS coefficient for column 9). In panel A, we estimate the combined treatment effects (PB and ROT methods), and find large and statistically significant effects for seven of nine outcomes. In reporting our results, we refer to the main effects using the regression coefficients (in percentage points [pp]) and the effect sizes using the point estimate divided by control mean (in percentages). For example, on average, the two methods increase topical knowledge (column 1) by 9.07pp, a 15 percent increase on a control mean of 58.94 percent, and the effect is statistically significant ($p < .01$). The effects on Big 5 knowledge are smaller (8 percent) but significant ($p < .01$). Using a slightly different measure, individual self-reports of a high level of financial knowledge (column 3), the results reveal even larger increases. The education increases the probability of "high" (i.e., ≥ 7) self-assessments of knowledge by 25pp (114 percent, $p < .01$), a very large effect. Taken together, these results strongly suggest that together, the methods are effective in increasing individuals' financial knowledge. We cannot determine if the large increases in self-assessed knowledge reflect overconfidence or if students are reporting knowledge on items not included in the other measures.

Turning to our measures of anticipated behavior and preferences, the education increased the probability of "high" (i.e., ≥ 7) assessments of financial self-efficacy (column 4) by 15.43pp (29 percent, $p < .001$), suggesting that both methods may impart confidence and enable students to complete more routine financial tasks that lead individuals to rate themselves higher. Encouragingly, the culminating personal financial exercise in the course aimed to do just that. However, given that the self-efficacy gains (29 percent) are somewhat larger than the objective knowledge gains (8 percent–15 percent), these

Table 4. OLS estimates of main program effects.

	Outcomes								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Variable	Topical knowledge	Big 5 knowledge	Self-assessed knowledge	Self-efficacy	Motivation to learn	Likeliness to seek advice	Self-assessed risk pref	Patience	New problem-solving
Panel A. Combined treatment vs. Control									
Control Mean	0.5894	0.7153	0.2165	0.5251	0.7512	0.8373	0.4486	0.3973	0.4234
PostxT	0.0907***	0.0566***	0.2463***	0.1543***	0.0840***	−0.0283	0.1454***	0.0153	T 0.1568***
	(0.0106)	(0.0154)	(0.0291)	(0.0291)	(0.0287)	(0.0326)	(0.0352)	(0.0145)	(0.0213)
R^2	0.3019	0.1298	0.0711	0.0431	0.0500	0.0233	0.0633	0.0217	0.2208
Observations	1,972	1,972	1,972	1,972	1,972	1,972	1,972	1,972	986
Panel B. PB method vs. Control									
Control Mean	0.5894	0.7153	0.2165	0.5251	0.7512	0.8373	0.4486	0.3973	0.4234
PostxPB	0.0917***	0.0521***	0.2589***	0.1908***	0.0821**	0.0052	0.1538***	0.0409**	PB 0.1474***
	(0.0122)	(0.0183)	(0.0318)	(0.0327)	(0.0312)	(0.0320)	(0.0349)	(0.0166)	(0.0226)
R^2	0.2840	0.1435	0.0680	0.0522	0.0616	0.0225	0.0715	0.0218	0.2247
Observations	1,412	1,412	1,412	1,412	1,412	1,412	1,412	1,412	706
Panel C. ROT method vs. Control									
Control Mean	0.5894	0.7153	0.2165	0.5251	0.7512	0.8373	0.4486	0.3973	0.4234
PostxROT	0.0897***	0.0613***	0.2334***	0.1168***	0.0860***	−0.0630	0.1368**	−0.0109	ROT 0.1625***
	(0.0117)	(0.0161)	(0.0322)	(0.0363)	(0.0293)	(0.0369)	(0.0551)	(0.0182)	(0.0344)
R^2	0.2963	0.1290	0.0514	0.0387	0.0441	0.0280	0.0589	0.0212	0.2177
Observations	1,396	1,396	1,396	1,396	1,396	1,396	1,396	1,396	698
Panel D. ROT method vs. PB method									
PB Mean	0.6775	0.7594	0.3038	0.5799	0.8455	0.9167	0.4670	0.3762	0.3022
PostxROT	−0.0020	0.0091	−0.0254	−0.0740*	0.0038	−0.0682***	−0.0169	−0.0518**	ROT 0.0087
	(0.0110)	(0.0154)	(0.0267)	(0.0378)	(0.0188)	(0.0216)	(0.0599)	(0.0198)	(0.0392)
R^2	0.2777	0.1137	0.0955	0.0480	0.0412	0.0209	0.0734	0.0319	0.1750
Observations	1,136	1,136	1,136	1,136	1,136	1,136	1,136	1,136	568

