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## Title

The Effects of Financial Education on Financial Literacy and Savings Behavior: Evidence from a Controlled Field Experiment in Dutch Primary Schools

## Abstract

This paper reports the results of a controlled field experiment designed to estimate the short-term effects of a 45-minute financial education program on the financial literacy and savings behavior of children in Dutch primary schools. Among fifth and sixth graders, the program led to a pre- to posttest improvement in financial literacy on almost one of eight questions, with about one-third of the increase in correctness attributable to the program. It also raised the probability of willingness to save by 4 percentage points. Nonetheless, whereas the program appears effective in respect to questions that explicitly address program content, its significant effects on financial literacy seem primarily driven by the results for girls, although we cannot reject homogeneous treatment effects with respect to gender.

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Financial literacy, which measures how well individuals understand and use personal finance-related information (Huston 2010, 306),<sup>1</sup> is crucial for dealing with every day finances, helping individuals, for example, better manage debt or make wiser savings decisions (Lusardi and Mitchell 2014; Brown et al. 2016). Even adolescents must make choices about cellphone contracts, student loans, debit card use, or clothing purchases. There is therefore little disagreement among policymakers that citizens need to be financially literate at a young age and that schools should begin offering financial instruction as early as possible (OECD 2006; APEC 2014). The feasibility of this goal is supported by psychological evidence that (upper) primary school children are capable of understanding basic economic concepts and managing their money and can thus be taught about personal finances (Otto et al. 2006; Webley 2005).

Indeed, following early evidence that children as young as 5 or 6 in U.S. metropolitan primary schools can understand such economic concepts as cost-benefit analysis and scarcity (Kourilsky 1977), more recent U.S. studies document increased financial knowledge among fourth and fifth graders after participation in Oakland's Money Savvy Youth program (Go et al. 2012). The financial capabilities of Midwestern urban fourth graders similarly improved following a financial education program that included access to a savings account (Sherraden et al. 2011). In certain Wisconsin schools, financial education for Grades 3–5 increased students' financial knowledge not only in the short term but also one year later, while also appearing to raise the savings probability (Batty, Collins, and Odders-White 2015). The evidence for Italy is similar, with Coda Moscarola and Kalwij (2018) identifying a positive effect of financial education on the financial literacy of primary school children, and Coda Moscarola and Migheli (2017) showing that a program promoting the importance of

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1. Other definitions are given in Hung, Parker, and Yoong (2009) and Remund (2010, 284).

saving decreased the children's impatience levels.<sup>2</sup> On the other hand, an overview of controlled field experiments that measure the effectiveness of school-based financial education for improving financial literacy in secondary school children indicates that although such programs can effectively improve *qualitative* financial knowledge and change behavior, they are less effective in improving *quantitative* financial literacy skills (Avery, de Bassa Scheresberg, and Guiso 2016).<sup>3</sup>

As the above literature suggests, an important part of this ongoing debate deals with financial education's effectiveness for improved financial literacy and behavior, as well as why interventions to improve the former (among various populations) explain so little of the variation in the latter (Fernandes, Lynch, and Netemeyer 2014). Based on their own meta-analysis, Fernandes, Lynch, and Netemeyer (2014) argue that any financial education that is not elaborated or acted upon shortly after the intervention has a reduced role, paving the way for a just-in-time type of financial education for situations such as acquiring a mortgage or deciding on a cellphone contract. Resolving this ongoing debate will thus require experimental evidence on the effectiveness of (basic) financial education in primary schools for improving financial literacy and behaviors (Lusardi and Mitchell 2014).

Our contribution to this literature on financial education's effectiveness is threefold. First, our experimental evidence for primary school children in the Netherlands sheds new light on whether the effectiveness demonstrated mainly in Italian and U.S. field experiments is

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2. Also, Berti and Monaci (1998) demonstrate that Italian third graders are able to acquire and retain knowledge of how banks work after receiving instruction on this topic.

