

Experiential Financial Literacy: A Field Study of My Classroom Economy[☆]

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Abstract

The teaching of financial capability in schools has shifted in the last decade to earlier grades, including elementary school. This randomized field study assesses the impact of a simulated classroom economy on student's financial knowledge and behavior. Students show evidence of gains in financial knowledge, even though the program was entirely 'learn by doing' rather than formal instruction. Students also self report improved financial behaviors, and school administrative data show gains in learning in social studies and to a lesser extent, mathematics. Simulated experiential learning about personal finance shows promise as a relatively efficient mechanism to build financial capability among elementary-school students and could serve as an important component of a comprehensive effort to promote financial well-being in schools.

Keywords: financial literacy; financial behavior; education evaluation

1. Introduction

The development of financial capability—defined as understanding basic financial management and engaging in positive financial behaviors—remains an elusive goal (Lusardi et al., 2010a). About 35 states have some form of K-12 personal finance education required in schools (Council for Economic Education, 2014). Over the past decade, the focus of financial education policies has shifted from high school programs to financial education in earlier grades. For example, the National Association of State Boards of Education's Commission on Financial and Investor Literacy issued a report recommending that states 'consider infusing financial and investor education *throughout* the K12 curriculum' (p. 20). The Federal Financial Literacy and Education Commission's 'Starting Early for Financial Success' initiative promotes the potential benefits of reaching students at

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young ages for financial capability later in life.

An important question is if learning about finances is appropriate at younger ages. Reviews of the literature on children’s cognitive development and economic understanding (see, for example, Schug (1987), Webley and Nyhus (2006), or Scheinholtz et al. (2012)) indicate not only that children can understand financial concepts at younger ages than high school, but also that their understanding is well developed by age 12. Moreover, many children control some financial resources by this age (see Doss et al. (1995)) and may need training and guidance in how to manage their finances. While other studies have examined the effects of financial programs for older students (see Peng et al. (2007) and Totenhagen et al. (2015)), elementary school age students are less frequently studied (for a discussion, see Batty et al. (2015a)).

Relatedly, Drever et al. (2015) argue that financial knowledge is only one piece of the puzzle; the formation of financial attitudes and habits—which commonly occurs during childhood—is another potentially important driver of adult financial outcomes. The process through which young people acquire these values, norms, and behaviors is typically referred to as financial or economic socialization (Danes, 1994).

Naturally, much of this socialization occurs in families, as parents or other influential adults model financial behaviors or discuss family finances (see Gudmunson and Danes (2011) for a review). Research suggests that financial behaviors and self-confidence are associated with higher levels of parental guidance and oversight (see Pliner et al. (1994); Grinstein-Weiss et al. (2011) and Kim and Chatterjee (2013)). Otto (2013) even observe a relationship between financial socialization and savings behavior in adolescence, although the impact on saving behavior in adulthood is less clear (Ashby et al., 2011).

Providing financial education in elementary school may help to counteract student’s lack of financial socialization outside of school (Suiter and Meszaros, 2005), ideally before negative habits can take hold (Schug and Walstad, 1991). The topic of how parental socialization and the role of non-school based experiences influence young people are an important area of study in general (for a discussion, see Grusec and Davidov (2007)). The role of socialization with younger children related to financial capability is an important, further application of this work (see Van Campenhout

(2015); Shim et al. (2010); Jorgensen and Savla (2010)).

While there are strong arguments in favor of introducing financial education in elementary schools, the curriculum in most schools is focused largely on math and language skills (Suiter and Meszaros, 2005). This leaves only minimal time for other topics. Moreover, many teachers feel unprepared to deliver personal finance instruction (Way and Holden, 2009); therefore, alternative educational approaches that focus more on financial socialization and rely less on dedicated lesson plans or teacher expertise can fill an important need.

One example of such an approach is bank-at-school programs. Some school districts offer in-school banking programs, facilitated through national organizations such as Save for America, via state-sponsored programs like the Delaware and Illinois Bank at School programs, or through independent partnerships between schools and local financial institutions. These initiatives offer children the chance to practice managing money with their own accounts (Johnson and Sherraden, 2007) and may enhance student learning by providing young people opportunities to apply what they learn in financial management programs, thereby increasing the relevance of the material and improving student engagement (Collins and Odders-White, 2015). While bank-at-school programs show promise, they require partnerships between school districts and financial institutions and ongoing oversight. These challenges limit the widespread use of these programs. In general there is support of the idea that experiences are powerful for learning in the context of non-education based experiential learning on subsequent behaviors (see Cai and Song (2017)) as well as in school settings (see Kourilsky (1977) and Rupp (2014)).

In this study, we consider an alternative approach that, like in-school banking, is experiential in nature, but is simpler to administer. In My Classroom Economy, students practice making financial decisions in a classroom-based economy that teachers implement as a classroom management system. This stands in contrast to more traditional financial education programs that follow specific lesson plans. To date, no rigorous studies have examined the impact of a simulated economy on elementary school students' financial knowledge, attitudes, or behavior.

Historically, the focus of education policy has been on the high school financial literacy curriculum, not programs offered at younger ages. Studies document knowledge gains from high school

financial education (e.g., Harter and Harter (2009); Walstad et al. (2010); Bruhn et al. (2016) document significant improvements in behavior following a high school financial education intervention, as do Brown and colleagues (2015). A meta-analysis conducted by Fernandes et al. (2014) suggests that these interventions have very small, or no impacts on financial behaviors, however.

Formal evaluations of economic or financial education programs targeted to elementary school students show positive effects on gaining measured financial knowledge (see Harter and Harter (2009), Sherraden et al. (2011), Batty et al. (2015b)). These studies also find some evidence of positive changes in student attitudes and behaviors. We build on this work by conducting a randomized field trial in upper-elementary classrooms to evaluate an experiential financial learning program.

We find statistically significant improvements in students' financial knowledge and behaviors, including the frequency with which students engage in budgeting, as well as student reports of discussing financial management outside of school. Students also report taking part in more economic experiences. Surveys and interviews with teachers show that the program enjoys strong support, suggesting that MCE may be a relatively efficient mechanism for building financial capability among elementary-school students.

This paper begins with a review of the program studied, as well as the study setting and design. Next, we provide an overview of the measures and data collection, followed by findings and discussion of the relative merits of this approach compared to other modes of financial education.

2. Study Design

2.1. My Classroom Economy

My Classroom Economy (MCE) is a K-12 a classroom economic system. Students apply for classroom jobs and practice budgeting and saving through several core activities including: (1) earning salaries (in the form of classroom currency) for performing assigned tasks; (2) managing expenses, including paying rent for or purchasing their desks; (3) earning bonuses or incurring fines for particular behaviors; and (4) making spending decisions at classroom auctions and stores. MCE's learning objectives align with Common Core standards as well as state and national stan-

dards for financial literacy, and materials are available to teachers free of charge online.