Note: DOD data. Columns 1–8 report the difference-in-differences estimates for equation (1) for each outcome listed. Column 9 reports OLS estimates of equation (2) for the new knowledge outcome that was included only on the final assessment. All regressions include section fixed effects. Heteroskedasticity robust standard errors, clustered at the instructor level, are depicted in parentheses. *$p < .10$; **$p < .05$; ***$p < .01$

reports could reflect overconfidence or actual increases in basic financial skills. The relationship between financial knowledge and self-efficacy warrants further attention. The course increased the probability of having a "high" level of motivation to learn about personal finance topics on their own (column 5, 8.40pp), a moderately sized effect (11 percent) that is statistically significant ($p < .01$). The course did not have an economic or statistically significant effect on the probability of being "highly" likely to seek advice on average (column 6, $p = .391$). Here, the point estimate suggests that the course could have lowered individuals' likeliness to seek advice. The course increased the probability of having a "high" self-assessed willingness to take financial risk (column 7) by 14.54pp, large effects (32 percent) that are statistically significant ($p < .01$) and consistent with previous findings that risk tolerance correlates with financial literacy (Hallahan, Faff, and McKenzie 2004; Grable and Lytton 1998). On average, the course did not increase individuals' patience (column 8, 1.53pp, $p = .302$). Finally, for new problem-solving (column 9), the OLS estimates reveal that the financial education increased performance by 15.68pp (37 percent, $p < .01$).

In panels B and C, we disaggregate the combined effects above and evaluate the effectiveness of each method compared to the control group. Many of the panel B estimates suggest very similar results as those above: the PB method increased knowledge (columns 1 through 3), self-efficacy (column 4), motivation to learn (column 5), willingness to take risk (column 7), and the ability to solve new problems (column 9).

In addition, the PB method increased individuals' patience (column 8) by 4.09pp (10 percent) ($p = .022$). The PB method does not appear to have a statistically or economically significant effect on individuals' likeliness to seek advice (column 6).

The panel C estimates suggest that the ROT method is also effective in increasing knowledge, self-efficacy, motivation to learn, willingness to take risk, and the ability to solve new problems. In most cases, the point estimates are very similar to the PB estimates. There are two exceptions: the ROT method appears to reduce individuals' likeliness to seek advice (column 6) by about 8 percent, but the statistical significance is marginal ($p = .102$). The ROT method has no effect on our measure of patience (column 8, $p = .555$).

Finally, in panel D, we provide estimates for the relative effectiveness of each financial education methodology. With three exceptions, the ROT method estimates do not differ significantly from the PB method (omitted group). In terms of differences, the ROT method reduces self-efficacy (column 4) by 7.4pp (13 percent) relative to the PB group ($p = .063$). This might suggest that the PB method imparts more technical skills and deeper understanding of personal finance topics that lead individuals to rate themselves higher. However, given that the methods do not differ significantly in their actual knowledge (columns 1 and 2), these reports might reflect overconfidence.

The ROT method also reduces the likelihood that an individual will seek financial advice (column 6) by 6.8pp (7 percent, $p < .01$). While the mechanism is unknown, one possibility is that the PB's complexity (e.g., more equations, use of MS Excel) leads individuals to conclude that they need assistance in making financial decisions. Another possibility is that the ROT method, by encouraging the use of online resources and providing specific Web sites, might inadvertently reduce individuals' likeliness to seek advice.