3. See also Mandell and Schmid Klein (2009) and the more general overviews in Alsemgeest (2015), Avery, de Bassa Scheresberg, and Guiso (2016), Fernandes, Lynch, and Netemeyer (2014), Lusardi, Mitchell, and Curto (2010), Lusardi and Mitchell (2014), McCormick (2009), and Willis (2008).

generalizable to Dutch primary schools. Second, our detailed analysis of pre-and posttest responses in relation to financial education program content provides valuable insights into what works and does not work for primary school children. Third, by allowing program effectiveness to vary by gender and grade, we improve understanding of both the gender gap in financial literacy (Bucher-Koenen et al. 2016) and the grades at which such programs best match the children's cognitive development (Scheinholtz, Holden, and Kalish 2012; Webley 2005).

To estimate the effect of a financial education program on children's financial literacy and savings behavior, we analyze data from a controlled field experiment whose pre-and posttests were designed to measure these variables among fifth and sixth graders in Dutch primary schools. The treatment group received a 45-minute financial education program whose impact was anticipated based on a closely related study by Madern et al. (2014), who documented increased financial literacy after a virtually identical Dutch financial education program. We, however, extend this work by evaluating the program using a controlled field experiment. More specifically, we quantify the differences in financial literacy and savings behavior among these primary school children based on pre- and posttreatment test results, using the responses of children in the control group that did not receive the 45 minutes of financial education to take into account the possible influence of pretreatment tests on posttreatment responses.

Accurate assessment of the intervention's effectiveness is particularly important because the program constitutes a real-life policy response by the financial sector to a government call for active involvement in children's financial education. More specifically, the program is part of the so-called Money Wise platform, a Ministry of Finance initiative in which partners from the financial sector, academia, and governmental and consumer organizations join forces

with the overarching aim of making citizens financially self-reliant.<sup>4</sup> Although some may argue that this rather short financial education program is unlikely to affect financial behavior later in life, the insights provided by our field experiment into what may work for primary school children are crucial if education policy is to provide basic financial education to children at a young age. Offering such instruction during the compulsory schooling years can teach all children different aspects of financial literacy appropriate to their age, allowing them to accumulate financial knowledge that prepares them for adult financial choices.

## FIELD EXPERIMENT

Our field experiment was conducted in 2016 as part of the Netherland's nationwide Money Week, a yearly event that focuses on financially educating children by providing all primary schools with thematic materials on a wide range of financial topics related to daily experience. Our procedure for selecting primary schools for participation and assigning them to the treatment or control group is outlined in Fig. 1. The resulting study population comprises 179 randomly selected Dutch primary schools plus the 18 participant primary schools from the Madern et al. (2014) study. Because this latter inclusion raises concerns about sample representativeness, caution is warranted in extending our conclusions to the entire population of primary school children in the Netherlands. Based on a school-level response rate of about 37%, our final sample includes 72 primary schools, each randomly assigned to *either* the control or treatment group (i.e., all children in the same school

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4. For more details on this platform, see the National Strategy for Financial Education in the Netherlands' 2014–2018 report, available at [www.wijzeringeldzaken.nl](http://www.wijzeringeldzaken.nl).

belonged to the same group).<sup>5</sup> During the week preceding Money Week and then about 2–4 weeks afterward, both groups were administered pretest and posttest questionnaires,<sup>6</sup> both of which measured financial literacy and savings behavior, but the first of which also recorded background characteristics.

The treatment, administered during Money Week, was a 45-minute financial education program in the form of a Cash Quiz developed by the Dutch Banking Association (NVB). This Cash Quiz game was played during the third week of March 2016, at about one-third of the primary schools in the Netherlands (about 120,000 children at 2,300 schools). The quiz covered four themes: (i) banks, money, and transactions, (ii) planning and managing, (iii) savings, borrowing, risk, and reward, and (iv) the financial landscape. The program content, which complied with the curriculum developed by the OECD International Network on Financial Education (OECD 2015a, OECD 2015b), was tailored to fifth or sixth graders but also gave the teacher a choice between two levels of difficulty (see Appendix A for the questions asked on all four quiz versions). The game was played between groups of at most five children, who could win virtual money for each question. Members of the group that won the most money received plastic bracelets as prizes. Although the use of two grade- and two difficulty-based levels of four themed quiz versions introduced heterogeneity into the financial education program treatment, it was important for our field experiment that every set of questions for each of the four versions contained equivalent items giving equal coverage to the four major themes.