Figure 1 shows displays example jobs that student could have in the classroom, including a banker and custodian. Figure 2 shows a schedule of fines for problem behaviors, and Figure 3 shows bonuses for positive behaviors or achievements. Figure 4 shows copies of in-classroom currency. The MCE teacher's guides provide many other materials, including paychecks, loan applications and job descriptions.

2.2. Setting: School District of Palm Beach County

The School District of Palm Beach County (SDPBC) implemented MCE during the first trimester of the 2015-2016 school year. With a total enrollment of more than 175,000 students, the SDPBC is the twelfth largest district in the U.S., with nearly 23,000 faculty and staff (Snyder et al., 2016). The SDPBC serves a diverse student base across its 276 schools. Among the District's 85,000 elementary-school students, 33 percent are white, 28 percent black, and 33 percent Hispanic, with the remainder from Asian, American Indian, or other backgrounds. 61 percent of K-5 students qualified for free or reduced lunch in 2015, and 18 percent were English Language Learners (Palm Beach County School District, 2016).

SDPBC's K-12 Financial Literacy Coordinator identified 24 schools at the end of the 2014-2015 school year both willing to implement MCE and participate in a research study. Of these 24, 15 schools were randomly assigned by the research team into either a treatment group that implemented MCE in the first trimester/term, and 9 were assigned to the control group that did not implement the program, or at least not until after the first trimester.

Teachers had hands-on opportunities to learn about MCE and to prepare MCE materials for their classrooms as part of a 3-hour training provided before the school year began. Most teachers were able to assemble most or all of their classroom materials during this time.

2.3. Students

Upper-elementary students are appropriate for this study for several reasons. First, cognitive development theory and related research suggest that the elementary years may be a window of opportunity when education can influence behavior later in life. Studies of cognitive development

show that skills related to saving money (ownership, conservation, planning, deferred consumption) are formed in early childhood (Webley (2005)). From a developmental perspective, the period between ages 5 and 7 (commonly referred to as the “5 to 7 shift”) is associated with marked growth in self-control, planning, and formal decision-making abilities. Students by age 8 to 10 are likely to be able to participate actively in MCE (see Melton (2013)). Finally, from a practical perspective, elementary school students tend to spend most of the day with their primary teacher, making elementary school a more natural environment to implement a classroom economy than later grades, where students move from room to room more often.

3. Data

3.1. Sample

As shown in table 2, 1,972 students across 115 classrooms in 24 schools were in the study and completed both pre and post-MCE assessment surveys. There were 1,187 students in the MCE (treatment) group, which started using the program during the first trimester, across 69 classrooms. The comparison group had 785 students across 46 classrooms. Figure 5 shows the locations of the schools in Palm Beach county.

Generally, the two groups are balanced based on observed demographic characteristics. One measure of school socioeconomic status is the percent of students at the school receiving free and reduced-price school lunches (FRL). This is a means-tested program, and schools with higher proportions of subsidized meals also have higher rates of low-income families and lower economic levels overall. MCE schools tended to have higher rates (60 percent) relative to the comparison schools (36 percent). Math performance was similar between the two groups of students, however. Students at comparison schools tended to be slightly older (less than 6 months). Similar to the District overall, 37 percent of students in the MCE group are White, with a higher percentage (47 percent) in the comparison group. The differences across groups appear to be minimal; nevertheless, we are careful to control for observable characteristics in the analysis.

3.2. Data Collection and Measures

Student outcomes are measured using in-class assessments at the beginning and end of the study period. Survey questions included in the pre- and post-assessments were developed based on validated measures presented in prior studies and were pretested with similarly aged children (Batty et al., 2015b). The survey processes and timing were the same for both the MCE and comparison groups. The University of Wisconsin Survey Center (UWSC) distributed and collected the in-class assessments at schools in late August and again in early November.

In-class assessments included: (1) Financial Knowledge (a 13-item quiz); (2) Budgeting Behaviors (a 5-item scale); (3) Propensity to Plan (a 4-item scale); (4) Financial Socialization (a 2-item scale) and (6) Economic Experiences (a 5-item scale). Each is discussed in more detail below.

Financial Knowledge

Although MCE does not employ direct lessons on financial topics, the exposure to financial situations that it provides could improve students' financial knowledge or motivate students to pursue that knowledge on their own. The financial knowledge scale that participating students completed for the MCE evaluation is composed of 13 quiz items that were pretested with similarly aged students. The quiz (see Appendix) includes questions related to owning and renting, budgeting, and opportunity costs, as well as basic financial numeracy, compound interest, profit and loss, account balances, and the costs of common items. The quiz items test objective financial knowledge rather than subjective self-assessments of knowledge.

When calculating students' financial knowledge score we employ item response theory (IRT), a technique used to generate a knowledge scale that accounts for differences in the difficulty of each question (DeVellis, 2016). We use a three-parameter logistic IRT model, where the three factors account for how difficult each item is, how well each item contributes to the overall scale, and how often students show a pattern of guessing. The scores are transformed to produce a mean of 50, where a high score shows higher financial knowledge. The standardized score is based on parameters estimated from the initial quiz. The changes in scores from the baseline to follow-up provide a consistent knowledge test score within subjects. The model and parameters, as well as a principal components factor table, are provided in the Appendix.

Budgeting

In classrooms using MCE, students earn money and must manage expenses. Students manage their cash flow in order to purchase items from the auction or classroom store, cover fines, and pay rent for or purchase their desks. This practice could translate into changes in how students understand budgeting. To test this possibility, we estimate a scale that assesses five items, each with five categorical responses (ordered so higher scores correspond to greater budgeting behavior). Since these are subjective and not objective quiz items of varying difficulty, the scale is simply the mean response across the five items. The items include:

- How important is it to keep track of how much money you earn and spend using a budget?
- How often do you have a plan for how you will spend money?
- How good are you at making decisions about how to spend your money?
- How confident are you about making decisions that deal with money?
- How good are you at keeping track of what you spend your money on?

Propensity to Plan

Along with potential benefits around instilling the importance of budgeting, the experience of having to earn money and manage expenses within the MCE program may promote an inclination to plan ahead. The student in-class assessments included four items about how often the student engages in general planning behaviors. The outcome is a normalized scale of responses from 1 to 5, again ordered so higher scores correspond to more positive behaviors. The items include:

- How often do you set goals for yourself?
- How often do you set goals for the next few days for what you want to achieve?
- How often do you have a plan for how your free time will be used in the next few days?
- How much better does it make you feel to have your free time planned out for the next few days?