The third difference suggests that the ROT method reduces our measure of individuals' patience (column 8) by 5.1pp (14 percent, $p = .020$). In this case, the PB method's more intensive use of NPV analysis and students' own calculations of the TVM may have increased their willingness to allocate money from an anticipated loan toward long-term goals. Or, the PB method may have better demonstrated the TVM and returns associated with saving early in life, or it might have improved students' understanding of the real income requirements of later life consumption through the use of detailed calculations and MS Excel.

While the majority of our results suggest that both methods are equally effective, there are no outcomes in which the ROT method improves student outcomes relative to the PB method. Conversely, the PB method appears more effective in improving financial self-efficacy, increasing the likelihood of seeking advice, and increasing savings toward long-term goals.

Heterogeneous treatment

Next, we examine whether the methods had differential effects for our nine outcomes within four student groups (females, those with low quantitative ability, low financial knowledge, and low initial motivation to learn), and we present the results in table 5. Given that the focus of this article is the comparison in teaching methods, we center our heterogeneous treatment analysis on the comparison between the ROT and PB groups (comparable to panel D in table 4).

In table 5, panel A, we estimate the treatment effects among female students. Persistent interest in the underrepresentation of women in undergraduate economics majors (Goldin 2013) and in the field of finance (GAO 2013) motivates this analysis. In short, our estimates suggest no meaningful differences in the effectiveness of the PB and ROT methods for female students. While most point estimates are negative, only a few approach statistical significance (i.e., motivation to learn and likeliness to seek advice). This finding is most likely explained by the self-selection of female students to a school with a robust mandatory STEM curriculum.

The findings and discussion in Drexler and colleagues (2014) suggested that ROT methods might be more effective among individuals with low ability, knowledge, or motivation. This could be the case if these methods ease the learning of difficult concepts. In table 5, panel B, we estimate the treatment

Table 5. OLS estimates of heterogeneous program effects (PB vs. ROT).

	Outcomes								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Variable	Topical knowledge	Big 5 knowledge	Self-assessed knowledge	Self-efficacy	Motivation to learn	Likeliness to seek advice	Self-assessed risk pref	Patience	New problem-solving
					Panel A. Females				
Control Mean	0.6345	0.6976	0.0952	0.5238	0.6310	0.9643	0.1905	0.3640	0.4444
PostxROT	− 0.0185	− 0.0384	0.0323	− 0.0228	− 0.1990	− 0.1038	− 0.0028	− 0.0235 ROT	0.0658
	(0.0215)	(0.0406)	(0.0616)	(0.1342)	(0.1303)	(0.0691)	(0.0777)	(0.0490)	(0.0456)
R^2	0.3221	0.2557	0.1190	0.1437	0.0825	0.0509	0.1736	0.0625	0.2602
Observations	184	184	184	184	184	184	184	184	92
					Panel B. Low Math SAT scores (Score ≤ 600)				
Control Mean	0.6330	0.6964	0.3036	0.5179	0.8393	0.9464	0.5804	0.3634	0.4345
PostxROT	− 0.0169	− 0.0201	− 0.0846	− 0.1428	0.0013	− 0.1653***	0.0429	− 0.0332 ROT	0.0388
	(0.0187)	(0.0341)	(0.1062)	(0.1594)	(0.0690)	(0.0473)	(0.1277)	(0.0462)	(0.0541)
R^2	0.2348	0.0912	0.1330	0.1163	0.1147	0.1118	0.1038	0.0870	0.1831
Observations	220	220	220	220	220	220	220	220	110
					Panel C. Low initial knowledge scores (Score ≤ 0.55)				
Control Mean	0.5167	0.6750	0.2083	0.5139	0.7222	0.9861	0.4444	0.3977	0.5000
PostxROT	− 0.0192	0.0551	− 0.1688*	− 0.1175	− 0.0555	− 0.1004	− 0.0940	− 0.0428 ROT	− 0.0540
	(0.0426)	(0.0843)	(0.0857)	(0.1771)	(0.1489)	(0.0664)	(0.1114)	(0.0692)	(0.0000)
R^2	0.3949	0.1935	0.1004	0.1252	0.1793	0.1695	0.1928	0.1502	0.2664
Observations	150	150	150	150	150	150	150	150	75
					Panel D. Low initial motivation scores (Score ≤ 6)				
Control Mean	0.6391	0.7457	0.1196	0.4130	0.2717	0.9348	0.3804	0.3647	0.5072
PostxROT	0.0246	0.0223	− 0.0824	− 0.0926	0.0036	− 0.0943	− 0.0578	− 0.0482 ROT	0.0191
	(0.0228)	(0.0364)	(0.0945)	(0.1168)	(0.0609)	(0.0656)	(0.1107)	(0.0463)	(0.0633)
R^2	0.3681	0.1980	0.1322	0.0619	0.4167	0.0584	0.1750	0.0662	0.1970
Observations	198	198	198	198	198	198	198	198	99