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5. All schools complied with the random assignment procedure except for two schools who switched from control to treatment group. Removing these two schools from the sample does not affect our main conclusions.

6. These questionnaires were developed by the National Institute for Family Finance Information (Nibud) and administered by teachers to all children in both groups.

The Cash Quiz was part of the program materials disseminated during Money Week to all primary school children in the Netherlands, including short videos on what occurs inside the Dutch Central Bank, how to earn income, entrepreneurship, happiness and money, and the costs of a smartphone. The program demanded a serious commitment from the primary schools – whose time is already at a premium – and especially from our study participants in the treatment group, who committed several months in advance doing the Cash Quiz during Money Week. Not only was the Cash Quiz relatively time intensive compared to other program materials, but it required individuals employed in the financial sector to visit the schools and act as quizmasters. This unique program feature is highly appreciated by teachers, who do not always feel comfortable teaching financial topics. The Cash Quiz is thus arguably superior to the other Money Week materials in terms of teacher quality, time spent, and commitment.

The posttest administered to all the children in our study (2–4 weeks after Money Week) included multiple choice financial literacy questions that were virtually identical to those in the pretest but differed in the ordering of the answers. Our inclusion of a control group who did not play the Cash Quiz game made it possible to account for any effect on the pre- to posttest improvements in financial literacy from either the children learning from the pretest or discussing the questions and answers among themselves or with their parents or teachers (even though instructed not to do so), the high profile of Money Week itself, the myriad financial education materials offered to schools during that period, and/or any input on the latter from peers, parents, or teachers.

#### Overlap of Pre- and Posttest Questions and the Cash Quiz



Table 1 reproduces the wording of the eight financial literacy questions (Q2-Q9), which related to the four Cash Quiz themes as follows: Q2 = banks, money, and transactions; Q6 = planning and managing; Q4, Q5, and Q8 = savings, borrowing, risk, and reward; and Q3 and Q7 = financial landscape. Q9 is a savings-related question.

Of particular interest for our study is the overlap between the questions on the Cash Quiz (see Tables A1–A4) and those in the pre- and posttest (see Table 1). A comparison of these items reveals that all four versions of the quiz ask about the budget diary (CQ4, Table A1; pre/posttest Q6, Table 1), while one fifth-grade (CQ12, Table A4) and one sixth-grade question (CQ8, Table A3) directly address the concepts of debt (pre/posttest Q3, Table 1) and the pay-to-win principle (Q5, Table 1), respectively. Other Cash Quiz questions are indirectly related to pre- and posttest questions, such as the question on purchasing balls for a sports club (Q8, Table 1), which involves a comparison of offers but in a different context to that on the quiz. Likewise, all four quiz versions contained a numeracy question that required calculation of the time needed to save for something (CQ10, Table A4), which is indirectly related to the question on savings (Q1, Table 2).

## DATA

The study data, collected by the National Institute for Family Finance Information (Nibud), include information on the financial literacy and background characteristics of 2,516 primary school children. We excluded 195 children who took only the posttest for whom we have none of the background characteristics elicited during the pretest. Our final sample thus encompasses 72 schools, 31 of which participated in both the pre- and posttest (see Fig.1). As Table 2 shows, these schools produced a total of 3,773 completed questionnaires generated by the pre- and posttests of 2,321 children. Of the 1,452 children who completed the questionnaire for both the pre- and posttest, 446 are in the control group and 1,006 in the treatment group.

The top half of Table 2 lists the percentages for the number of correct answers to all eight questions, with a mode of five (19.9%). On the pretest, the control group gave more correct answers on average than the treatment group, probably because the former contained relatively more sixth graders (bottom panel). However, children in both the control *and* treatment groups performed better on the posttest than on the pretest. On Q1, the children were more likely on the posttest than on the pretest to give the (arguably more desirable) answer of being willing to save for something they would like to buy but do not yet have the money for (middle panel).