Financial Socialization

In many homes, money is not a topic of frequent discussion. MCE allows students to experience economic and financial issues (for instance, income and the impact of fines and bonuses) in a safe setting, potentially leading to discussions at home that parents would not otherwise initiate. We include two items related to financial socialization. These measures relate to whether a student self reports that their family talks about money at home. The outcome is a normalized scale of responses from 1 to 5 across these two items: (1) How often does your family talk about how you spend money?, and (2) How often do you talk to your family about financial issues?

Economic Experience

Finally, we attempt to measure students' financial experiences outside the MCE setting. It is plausible that students' experiences with MCE might motivate them to look for ways to earn real income, save, or take on more financial tasks independently. The student in-class assessments includes six yes or no items that form a summed scale of responses (ordered so higher scores correspond to more experiences). The items include:

- In the last month, have you received an allowance?
- In the last month, have you gotten money from a job?
- In the last month, have you gotten money from your family for doing chores?
- Do you currently have a bank account in your own name?
- In the last month, have you received spending money or money as a gift?
- Do you make your own decisions about how to spend your money?

Table 2 provides summary reliability statistics for each measure at baseline across all students in the evaluation at baseline. The internal reliability, or Cronbach's alpha, is used to gauge how well the questions describe a common characteristic. As noted above, all measures were pretested prior to the study with other students of a similar age to refine the items included and to test each scales internal consistency, or how closely related items are as a group, and its validity, or how well

the scale performs relative to other measures of similar outcomes. Details can be found in Batty et al. (2015b).

Table 3 shows the means and standard deviations for the key variables in the student assessments for the MCE and non-MCE groups, before and after the program was offered.

3.3. Administrative Data

In addition to student in-class assessments, SDPBC provided data at the end of the school year on student grades from each trimester, student progress toward grade-based learning standards, and scores on the Florida State Assessment (FSA) standardized math exam. These data are all measured per student, in cross section, and do not represent changes from baseline to post-treatment. Because students in the control group may have taken part in MCE in the second and third trimesters and some classes in the MCE group may have stopped using it, these estimates may represent lower-bounds of potential effects.

Standards data are recorded when students are assessed for each Florida state standard in the course of the normal academic year. If the student is assessed, and then meets or exceeds the state standards, that is recorded in the data. For social studies there are 16 state standards, two to which are economics standards. For math, the standards include 12 standards. The outcome of interest is what proportion of assessed standards show the student has met or exceeded the threshold. The administrative data also record teacher provided grades in each of the three trimesters. Grades at the elementary level are measured as Exemplary, Proficient, Approaching, or Needs Development, with the first two categories considered passing. In addition, there is data on student's FSA math test scores. We do not have detailed student characteristics on each student, but do observe the student's school, race, English language status and attendance record (days absent for the year in total).

As a further test of the effects MCE, we were able to obtain a random sample of 2,450 4th and 5th graders who attend schools where MCE was never offered. However, the data contain no student characteristics or FSA scores-only indications as to whether or not each student met the assessed learning standards in social studies and math. Still, this adds an additional contrast to

be able to estimate the effects of schools that had any offering of MCE, combining the first trimester ‘treatment’ group and schools that potentially offered MCE later.

4. Fidelity to Program Design

Student assessments offer some evidence on how students in the first semester treatment group report using MCE. Figure 6 shows the number of times students recall buying something at the classroom store (or auction); the majority of students (60 percent) reported buying at least one item, meaning they were able to convert their income into some consumption during the study period. (Others may have been saving or used their income to pay fines or classroom expenses.)

In Figure 7 Nearly three out of four students reported paying a fine, consistent with the classroom management aspects of MCE. Figure 8 shows that students, at the end of the first trimester, had an average MCE account balance of \$1,295 (median \$1,000) and only 10 percent had less than \$20. All these student-reported behaviors indicate that MCE was in fact implemented, and that students had experiences with the program.

In addition, 60 of the 69 teachers who implemented MCE during the study period completed a nine-question teacher survey at the end of the first trimester. Ninety-four percent of the responding teachers were women, and nearly one-quarter of respondents had been teaching professionally for more than 20 years (24 percent), with another 36 percent having taught for between 11 and 20 years. A majority (52 percent) of teachers reported giving students opportunities to earn income more than once per day. Although a small percentage of teachers (10 percent) reported giving students opportunities to buy items at a store or auction once a week or more often, 40 percent reported doing so once every other week, in line with suggested guidelines from the training. Over 30 percent rated their overall experience with MCE as excellent, and 52 percent rate it as good. In line with this high level of satisfaction, 95 percent of teachers reported that they planned to use MCE again.

5. Analysis

The impact of MCE is estimated based on changes in student’s assessed measures conditional on if they attended schools assigned to receive the program in the first trimester of the school year. This is an Intention-to-Treat (ITT) estimate for a student assigned to an MCE school—not Treatment-on-the-Treated (TOT). Therefore this method should account for the selection effects that often introduce bias into students of non-randomized educational programs.

The main estimate the effects of MCE, is as follows:

$$Y_{followup} = \alpha_0 + \beta_1(1stTermMCE) + \beta_2(Y_{baseline}) + \beta_3X + \epsilon_{i,s} \quad (1)$$

where the estimate on the *1st Term MCE* indicator is the outcome of interest for a student at time 2 (where baseline is time 1 and follow-up is time 2), controlling for the baseline measure. *1st Term MCE* is an indicator for MCE participation by the student’s school in the first trimester.

In an iterative specification we then add in \mathbf{X} , a set of demographic characteristics including student race, student gender, student age, and student scores on a standardized math test in the prior school year. The controls are based on prior studies. For example, studies of gender indicate females have different financial knowledge than males (Edwards et al., 2007; Lusardi et al., 2010b) Because so many financial and economic decisions require quantitative reasoning, the relationship between math ability and financial knowledge is also important to consider (Agarwal and Mazumder, 2013).

A third specification with these controls includes clustered standard error at the school level—the level of treatment assignment. We are primarily interested in the estimate of the *1st Term MCE* indicator, which represents the causal effect of MCE on the change in each outcome from baseline to follow-up. Overall, this is a robust approach that allows us to isolate the ITT effect of a student being in a school assigned to the MCE group during the study period.

The administrative data analysis is cross-sectional based on student level records. Again the key estimate is a school offering MCE, as in the prior analysis, where MCE was offered in the

first term, are compared to schools where MCE was not offered in the first term. MCE schools may have ceased using MCE, and comparison schools may have taken up MCE. This contrast can be thought of as showing the effects of being assigned to a ‘more MCE’ versus less or no MCE programming. Here the outcomes are meeting curriculum standards, grades, and FSA math test scores:

$$Y = \alpha_0 + \beta_1(1stTermMCESchool) + \beta_2X + \epsilon_i \quad (2)$$

where the outcome of interest for a student is *MCE 1st Term School* where MCE was offered in the first trimester or term. The vector \mathbf{X} includes controls for student race, days absent, English-learner status, grade level, and the prior year’s FSA score.