Note: DOD data. Columns 1–8 report the difference-in-differences estimates for the outcome in each column for the group in each panel. Column 9 reports OLS estimates of the new knowledge outcome for the group identified in each panel. All regressions include section fixed effects. Heteroskedasticity robust standard errors, clustered at the instructor level, are depicted in parentheses.
*$p < .10$; **$p < .05$; ***$p < .01$

effects among relatively lower quantitative ability students (i.e., the lowest quartile of SAT math scores, score ≤ 600). The PB curriculum might be less effective for students with lower quantitative abilities given its emphasis on calculations and analytic approaches. Our results suggest that both methods are similarly effective among this group with one notable exception: the ROT course again reduces an individual's likelihood of seeking advice (column 6) by 16.5pp (17 percent, $p < .01$). Given that the mean SAT math score for this "low" ability group is still 575 and that they will have completed calculus prior to the economics course, these results are unsurprising.[7] They suggest that even among individuals with moderate quantitative abilities, the PB method appears slightly better than the ROT method.

In table 5, panel C, we estimate the effects of the methods among individuals with low initial levels of financial knowledge (roughly the lowest quartile, with initial topical knowledge assessment scores ≤ 55 percent). For these individuals, a ROT method might be more accessible and hence more effective. Our results suggest the opposite. All but one of the point estimates are negative, although only one is statistically significant. The results suggest that the ROT method reduces self-assessed knowledge (column 3) by 16.8pp (80 percent), although the result is only marginally statistically significant ($p = .0746$). Our explanation is similar to that above; even the "low" scoring individuals in this sample appear to have substantial financial knowledge.[8] Even so, the PB method again appears to be at least as effective as the ROT method and more so in one area.

Finally, in panel D, we estimate heterogeneous treatment effects for individuals with low initial scores for their motivation to learn (roughly the lowest quintile, with Likert scale scores ≤ 6 out of 10). One concern in selecting an appropriate teaching methodology is identifying an approach that will prove

effective even for those students least interested in the material. Here, the two methods appear to be roughly equally effective. None of the point estimates are statistically significant, and they appear equally divided between positive and negative. While the zeros are not especially precise, the results do not suggest a penalty for the PB method in this subgroup. We conclude this section by noting that while both teaching methods appear effective for a variety of outcomes, overall the PB method appears to generate more beneficial effects than the ROT method among our subgroups.

Robustness checks

We completed a series of robustness checks to further support our findings, although the empirical results are not reported here for the sake of parsimony. These robustness checks included analysis of student attention, alternative clustering methods for computing our standard errors, alternative functional forms (nonlinear regressions and binary treatment variable estimates), and alternative thresholds for "high" levels of outcomes three through seven (self-assessed knowledge, self-efficacy, motivation to learn, and likeliness to seek advice). None of these methods affected our primary results or inference.

Discussion and conclusion

We estimated the effects of two different financial education methodologies (PB and ROT-based) on several economic outcomes using a field experiment in a sample of high-performing undergraduate students. We found that both teaching methods increased cognitive measures (i.e., actual and perceived knowledge) and noncognitive measures (i.e., self-efficacy, motivation to learn, and willingness to take risks) of financial literacy.