As the table also shows, control group children were more likely than treatment group members to be girls and were on average older and more likely to receive pocket money. The youngest age category (age  $\leq 10$ ) includes 0.8% of children aged 9 (and no younger), while the oldest category (age  $\geq 12$ ) includes 1% of children aged 13 (and no older). Not

reported in the table is that the treatment–control group differences in age composition and reception of pocket money are significant (at the 5% level) while those for other characteristics (including gender) are insignificant.<sup>7</sup>

Table 1 summarizes the results for pre- and posttest questions Q2-Q9, each of which reveals improvements for both the control and treatment groups. On average, the children performed best in the pretest on the question that is arguably most closely related to their daily lives – namely, Q4 on advertisements in free online games – for which relatively small pre- to posttest improvements are observable for either group. They performed worst on Q6, keeping a budget diary, a concept likely to be unfamiliar to young children, although interestingly, the most pre- to posttest improvement in this case held equally for both groups.

## EMPIRICAL MODELS

In our empirical models, the dependent variable is either the number of correct responses to eight of the nine financial literacy questions (Q2–Q9) or whether or not a correct answer is given to each questionnaire item (Q1–Q9) separately (a linear probability model). For these models, the outcome variable is  $Y_{it}$ , with indices  $i$  and  $t$  designating the child and time of the pretest ( $t=0$ ) and posttest ( $t=1$ )<sup>8</sup>, respectively, and  $X_{it}$  is a set of explanatory variables. All

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7. The differences in pre- versus posttest sample statistics on time-constant background variables are a result of some children taking the pretest but not the posttest.

8. We distinguish only two time periods (pre- and posttest) because although the posttest could be administered any time within 2–4 weeks after Money Week, we have no information on exactly when.

models are estimated using ordinary least squares (OLS) with standard errors clustered by school (Abadie et al. 2017).<sup>9</sup>

The model formalized in Eq. (1) is estimated using only pretest responses ( $t=0$ ) and identifies how financial literacy and savings behavior are associated with background characteristics, including gender, age, grade, and whether or not the child receives pocket money, does chores for money, or is interested in money matters:

$$Y_{i0} = \alpha_0 + \mathbf{X}_{i0}^T \boldsymbol{\alpha} + \eta_{i0}, \quad i \in \{1, \dots, n\}, \quad (1)$$

where  $\eta_{i0}$  is an error term.

We then estimate Eq. (2) using the sample of children who completed both the pre- and posttests with background characteristics omitted, because they remain constant over time and are controlled for by including a child-specific fixed effect  $\alpha_i$ :

$$Y_{it} = \alpha_i + \theta_1 t + \theta_2 \text{Treatment}_i + \beta \text{Treatment}_i \times t + \varepsilon_{it}, \quad i \in \{1, \dots, n\} \text{ and } t \in \{0, 1\}, \quad (2)$$

where  $\varepsilon_{it}$  is an error term. The variable *Treatment* equals one if child  $i$  participated in the Cash Quiz (treatment group) and zero otherwise (control group). The parameter  $\theta_2$  is the mean difference in  $Y_{it}$  between the control and treatment groups in the pretest. The treatment effect  $\beta$  is the mean difference in  $Y_{it}$  between the pre- and posttest in the treatment group minus the mean difference in  $Y_{it}$  between the pre- and posttest for the control group ( $\theta_1$ ). This latter only holds, however, under the necessary model assumption of a common

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9. Using logit or probit models instead of a linear probability model to explain our binary outcome variables with only pretest data yields similar results. We cannot use such alternatives to estimate the treatment effects in Eq. (2) because it includes individual specific fixed effects. In addition, because there are few small clusters we have checked that applying wild bootstrapping does not change the main findings.

trend; that is, in the absence of treatment (but controlling for child-specific fixed effects), the mean difference between pre- and posttest  $Y_{it}$  is the same for the treatment and control groups (Angrist and Pischke 2009).

In Eq. (3), we eliminate fixed effects by taking first differences of Eq. (2), so the estimator of  $\beta$  is a difference-in-difference estimator (Angrist and Pischke 2009):

$$\Delta Y_i = \theta_1 + \beta \text{Treatment}_i + \Delta \varepsilon_i, \quad i \in \{1, \dots, n\}. \quad (3)$$

Here, the treatment effect  $\beta$  represents the causal impact of the financial education program (Cash Quiz) on financial literacy or on the savings decision, formally expressed as

$$\beta = E(Y_{i1} - Y_{i0} | \text{Treatment}_i = 1) - E(Y_{i1} - Y_{i0} | \text{Treatment}_i = 0). \quad (4)$$