The final approach includes students at the 24 schools in the prior analysis where MCE was potentially offered, as well as a sample of similar age students who attended a different school with no MCE offered at any point. Here a *1st Term MCE School* = 1 means the school could have ever offered MCE to any students, and = 0 means the school never offered MCE. There are no other characteristics (including classroom or school) that are observed, providing a limited estimation:

$$Y = \alpha_0 + \beta_1(MCESchool) + \epsilon_i \quad (3)$$

where the outcome of interest is *MCE School* where MCE was offered at any point to at least some students.

6. Results

Table 6 shows changes in the financial literacy or knowledge quiz, as scored using item response theory and then as a simple summed score. The overall estimate is about 1.4 points, or about one-half (0.4) more questions correct out of 13 items. In terms of effect size relative to the standard deviation (also sometimes called a sigma unit), is just under one-fifth of a standard deviation.

Table 6 shows changes in the student budgeting scale. The largest estimate of MCE's effect is about .09 points on a 5 point scale. The results are also only statistically significant when adding in controls. Relative to the standard deviation, this is only 0.05 sigma units. Table 6 also shows no significant changes in the propensity-to-plan scale, indicating that MCE did not have measurable effects in this area. The next row in Table 6 shows positive changes in the student-reported financial socialization scale. Here, the overall MCE effects are statistically significant and of relatively robust magnitudes, about one-quarter of a standard deviation.

Finally, the last estimates in Table 6 show changes in the student-reported financial experiences scale. Here the overall effect of MCE is statistically significant, showing about one-third more activity or behavior on a 6 item sum of indicators (the mean was 2.6 activities at baseline). This finding is consistent with MCE encouraging students to engage in more economic activity in the real world, including at home. However, even though it was not the intent of the assessment survey, students may have been reflecting on MCE activities, rather than economic behaviors at home. Of the five items in the scale (money for chores from family, having a bank account, receiving spending money, money from a job, making decisions about spending) the latter two could have been viewed in the context of MCE by some students. Therefore, we construct a 4-item version of the scale without these two items. The results are consistent with students engaging in greater levels of economic activities after their experience with MCE.

Table 5 shows the MCE estimated effect on students achieving state standards for social studies (which includes economics) in Columns 1 and 2, the effect on students achieving economics standards (a subset of social studies) in Columns 3 and 4, and the impact on the likelihood of receiving a passing grade in the third and final trimester in social studies in Columns 5 and 6. The MCE estimated effect on students achieving social studies standards is 0.044, relative to a mean of 0.527, or about 8 percent as a marginal effect. The results remain when adding in controls (race, absences, English learners, and grade level), as well.

The MCE estimated effect on students achieving any of the two economics learning standards is 0.273, which is an effect size relative to the standard deviation (0.311) of close to 0.9 (i.e., close to one sigma unit). The results remain significant when adding in controls, but are greatly reduced

in magnitude. Columns 5 and 6 show that there is no effect on these grades by the final trimester based on assignment to MCE.

Table 6 shows the MCE estimated effect on third trimester math grades in Columns 1 and 2, students achieving state standards for math in Columns 3 and 4, the impact on FSA standardized math test levels in Columns 5 and 6. The MCE estimated effects on students achieving math standards and the FSA test are not statistically significant. A student in a classroom assigned to MCE earns a third trimester math grade that is about 0.032 points higher than students in other classrooms. The effect size relative to the standard deviation is small in magnitude, close to 0.09, but statistically significant.

As a further test of the effects of students in schools assigned to MCE, Table 7 compares assessed standards for 2,450 non-MCE school students to those students in the primary study. These are all 4th and 5th grader students, but the MCE schools are combined regardless of the first term MCE assignment, and the comparison students attend schools where MCE was not offered at all. However, the data contain no student characteristics-only indications as to whether or not they met the assessed learning standards. The table compares the percentage of assessed standards in social studies, economics, and math met by the MCE group to the percentage for this comparison group. The magnitudes of the effects are relatively large and statistically significant, showing more academic standards being met. Given that the mean percentage of standards met in Table 8 in these data was approximately 50 percent for social studies, 34 percent for economics and 61 percent for math, these are relatively large effects.

7. Conclusions

Overall, the results of this study highlight the promise of experiential learning programs like MCE for elementary school-age students. Student assessments document gains in financial knowledge, budgeting, socialization, and financial experiences after 10 weeks of participation in the program. These findings are echoed in the parent survey. Moreover, school administrative data suggest gains in learning in social studies and economics, and teachers' feedback on the program was very positive. Collectively, these results show the potential of experiential programs like MCE

to begin to build financial capability.

Figure 9 shows the results of this study compared to a study of a traditional 3-5 hour formal instruction program on financial literacy by Batty et al. (2015c). Both that study and this current study examined a similar age group, research design and shared five common financial knowledge test questions.⁵ We were able to use the same IRT scoring procedures for both test scales, and then produce comparable pre-post estimates of effect sizes on knowledge based on treatment assignment. It is notable that the size of the gain is similar between the two studies. The Financial Fitness for Life (FFFL) program is a formalized course that taught specific content that appeared on the student knowledge quiz. Our results indicate that MCE produces similar knowledge gains without a formal curriculum. Both programs produce gains in knowledge on this scale of similar magnitudes (4 to 7 points, relative to a baseline mean of 33), and both have statistically positive effects. MCE has the advantage of being widely supported by students and also serving as a classroom management strategy.

The effects of MCE are not isolated to financial knowledge. The program also appears to spillover into learning about social studies, economics, and math. This finding supports the use of MCE to achieve broader learning objectives. This is one of the first studies to show how financial education programs might support other non-financial learning objectives.

It should be noted that the positive impact associated with participation in MCE does not differ across subgroups—that is, student and parents from a variety of backgrounds see similar effects in response to MCE. The effects are not concentrated among higher-SES schools, or even among students who are more proficient at math. School-based assignment to MCE is not ideal to test for subgroup effects, however, and how experiential learning affects more economically vulnerable students is an issue that may benefit from further exploration.

MCE is designed to run the length of a school year, giving students more opportunities to make

⁵(1) 'Ming wanted to buy a fancy notebook for school and save her money to buy a computer. Ming decided to buy a plain notebook that is less expensive so she can save more money for the computer. Mings decision is an example of ? ' (2) 'Jill had \$50 in her checking account. She made a withdrawal of \$10 and a deposit of \$20. What is Jills balance in her checking account? (3) 'The Smiths have \$750 in income, and \$800 in expenses this month. Are they saving money this month?' (4) 'A plan for spending your money is called?' (5) 'Suppose you have \$100 in a bank account that pays an interest rate of 10 percent per year. How much would you have in this bank account at the end of 2 years?'

financial decisions and receive feedback, and allowing teachers to incorporate more sophisticated elements of personal finance. The 10-week version of the program used for this study generated positive effects. The full, year-long version of MCE would likely show more substantial effects, and with decreasing demands on classroom time as the year goes on.