Interestingly, we found only a few differences in the relative effectiveness of each method. The PB methodology appears to generate larger gains in self-efficacy, while the ROT method appears to reduce individuals' willingness to seek advice. Because the PB method arguably provides a more general toolkit than the ROT approach, we expected that it would better prepare students to solve new financial problems. However, both methods proved equally effective in preparing students on this dimension. The most likely explanation for the lack of differential effects for the two methodologies is their similarity in overall content. Despite attempts to make the methods distinct, the common readings, same syllabus topics, nearly identical culminating graded assignment, and the likelihood that instructors may have provided comparable instruction gave students a somewhat combined methodological experience. Researchers in this area should be aware that their treatment intentions may be more difficult to execute than they anticipate.

We also found a few heterogeneous treatment effects. For individuals with low quantitative abilities, initial knowledge scores, or initial motivation levels, the principles method appears to be slightly more effective overall, although the ROT method is effective in many cases. We found no statistically significant differences between the two methodologies for female students.

Relative to existing estimates, ours appear reasonable. Good causal estimates of financial knowledge gains from personal finance instruction are uncommon, but Lusardi and colleagues (2014) found knowledge effects from 6 percent to 20 percent and self-efficacy effects of 20 percent. Our estimates on knowledge (7 percent to 16 percent) are comparable, but our self-efficacy estimates (22 percent to 36 percent) are higher than theirs. Our larger effects seem reasonable given the duration of the course we study (one semester with 8 hours of instruction) versus theirs (about 5 minutes) and the required assignments (e.g., practice problems and a capstone personal financial planning exercise). To our knowledge, we are the first to measure the effects of different teaching methods on risk preferences, time preferences, individuals' likeliness to seek advice, and their problem-solving skills for new topics.

Perhaps of more direct interest, Drexler and colleagues (2014) evaluated these same training methods among micro-entrepreneurs. They found no improvements in self-reported accounting behaviors for the principles method and 8 percent to 25 percent improvements for the ROT method. While we do not measure any specific financial behaviors, our estimates for behavioral attributes such as self-efficacy (22 percent to 36 percent) and motivation to learn (11 percent) appear comparable to theirs.

Importantly, relative to their work, we found beneficial effects of both teaching methods and suggestive evidence that the PB method is more effective overall. While the exact reason is unknown, we suspect that although the ROT method may be effective for audiences with lower levels of human capital, PB methods may be equally or more effective in higher human capital settings. The optimal choice of teaching methods for audiences with human capital levels between our sample (West Point cadets) and theirs (micro-entrepreneurs in the Dominican Republic) requires additional study

Some internal validity considerations suggest reason for even more optimism in our sample. Absences among the treatment group will reduce actual differences in education and bias downward our estimates in the first three comparisons. A "John Henry" effect among the control group would have similar effects. For all four comparisons, sharing of course materials and new knowledge between groups, which seems even more likely in this team-focused environment than in other undergraduate settings, will result in contamination that also biases our estimates downward. Despite the intervention's design, the commonalities in the teaching methods (see the second section) also produce contamination. The last two concerns may explain why we did not find even more differences between the PB and ROT methods.

Our institutional setting is unique, and our results should be interpreted carefully. On the one hand, West Point is like many other competitive and elite undergraduate settings. For example, using estimated median SAT scores, West Point's nearest peer institutions are the University of Wisconsin-Madison and Boston University.[9] National ranking systems tell a similar story with West Point placing between Massachusetts Institute of Technology and the University of Pennsylvania in the *Forbes* 2015 rankings and between Colgate University and Macalester College in the *U.S. News and World Report* 2015 Liberal Arts College rankings.[10] Previous research on peer effects in the student body at West Point (Lyle 2009) identified Dartmouth and Williams as peer institutions, while research on classroom mentor effects at the Air Force Academy (Carrell, Page, and West 2010) identified institutions including Georgia Tech, California Institute of Technology, and Virginia Tech as peer institutions. While none of these institutions are the same as West Point, they provide some insight into the educational settings and student populations for which these financial education methodologies might have similar results.

On the other hand, self-selection into West Point (a military institution where students may take instructors' advice especially seriously), students' relatively high levels of human capital, their professional motivations to learn the material in preparation for their careers as leaders in the Army, and their near certain approval of a low-interest $40K loan during their junior year all suggest that our estimates could be upper bounds relative to typical undergraduates.