Eqs. (2) and (3) implicitly assume a homogeneous treatment. As discussed earlier, although all children are asked the same *types* of questions, they are not asked the same questions, because the Cash Quiz has four (difficulty and grade based) versions. In the empirical analysis, therefore, we analyze the quiz's effectiveness by grade, and then in a subsequent robustness test, control for level of difficulty. In addition, because the Cash Quiz is a field experiment, it may be played somewhat differently in different classrooms, varying, for instance, with such factors as the level of quiz master enthusiasm or classroom compliance with the ideal quiz setup. As we cannot fully control such factors, the effect of our treatment (playing Cash Quiz in class) can be considered an intention-to-treat effect (Mealli and Rubin 2002, Angrist and Pischke 2009) whose magnitude could be higher given ideal implementation (perfect compliance).

We can then estimate the heterogeneous treatment effects as follows:

$$\Delta Y_i = \sum_{j=1}^J \gamma_1^j G_i^j + \sum_{j=1}^J \gamma_2^j G_i^j \times \text{Treatment}_i + \Delta u_i, \quad i \in \{1, \dots, n\} \text{ and } j \in \{1, \dots, J\}. \quad (5)$$

where  $G_i^j$  is a dummy variable equal to one if child  $i$  belongs to group  $j$  and zero otherwise,  $J$  is the number of groups,  $\Delta u_i$  a first-differenced error term, and  $\gamma_1^j$  and  $\gamma_2^j$  a group-specific common time trend and the treatment effect for children in group  $j$ , respectively. In the empirical analysis, these groups are defined based on gender and grade.

## EMPIRICAL RESULTS

First, using the pretest sample, we test for endogenous selection into either the treatment or control group or into the panel, reporting these (and all subsequent results) at a 5% level of significance. As Table 3 shows, we cannot reject the null hypothesis of exogenous selection for any questions except Q9, level of interest (penultimate column),<sup>10</sup> which we nonetheless retain in subsequent regressions because removing it changes none of the main findings. Nor can we reject exogenous selection into the panel for any of the questions (last column), suggesting that our results can be validly interpreted without conditioning on both tests having been taken.

### Associations between Financial Literacy and Background Characteristics

The results for Eq. (1), estimated based only on pretest responses, provide further evidence for the gender gap documented for (Dutch) adults (Bucher-Koenen et al. 2016): on average, the girls give fewer correct answers than the boys (Table 3). Yet our control for level of interest in money matters rules out the explanation that girls are less interested in the topic than boys. The question-by-question breakdown of correct answers in Table 3 reveals that girls are less likely to answer five out of the eight questions correctly. The largest gender gap is for the financial numeracy question on which offer to choose when purchasing balls for a sports club (Q8). It should be noted, however, that any similar association between financial

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10. In unreported results, all else being equal, treatment group children have a 5 percentage point lower probability of answering the interest rate question correctly.

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literacy and age should be interpreted cautiously because this present study controls for grade,<sup>11</sup> without which (in unreported analyses), older children did better on average than younger children.

A greater number of correct answers is positively associated with receiving pocket money, especially for questions related to a bank balance (Q2), loan repayment (Q3), a budget diary (Q6), or offers for the sports club ball purchases (Q8). We find no evidence, however, that doing chores for money is associated with higher financial literacy. In fact, being interested in money is associated with fewer correct responses overall, although no significant associations are observable for individual questions.

#### Evaluation of Cash Quiz

The results for Eq. (3), estimated based on both pre- and posttest responses, indicate that children from both the control and treatment groups improved their financial literacy between the two tests (Table 4, first column, top two rows). Whereas the estimated trend coefficient shows an average improvement on about 0.6 of eight questions for the control group, the estimated treatment coefficient shows an additional average pre- to posttest improvement in financial literacy on 0.32 of eight questions for the treatment group. Hence, about one-third of the improvement between the pre- and posttest is attributable to the Cash Quiz. This improvement is especially notable for Q5, free online games, a question conceptually related to the sixth-grade Cash Quiz item on pay-to-win, which may explain the 9 percentage point

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11. When we remove children aged 13 from the sample (i.e., children who should already be in secondary school but have apparently fallen behind in their educational development), the age associations become insignificant.