Indeed, the natural advantage of a simulated economy is that it can operate as a classroom management system without requiring the development of additional curricula. Experiential simulations like MCE could be operated concurrently with a traditional financial education curriculum. The combination of experiential learning and classroom work from elementary grades into middle school and high school may have promise as a flexible strategy that can continue to engage students as they develop and practice financial capability. A student who experiences MCE at age 9 and 10, in-school banking and coursework through age 14, and a combination of experiential and classroom learning at ages 15 to 18 might be most likely to develop stronger financial capability in adulthood. Engaging parents more directly could enhance the development of financial capability even further.

MCE also has the added advantage of serving as a classroom management system, ideally integrating with teachers' day-to-day efforts to promote positive behaviors. The approach imposes fewer requirements than more traditional financial education programs and requires less effort overall from teachers in terms of training and support. Interviews with teachers show the program enjoys strong support among teachers who participated in the pilot and the evaluation; in fact, 95 percent of teachers reported that they plan to continue using the program. Thus, MCE and similar approaches show promise as a relatively efficient mechanism to promote financial capability among K-12 students and could serve as an important component of a comprehensive effort to promote financial well-being.

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9. Tables and Figures

Figure 1: MCE Teacher Materials: Jobs

JOB	JOB DESCRIPTION	MONTHLY SALARY
Banker <i>1 for every 5 students</i>	Keep banking records for 4 to 6 students. Accept money for deposits. Pay out money for withdrawals. Keep some cash ready to meet requests. Deposit remaining cash in the Central Classroom Bank. Requires a recommendation.	\$700
Police Officer <i>1 for every 5 students</i>	Check for violations of class rules. Hand out tickets to fine students who break the rules. Keep a record of fines and payments. Deposit money from fines in the Fine Folder. Requires a recommendation.	\$650
Loan Officer <i>1-2 per class</i>	Allow students to acquire loans for a set amount. Hand out loan slips and calculate interest. Keep a record of all loans. Work with the Banker to deposit money from the students' accounts.	\$650
Clerk <i>2-3 per class</i>	Hand out papers to students. Hand out materials such as art supplies. Collect papers or homework from students when asked. Organize the class supply shelves and keep them neat.	\$600
Messenger <i>1-2 per class</i>	Deliver written or spoken messages to people throughout the building. Answer the class phone.	\$550
Custodian <i>3-5 per class</i>	Keep the writing boards and countertops clean. Tidy up classroom areas when they need it. Make sure recycling items are placed where they should be.	\$600

Source: <http://myclassroomeconomy.org/>

Figure 2: MCE Teacher Materials: Fines

FINES

In the classroom economy, the role of fines is to help students understand costs and consequences—it is **not to punish them**. The list of fines should be short and direct, matching your classroom priorities. Our list is an example.

RULE	TICKET AMOUNT
Dishonesty	\$500
Rudeness	\$100
Messy desk or cubby	\$100
Missing work	\$50
Off-task behavior	\$50
Tardiness	\$50

Although the Police Officers write tickets for fines, you control the process through an offense log. As you correct a student, you can mention that you're adding the violation to the log. Then, when Ticket Day comes, the Police Officers write tickets based on the entries in your log. In this way you retain explicit authority over dealing with misbehavior.

Source: <http://myclassroomeconomy.org/>

Figure 3: MCE Teacher Materials: Bonuses

BONUSES

In addition to the salaries that students earn from their jobs, they can earn bonus money by performing well academically and participating in extracurricular activities. Students need to earn bonuses to make rent and save up for the auction. In addition, bonuses can be useful incentives for your own class goals.

The following bonuses should be included if at all possible. The bonus amounts are a suggestion.

ACTIVITY	BONUS AMOUNT
Earn 100% on a small test or quiz.	\$50
Earn 100% on a major test.	\$200
Earn 90% to 99% on any assignment.	\$100
Complete an outside reading assignment.	\$100
Get a compliment from another teacher.	\$200
Join in an extracurricular activity.	\$100

Source: <http://myclassroomeconomy.org/>

Figure 4: MCE Teacher Materials: Currency



Source: <http://myclassroomeconomy.org/>

Table 1: Study Sample: Students and Classrooms in MCE and Non-MCE Schools

Group	Students	Classrooms	Schools	FRL	FSA Math	Age	White
MCE	1,187	69	15	0.60	52.6	8.98	0.37
Comparison	785	46	9	0.36	53.4	9.49	0.47
Total	1,972	115	24	Yes	No	Yes	Yes

Study Sample; Yes indicates difference based on 2-tail t-test at 0.05 level.

Table 2: Scale Construction

Scale	Reliability
Financial Knowledge	0.63
Budgeting	0.68
Propensity to Plan	0.60
Financial Socialization	0.47
Economic Experience	0.48

Scale reliability coefficient coefficient at baseline.

Source: 1,972 baseline student assessment surveys.