We omit a detailed discussion of the costs associated with each method but highlight a few important considerations. In our study, cost differences were negligible because we provided all lesson plans and materials to the instructors. In general, the principles method requires the educator to have a more complete understanding of the material, including the mathematical concepts inherent in financial problems (e.g., how to compute a loan payment) and the relevant policy rules for the audience (e.g., IRA eligibility). While these requirements may not exceed those of typical economics or finance classes at colleges and universities, they may not be assured in all educational settings (e.g., Way and Holden [2009] for U.S. high schools). The ROT method may be easier to execute once lessons are prepared, but the preparation itself may be more challenging as it requires identification and articulation of an appropriate rule-of-thumb as well as validation and integration of useful (often online) resources.

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Notes

1. Among the sophomores, some students were enrolled in both courses ($N = 60$). We assigned them to the treatment group because they received financial education, and we controlled for their dual attendance with an indicator variable. In addition, a small number of freshman ($N = 47$), juniors ($N = 25$), seniors ($N = 1$), and foreign exchange cadets ($N = 6$) were enrolled in one course, and we omitted them from the analysis.
2. We use SAT scores imputed by the school. The scores reflect the maximum of the individuals' actual SAT score or their estimated SAT score using an ACT/SAT concordance table.
3. Nine hundred ninety-four students took the first assessment, and 986 (99.2 percent) completed the second assessment. We restrict our analysis to individuals with data for both assessments.
4. The common economics text for both groups was R. Glenn Hubbard and Anthony P. O'Brien, *Economics*, 5th ed., 2015, Boston: Pearson.
5. For more information on Moneythink, see http://moneythink.org/.
6. The majority of students at USMA accept a low interest "pre-commissioning loan" during the spring semester of their junior year. The loan for the class of 2016 was a five-year loan for a maximum of $36,000 at an APR of 0.75 percent.
7. The 2012 U.S. SAT math mean was 514, which is between the first and fifth percentiles of our student distribution (http://testprep.about.com/od/SAT_Scores/a/2012_Average_SAT.htm).
8. Using a related outcome (Big 5 knowledge) and the National Financial Capability Study, Hastings and colleagues (2013) reported that 14 percent of respondents with "some college" answer all the Big 5 questions correctly compared to 17 percent in our sample. This suggests that our student population is relatively financially knowledgeable.
9. We estimated the median SAT score using Integrated Postsecondary Education Data System statistics for the class of 2017. We estimated the median using the average of the 25th and 75th percentile scores for each institution.
10. For the *Forbes* rankings, see http://www.forbes.com/top-colleges/list/. For the *U.S. News* rankings, see http://colleges.usnews.rankingsandreviews.com/best-colleges/rankings/national-liberal-arts-colleges/data.

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Appendix

Table A1. Financial education outcome instrument.