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increase in correct answers (first column). The largest improvement attributable to the Cash Quiz is 13 percentage point for Q6 (keeping a budget diary), possibly explainable by the inclusion of the budget diary concept in all four Cash Quiz versions. About two-thirds of this pre- to posttest improvement is attributable to a significant and strong common trend effect for half the questions, whose magnitude is largest for Q6, keeping a budget diary (first column).

### Heterogeneous Treatment Effects

When we use Eq. (5) to estimate the heterogeneous treatment effects with respect to gender and grade, we find relatively few significant heterogeneous treatment effects, signaling that the results should be interpreted with caution.<sup>12</sup> The only significant positive treatment effects are for sixth grade girls (Table 4, first row), with significant improvement on Q5, free online games, and Q6, keeping a budget diary, both of which are related to Cash Quiz content. Fifth grade girls also showed improvement on Q3, loan repayment, it too a part of the fifth-grade Cash Quiz. These significant gender-based improvements on Q3 and Q5 suggest that girls learned more from the Cash Quiz than boys. On the other hand, the only group that did not show improvement on Q6, keeping a budget diary, were fifth grade girls. It is worth noting, however, that homogeneous treatment effects with respect to gender could not be rejected for any question (Table 4, second last column), so although gender

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12. We estimated 36 treatment effects, so a couple may be significant because of a Type I error.

differences appear to exist, they are not statistically significant.<sup>13</sup> With respect to grade, homogeneous treatment effects could not be rejected for any question except Q3 (Table 4, last column), possibly because debt is included in the Cash Quiz content for fifth-graders but not sixth-graders (Q3 in Table 1; CQ12 in Appendix A).

### Robustness Checks

Because the Cash Quiz has four versions that address somewhat different financial issues, the differences between them may have influenced the pre- to posttest treatment effects (see Appendix A). A second possible source of influence is that, according to the teachers who filled out a posttest questionnaire (representing about 70% of the classes and 1,008 children, 48% in Grade 6), in-class content between tests included a discussion of the pretest taken for about 14% of the children and non-Cash Quiz materials offered during Money Week for about 71% of the children. Also, of importance is that in the treatment group, 66% of the fifth graders and 38% of the sixth graders played the relatively easier version of the Cash Quiz (Version B, Appendix A). We therefore performed a robustness check on the Table 4 results by incorporating controls into Eq. (3) for whether the pretest was discussed in class, whether (other) financial themes were discussed in class, and for the level of difficulty of the Cash Quiz. The main finding is that incorporating these additional controls makes little difference to correctness levels, meaning that the treatment effects were

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13. The results using “Don’t know” responses (Table B1) may suggest that increased confidence is not part of the explanation for girls appearing to learn more from the Cash Quiz than boys (Bucher-Koenen et al. 2016).

not significantly affected by the in-class discussion, exposure to other Money Week material, or the level of difficulty.<sup>14</sup>

### Effect of the Cash Quiz on Willingness to Save

The literature often relates savings behavior to financial literacy because of the potential for financial literacy education programs to serve as a tool for policymakers to improve savings decisions. We therefore additionally assess whether the Cash Quiz treatment affected the probability of willingness to save (Q1). As Table 5 shows, the only significant effect is for fifth graders. With respect to grade, as with gender, homogeneous treatment effects could not be rejected (Table 5, last row), so again, although differences in the treatment effect seem to exist, they are not statistically significant.<sup>15</sup>

### SUMMARY AND DISCUSSION

By estimating the short-term effects of the Cash Quiz financial education program on financial literacy and savings behavior among fifth and sixth graders in Dutch primary schools, we show that the treatment improves children's willingness to save for a desired product. This finding echoes that of Go et al. (2012) and Sherraden et al. (2011) for the U.S. We also demonstrate that approximately one-third of the pre- to posttest improvement in

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14. The full set of results for this robustness check are reported in Table B2.

15. Table C1 reports regression results from an analysis of the associations between financial literacy and the probability of the willingness to save.