Figure 5: School Locations in Palm Beach County Florida

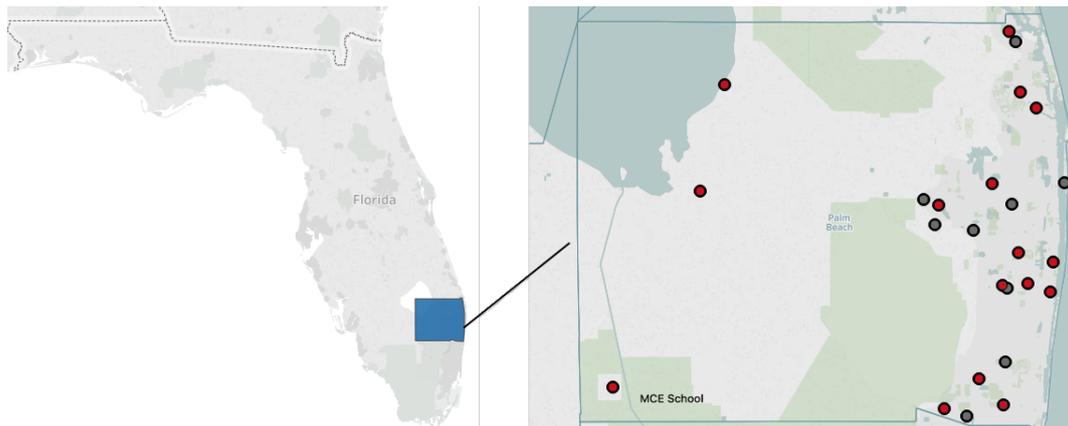
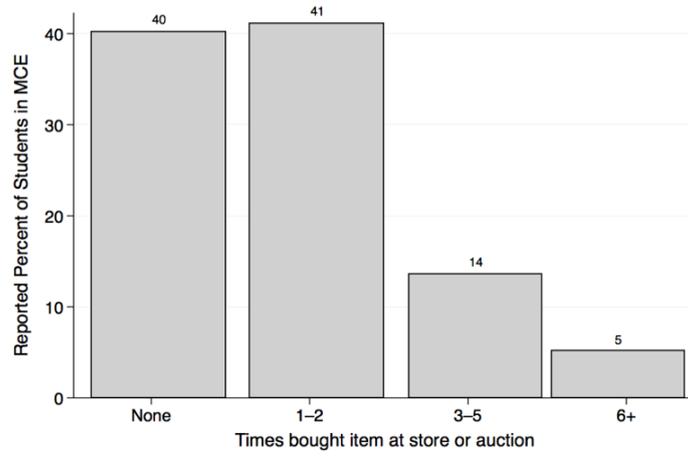
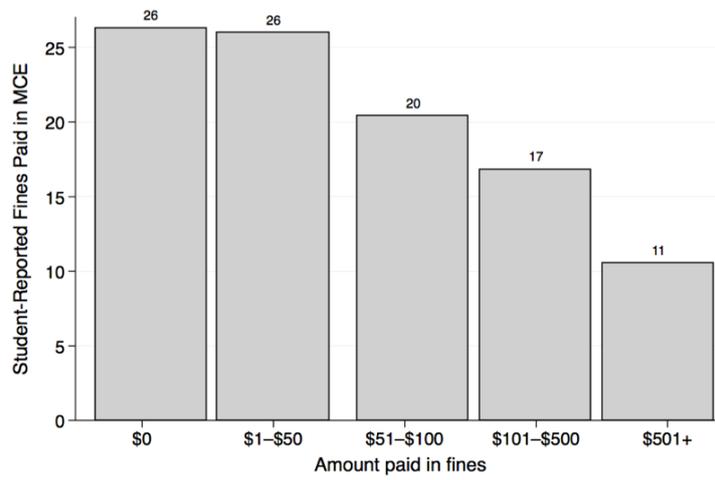


Figure 6: Student Reported Store Usage



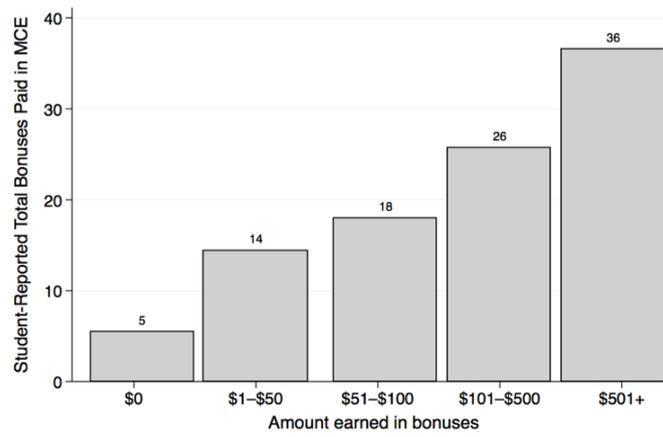
Source: Student Assessment Surveys, MCE Group

Figure 7: Student Reported Fines



Source: Student Assessment Surveys, MCE Group

Figure 8: Student Reported Account Balances



Source: Student Assessment Surveys, MCE Group

Table 3: Means and Standard Deviations

	(1)		
	Comparison	MCE Treatment	All
Baseline IRT Knowledge Score	49.27 (7.419)	50.94 (8.395)	50.27 (8.057)
Followup IRT Knowledge Score	48.78 (7.621)	51.53 (8.346)	50.42 (8.172)
Baseline Summed Knowledge Score	5.368 (2.433)	5.899 (2.663)	5.686 (2.585)
Baseline Summed Knowledge Score	6.451 (2.627)	7.307 (2.775)	6.964 (2.748)
Baseline Budgeting Scale	3.413 (0.793)	3.665 (0.760)	3.564 (0.783)
Followup Budgeting Scale	3.567 (0.785)	3.737 (0.766)	3.669 (0.778)
Baseline Planning Scale	3.351 (0.807)	3.479 (0.811)	3.428 (0.812)
Followup Planning Scale	3.385 (0.861)	3.461 (0.864)	3.430 (0.864)
Baseline Socialization Scale	2.324 (0.998)	2.621 (1.093)	2.502 (1.066)
Followup Socialization Scale	2.372 (1.062)	2.730 (1.091)	2.587 (1.093)
Baseline Experience Scale	2.398 (1.264)	2.722 (1.301)	2.592 (1.296)
Followup Experience Scale	2.512 (1.326)	2.957 (1.303)	2.778 (1.330)

Standard Deviations in parentheses. Source: Student assessment surveys.

Table 4: Estimated Effects

	(1) Main Effect	(2) + Controls	(3) School SE Clustering
IRT Knowledge Score			
MCE Group	1.380*** (0.305)	1.422*** (0.319)	1.422** (0.660)
Summed Knowledge Score			
MCE Group	0.403*** (0.106)	0.447*** (0.112)	0.447* (0.219)
Budgeting Scale			
MCE Group	0.0413 (0.0317)	0.0868** (0.0342)	0.0868** (0.0417)
Planning Scale			
MCE Group	0.00722 (0.0353)	-0.00173 (0.0388)	-0.00173 (0.0633)
Socialization Scale			
MCE Group	0.239*** (0.0471)	0.201*** (0.0526)	0.201** (0.0746)
Financial Experiences Scale			
MCE Group	0.288*** (0.0547)	0.271*** (0.0583)	0.271*** (0.0634)
Financial Experiences Scale - B			
MCE Group	0.118** (0.0544)	0.107* (0.0583)	0.107* (0.0560)
Controls	No	Yes	Yes
Observations	1972	1972	1972

Standard errors in parentheses.

Controls include race, age, gender and prior year math test scores.

Source: Student Assessment Survey.

* $p < .1$, ** $p < .05$, *** $p < .01$

Table 5: Notes: Social Studies and Economics Standards Met and Grades

	(1)	(2)	(3)	(4)	(5)	(6)
	SS Stds	SS Stds	Econ Stds	Econ Stds	3rd Term A	3rd Term A
1st Term MCE	0.0438*** (0.00681)	0.0487*** (0.00615)	0.273*** (0.0118)	0.0758*** (0.00730)	-0.00884 (0.00947)	0.0152 (0.0107)
Controls	No	Yes	No	Yes	No	Yes
Observations	1885	1885	1833	1833	1772	1772

Standard errors in parentheses; Notes: Soc Studies out of 16 standards. Economics out of 2 standards.

Controls include student race, days absent, English learner, grade level.