	Outcome		Items (correct answers)
1	Topical knowledge	1	You have assets and liabilities with the following values: Home: $150,000, Investment accounts: $50,000, Bank accounts: $3,000, Credit card debt: $500. Based on the information above, what is your total net worth? ($202,500)
		2	Why diversify your investments? (Because buying Intel and Microsoft exposes you to the same sector)
		3	If you have a child, a job, a home, and do not own a car, which of the following insurance policies should you most likely not purchase? (Renter's insurance)
		4	Which of following best describes a financial goal? (Saving $30,000 for a down payment on a home in 7 years)
		5	What is the difference between a mutual fund and an exchange traded fund (ETF)? (A mutual fund is priced at the end of the trading day, and an ETF can be traded during the trading day)
		6	A Roth IRA allows you to contribute income_____ (Post-tax, paying federal income taxes in the current year)
		7	If Hannah has an average tax rate of 15% and a marginal tax rate of 25%, at what rate will her next dollar of income be taxed? (25%)
		8	What is the primary advantage of starting to save for retirement early? (You take advantage of compounding interest)
		9	As you approach retirement, your investments should become _____. (Less risky)
		10	If you invested for retirement in an IRA instead of a traditional account, you would have _____, given the same rate of return for both accounts. (More after-tax savings than if you invested in a taxable account)
		11	A budget is important for all of the following reasons (Both A [Spend less than you earn] and C [Track your expenses over time])
		12	What are the two most important determinants of your credit score? (Your credit usage and payment history)
		13	A fund with a front load means that _____. (Brokers get their commission up front)
		14	What is dollar cost averaging? (Buying a fixed dollar amount of an investment regardless of the share price)
		15	If you have a marginal tax rate of 25%, what is your tax savings in the current year if you invest $1,000 in a traditional IRA? ($250)
		16	When deciding between renting versus buying a home/condo/etc., which factor matters least in your financial analysis of the decision? (Prevailing interest rates for auto loans)
		17	Index funds are _____. (A specific type of mutual fund or ETF that matches a market index)
		18	_____ life insurance provides a stated benefit for a fixed period of time and fixed premium payment. (Term)
		19	Why is it important to understand your risk tolerance and time horizon when saving for short-term, medium-term, and long-term goals? (Different savings and investment assets do not have the same interest rates)
		20	What financial asset can you purchase within your IRA account? (All of the above [stocks, bonds, mutual funds, exchange traded funds])
2	Big 5 knowledge	1	Suppose you had $100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow? (More than $102)
		2	Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, would you be able to buy more than today, exactly the same as today, or less than today with the money in this account? (Less than today)
		3	Do you think that the following statement is true or false? Buying a single company stock usually provides a safer return than a stock mutual fund. (False)
		4	Do you think that the following statement is true or false? A 15-year mortgage typically requires higher monthly payments than a 30-year mortgage, but the total interest over the life of the loan will be less. (True)
		5	If interest rates rise, what will typically happen to bond prices? (They will fall)

(*Continued on next page*)

Table A1. (Continued)

3	Self-assessed knowledge		How would you assess your overall financial knowledge? (1 = Very low and 10 = Very high)
4	Self-efficacy		I am good at dealing with day-to-day financial matters, such as checking accounts, credit and debit cards, and tracking expenses. (1 = Strongly disagree and 10 = Strongly agree)
5	Motivation to learn		I am motivated to learn about personal finance topics on my own. (1 = Strongly disagree and 10 = Strongly Agree)
6	Likeliness to seek advice		When facing an important financial decision, how likely are you to seek assistance or advice? (1 = Not at all likely and 10 = Very likely)
7	Willingness to take risk		When thinking of financial investments, how willing are you to take risks? (1 = Not at all willing and 10 = Very willing)
8	Time preference		Assume that you have just received $40,000 for your COW loan and that you have no other debts. Write the amount that you would allocate to each option in the space provided: Present consumption (0–6 months after receipt of loan), such as spring break, car, gifts, and clothing; Short-term savings (6–18 months after receipt of loan), such as class ring, uniforms, and furnishings; Medium-term savings (within 10 yrs. of graduation), such as wedding, real estate, and graduate school tuition; Long-term savings (more than 10 yrs. in the future), such as children's education and retirement.
9	New knowledge	1	One of your soldiers asks your advice regarding what he should do with $1,000 he recently inherited. The soldier has $2,500 in credit card debt with an APR of 18%, a $5,000 car loan with an APR of 6%, $500 in payday loan debt with an APR of 260%, and a $10,000 loan from his credit union at 7%. How much money from his inheritance do you recommend he allocate to each type of debt? ($500 to payday loan, $500 to credit card)
		2	Education savings. Imagine that you are a newly promoted Captain with two children and you are trying to decide how best to save for their college expenses. Assume that you have already expended your GI Bill benefit. Which of the following plans would afford you the most money available for your children's college expenses in 15–20 years? (A tax-advantaged savings account with an estimated real return of 5% wherein your savings contributions each year are made with after-tax dollars, the contributions grow each year without being taxed, and you pay no taxes upon withdrawal (much like a Roth IRA, but for college expenses)
		3	Time-value of money. You are interested in purchasing a home when you retire and you currently have $15,000 saved for a down payment. How long will it take you to double your down payment to $30,000, assuming a 6% real rate of return? (12 years)