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financial literacy is attributable to Cash Quiz questions that explicitly deal with the financial aspects tested, such as the keeping of a budget diary. The children show no improvement, however, on financial literacy issues either not dealt with during the program or presented in a different context, such as choosing the best offer when purchasing balls for a sports club (Q8).<sup>16</sup> Lastly, although our tests for treatment heterogeneity suggest that the Cash Quiz is more effective for girls than for boys, the test statistics indicate no significant gender differences in the treatment effects across all eight financial literacy questions.

This field experiment, the first of its kind in the Netherlands, was designed to gain insights into the effectiveness of financial education during the compulsory schooling years. Although the financial education program studied was rather short, policymakers and educators can draw two lessons from our analysis, both of which are supported in the literature. First, our findings suggest that the cognitive development of most fifth and sixth graders is such that they cannot yet reason beyond concrete examples (see, e.g., Scheinholtz, Holden, and Kalish 2012). Second, this observation appears to hold particularly for quantitative financial knowledge questions (see, e.g., Avery, de Bassa Scheresberg, and Guiso 2016), implying that at these ages, such topics should be taught using concrete examples close to the children's daily lives. A further implication is that financial education programs at primary schools might be most effective when they direct children's attention to conceptual topics (i.e., qualitative financial knowledge) such as money management. In particular, if children are to be prepared for financial decisions later in life, they need to learn the different aspects of financial literacy at various ages and accumulate financial knowledge. Given that financial literacy skills can be considered general skills, basic financial education can best be

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16. One possible explanation, to be investigated in future research, is that this finding is related to the use of percentages in one of the answers to Q8.

embedded in the curriculum of compulsory education. Nevertheless, more educational policy relevant research – preferably of the experimental type – needs to be conducted to identify which types of financial educational programs are (in)effective at which ages before strong policy conclusions can be drawn.

This detailed investigation into the relation between our financial education program and the pre-and post-test questionnaires also brings to light several unresolved issues that warrant additional research. For example, a more critical assessment might query whether the limiting of the Cash Quiz's impact to financial literacy aspects dealt with explicitly in the program content implies that any observed improvement may result more from mimicry than learning. That is, even though the positive treatment effect suggests that the Cash Quiz may actually teach children the purpose of a budget diary (Q5) or that online games are not always free (Q4) and why; the insignificant treatment effect for the balls for the sports club question (Q8) suggests that they may only be recalling correct responses without understanding why they are correct. Future research might thus aim to disentangle learning from mimicry effects (a seemingly as yet unstudied aspect). The Cash Quiz's limited impact may also raise doubts about the appropriateness of current methods for evaluating financial education's effectiveness. It may be, for instance, that financial literacy is more related to motivation to acquire than to the financial education goal of increased knowledge on specific financial topics (Caskey 2006). Such a consideration is especially important given that the cognitive development level of most primary school children enables only short-term measurements of the effect of concrete examples (Scheinholtz, Holden, and Kalish 2012). Hence, in light of the suggested link between financial education and improved student attitudes toward money issues and the role of motivation and attitude as important drivers of informed financial decisions (Batty, Collins, and Odders-White 2015), future research might

consider evaluating financial education programs like the Cash Quiz by also measuring changes in the psychological factors related to financial empowerment.

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## APPENDIX A

### CASH QUIZ QUESTIONS

FOUR VERSIONS BASED ON LEVELS OF DIFFICULTY (A OR B) AND GRADE (5 OR 6)