Source: PBCSD Administrative Data.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 6: Math Standards, Grades and Test Scores

	(1)	(2)	(3)	(4)	(5)	(6)
	3rd Term A	3rd Term A	Stds Met	Stds Met	FSA Math	FSA Math
1st Term MCE	0.0320** (0.0147)	0.0340** (0.0150)	-0.00987 (0.00827)	0.00308 (0.00895)	-0.0511 (0.0379)	-0.0466 (0.0376)
Controls	No	Yes	No	Yes	No	Yes
Observations	1739	1739	1755	1755	1741	1741

Standard errors in parentheses; Notes: Share of 12 Math Standards assessed as positively

Exemplary Grade 3rd Trimester; FL Standardized Assessment (FSA) test score.

Controls: race, absences, English status, grade, prior FSA.

Source: PBCSD Administrative Data.

* $p < .1$, ** $p < .05$, *** $p < .01$

Table 7: Standards Met, MCE Schools Compared to non- MCE Schools

	(1)	(2)	(3)
	SS Stds	Econ Stds	Math Stds
MCE vs Comparison	0.0579*** (0.00640)	0.101*** (0.0119)	0.111*** (0.00838)
Observations	4311	3489	4347

Standard errors in parentheses

Notes: All MCE Schools vs. Non-MCE schools. Source: PBCSD Administrative Data.

* $p < .1$, ** $p < .05$, *** $p < .01$

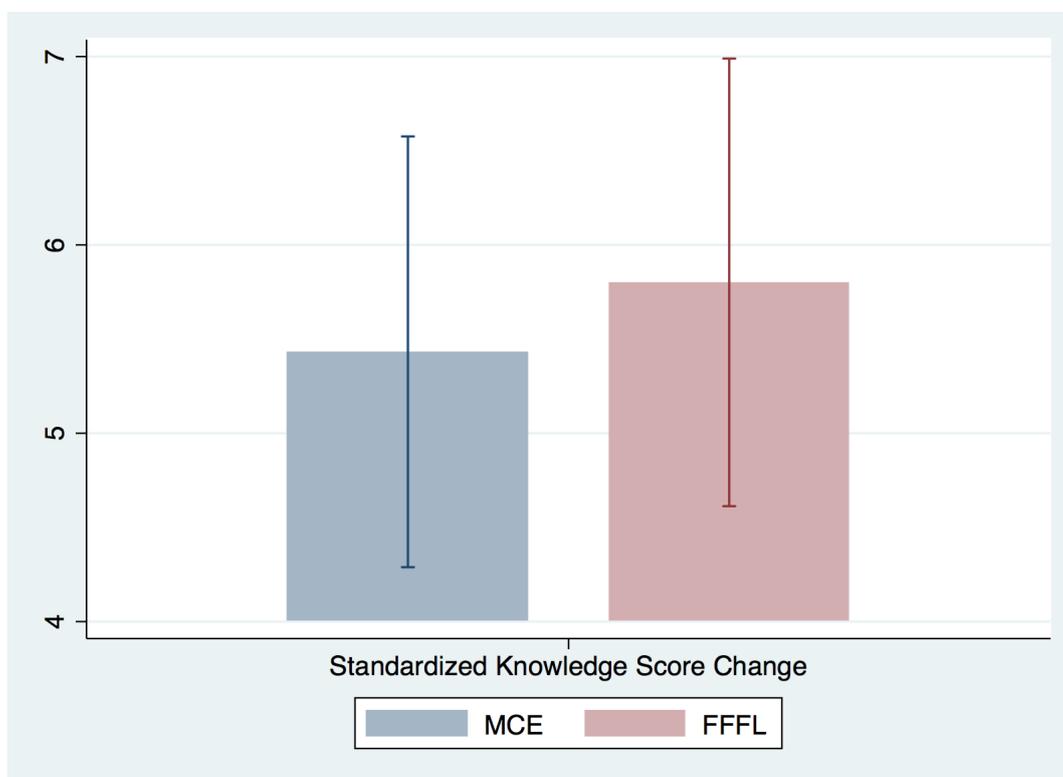
Table 8: School Administrative Data

	MCE Control	MCE 1st	Non-MCE Comparison	Total
Pct Soc Stud Stds Met	0.501 (0.137)	0.545 (0.157)	0.469 (0.265)	0.495 (0.224)
Pct Econ Stds Met	0.232 (0.134)	0.506 (0.350)	0.289 (0.385)	0.342 (0.351)
3rd Term: Soc Stud	0.952 (0.214)	0.925 (0.263)	. .	0.936 (0.244)
Pct Math Stds Met	0.723 (0.223)	0.642 (0.243)	0.564 (0.314)	0.612 (0.289)
3rd Term: Math	0.198 (0.399)	0.148 (0.356)	. .	0.169 (0.375)
FSA Math	3.738 (1.250)	3.263 (1.343)	. .	3.458 (1.326)
Num Obs	775	1,109	2,463	4,347

Standard errors in parentheses

Source: PBCSD Administrative Data.

Figure 9: Comparison of MCE to Prior FFFL Study Results



Source: Batty et al. (2015a)

10. Appendix

10.1. Knowledge Scale Items

1. People who own things may earn money by renting them to other people. (True, False, Dont know or not sure)
2. A plan for spending your money is called a [...] (budget, stock, credit, balance, Dont know or not sure)
3. David has to pay \$750 in rent for his apartment this month, but he only has \$500 in income. What should he do? (Put \$250 into savings, Borrow \$250, Not pay his rent , Dont know or not sure)
4. David just found a job that pays \$2,000 per month. He must pay \$1,000 for rent and \$600 for everything else he needs. How long will it take him to save \$800? (1 month, 2 months, 3 months, 4 months, Dont know or not sure)
5. Imagine you have to pay \$2 per week to use your desk at school, but you also have the option to buy the desk for \$35 and never pay per week again. If there are 15 weeks left in the school year, is it a good idea to purchase the desk if you have \$35 you can use to buy your desk today? (Yes, No, Dont know or not sure)
6. Suppose you have \$100 in a bank account that pays an interest rate of 10 percent per year. How much would you have in this bank account at the end of 2 years if you leave your account alone? (Exactly \$102 , \$120 , Less than \$120 , More than \$120 , Dont know or not sure)
7. Jane sets up a lemonade stand to sell drinks at the park. She paid \$3 for sugar, \$4 for fresh lemons, and \$3 for cups. Jane made \$12 in revenue from selling lemonade. How much profit did Jane make? (\$1 \$2 \$3 \$4 \$12 Dont know or not sure)
8. The Smiths have \$750 in income, and \$800 in expenses this month. They are saving money this month. (True False Dont know or not sure)
9. Tracy has \$250. She wants to buy a nice backpack for \$100 and buy a new tablet for \$200. She decided to buy a simple \$50 backpack. Tracy must have decided it was more important for her to have a nicer backpack than a tablet. (True, False, Dont know or not sure)
10. Which is closest to the cost of one ticket to a newly released movie at a regular movie theater? (\$1 \$10 \$50 \$75 \$100 Dont know or not sure)
11. Which is closest to what one weeks worth of groceries cost for a family of 4? (\$5 \$20 \$200 \$1,000 \$10,000 Dont know or not sure)
12. Ming wanted to buy a fancy notebook for school and save her money to buy a computer. Ming decided to buy a plain notebook that is less expensive so she can save more money for the computer. Mings decision is an example of [...] (paying interest, depositing money, making a tradeoff, choosing a service, Dont know or not sure)
13. Jill had \$50 in her checking account. She made a withdrawal of \$10 and a deposit of \$20. What is Jills balance in her checking account? (\$10 \$20 \$50 \$60 Dont know or not sure)

10.2. Appendix 2: Financial Knowledge Test Score Construction

Item response theory (IRT) accounts for differences in the difficulty of individual questions. The model estimates a parameter for each of the quiz items in terms of how well a correct answer to that question predicts overall performance on the quiz. In addition, the IRT approach determines how well each question discriminates between high- and low-performing students, where ‘performance’ in financial knowledge is the latent trait the scale is attempting to measure. The output below shows the parameters used. This estimate is based on a three-parameter logistic IRT model, which includes parameters for difficulty, discrimination, and guessing.

The test characteristic curve shows the distribution of predicted scale value compared to correct answers.

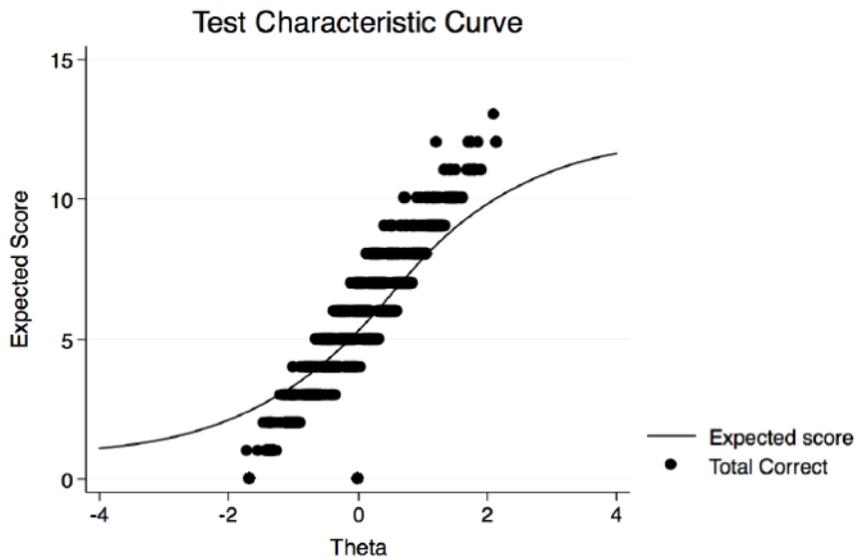
Based on the factor analysis of the scale items, all of the items have a unique loading value for one or more factors, indicating that the scale generally performs well; that is, it measures what it is intended—financial knowledge.

Figure 10: IRT Estimates and Parameters

	Para Coef.	Std. Err.	Z	P>z	[95% Conf Interval]	
Discrim						
Q1	0.7743	0.0783	9.9	0.00	0.621	0.928
Q2	0.5825	0.0683	8.5	0.00	0.449	0.716
Q3	0.8281	0.0820	10.1	0.00	0.667	0.989
Q4	1.1781	0.1111	10.6	0.00	0.960	1.396
Q5	0.9361	0.0861	10.9	0.00	0.767	1.105
Q6	-0.1425	0.0833	-1.7	0.09	-0.306	0.021
Q7	2.4674	0.3375	7.3	0.00	1.806	3.129
Q8	0.8907	0.1038	8.6	0.00	0.687	1.094
Q9	1.0442	0.0930	11.2	0.00	0.862	1.227
Q10	0.8600	0.0808	10.6	0.00	0.702	1.018
Q11	0.9165	0.0833	11.0	0.00	0.753	1.080
Q12	1.1048	0.2475	4.5	0.00	0.620	1.590
Q13	0.8063	0.0810	10.0	0.00	0.648	0.965
Diff						
Q1	-0.6846	0.1042	-6.6	0.00	-0.889	-0.480
Q2	-0.1893	0.1118	-1.7	0.09	-0.408	0.030
Q3	0.5964	0.0946	6.3	0.00	0.411	0.782
Q4	0.6378	0.0731	8.7	0.00	0.494	0.781
Q5	-0.0270	0.0760	-0.4	0.72	-0.176	0.122
Q6	-11.3994	6.5651	-1.7	0.08	-24.267	1.468
Q7	0.5961	0.0498	12.0	0.00	0.498	0.694
Q8	1.2850	0.1195	10.8	0.00	1.051	1.519
Q9	-0.0362	0.0709	-0.5	0.61	-0.175	0.103
Q10	-0.1079	0.0805	-1.3	0.18	-0.266	0.050
Q11	-0.2893	0.0785	-3.7	0.00	-0.443	-0.136
Q12	2.4634	0.2648	9.3	0.00	1.944	2.982
Q13	0.3596	0.0883	4.1	0.00	0.187	0.533
Guess	0.0435	0.0175	2.5	0.01	0.009	0.078

Source: Author's calculations using baseline student assessment data.

Figure 11: IRT ICC Scale Analysis



Source: Author's calculations using baseline student assessment data.

Figure 12: Knowledge Scale Factor Analysis

Rotated factor loadings (pattern matrix) and unique variances

Variable	Factor1	Factor2	Factor3	Uniqueness
q1	0.2012	0.4111	0.2386	0.7336
q2	0.1657	0.3447	0.2643	0.7839
q3	0.3391	0.2540	-0.1312	0.8033
q4	0.5575	0.1252	-0.1538	0.6498
q5	0.3692	0.2760	-0.1259	0.7716
q6	-0.0635	0.0205	0.7962	0.3616
q7	0.5699	0.3304	-0.2096	0.5221
q8	0.2529	0.3545	0.1232	0.7952
q9	0.5531	0.0886	-0.1683	0.6579
q10	0.0069	0.7113	0.0318	0.4929
q11	0.0887	0.6314	-0.0738	0.5881
q12	0.5695	-0.1741	0.3359	0.5326
q13	0.5211	0.0379	0.1453	0.7059

LR test: independent vs. saturated: $\chi^2(78) = 1562.32$ Prob> $\chi^2 = 0.0000$

Source: Author's calculations using baseline student assessment data.