TABLE A1

*Cash Quiz: Banks, Money, and Transactions<sup>†</sup>*

Question	Version	Grade 5	Grade 6
CQ1	A	How does a bank earn money?	What does a bank do with the money in savings accounts of its customers?
	B	<p>A bank is a business that needs to earn money to remain open. Which statement is correct?</p> <ol style="list-style-type: none"> <li>1. A bank earns money by selling things such as bankcards,</li> <li>2. A bank earns money by playing the national lottery,</li> <li>3. <i>A bank earns money by lending it and asking for interest in return.</i></li> </ol>	<p>You saved €80. A part of it you put in your savings account.</p> <p>What does a bank do with the money in savings accounts of its customers?</p> <ol style="list-style-type: none"> <li>1. The bank keeps the money in a vault until the customer comes to collect it,</li> <li>2. The bank gives the money to the government so it can govern the country,</li> <li>3. <i>The bank lends the money to other people or business.</i></li> </ol>
CQ2	A	Is it better to open a savings account than a current account? (Yes/No)	<p>Wealth is unfairly distributed: some people have a lot of money, other too little.</p> <p>Why can money factories not print more money so everyone who has too little can have more?</p> <ol style="list-style-type: none"> <li>1. <i>Because money loses value if too much is printed,</i></li> <li>2. Because everyone will have enough money and nobody want to work anymore,</li> <li>3. Because rich people do not want poor people to become also rich.</li> </ol>
	B	<p>You saved about 80 euros. You would like to put the money into a bank account and do not know yet what to do with the money. You sometimes like to buy things. Why is it better to put your money into a current account than a savings account?</p> <ol style="list-style-type: none"> <li>1. <i>If the money is in a current account, it is easier to get when you would like to buy something,</i></li> <li>2. If the money is in a current account, you receive more interest,</li> <li>3. If the money is in a current account, you have to spend it.</li> </ol>	<p>Banknotes are printed in money factories. Who decides how many banknotes can be printed?</p> <ol style="list-style-type: none"> <li>1. The bank can decide on its own,</li> <li>2. That is decided by the prime-minister,</li> <li>3. <i>That is decided by the European Central Bank.</i></li> </ol>
CQ3	A	<p>Which country does not have the euro as its currency?</p> <ol style="list-style-type: none"> <li>1. Germany,</li> <li>2. Greece,</li> </ol>	<p>Why is the price of the same bottle of soda higher in a restaurant than in the supermarket?</p> <p><i>(you also pay for the service/ambiance)</i></p>

## 3. England.

B	On one side of a euro coin the value of the coin is printed. What is on the other side? 1. <i>A symbol of one of the euro countries,</i> 2. The map of Europe, 3. A picture of the European parliament.	Why is a trouser from the new collection more expensive than a trouser from the collection of three years ago?  <i>(People like clothing that is in fashion and shops know this)</i>
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<sup>†</sup>Correct answers in italics

TABLE A2

Cash Quiz: Planning and Managing<sup>†</sup>

	Version	Grade 5	Grade 6
CQ4	B	Kris has a budget diary. He writes down as income how much money he receives and for expenditures how much money he spends.  (A show card) Which words have to be filled in for the letters (A, B, C) 1. A: expenditures, B: income, C: total, 2. A: income, B: total, C: expenditures, 3. A: <i>income</i> , B: <i>expenditures</i> , C: <i>total</i> .	Ryan has a budget diary. He writes down as income how much money he receives and for expenditures how much money he spends. Look at the table (show card).  Ryan sees that his income is higher than his expenditures. What does that mean? 1. Ryan is short of money, 2. <i>Ryan has money to spare</i> ,  3. <i>Ryan receives has as much money as he spends.</i>
	A	(A show card) How does Kris calculate how much money he has? 1. <i>He subtracts the expenditures from income: €6.70-€2.80,</i> 2. He subtracts income from expenditures: €2.80-€6.70, 3. He adds income and expenditures: €6.70+€2.80.	Ryan calculates how much money he has. How does he do that? (Showcard) <i>(He subtracts the expenditures €5.65 from income €4.20 = €1.45.)</i>
CQ5	B	You are watching a talent show on television. Your favorite candidate needs votes from viewers to go to the next round. You vote on your favorite candidate using a text-message. What does it cost?  1. Nothing, 2. Less than €0.30, 3. <i>€0.80 or more.</i>	Alicia goes into town to buy clothes. She is in a shopping mood! But she cannot spend more than €100. Her father doubts: shall he give Alicia the money in cash or shall he transfer the money into her account and she can use her debit card? He decides to give the money in cash to her. Why does Alicia's father not let her use her debit card? 1. Alicia is only 12 years old and children of 12 are not allowed to use a debit card, 2. <i>The father is afraid that Alicia will see so many nice clothes that she will spend more than €100,</i> 3. It is saver to walk on the street with cash than with a debit card.
	A	How does the broadcast station earn money with the talent show? <i>(correct answers are: advertisement, text messages, merchandising)</i>	Alicia and her father are thinking about the pros and cons of a debit card. What is an important advantage and an important disadvantage of a debit card in the situation of Alicia?
CQ6	B	Who earns most money?	What is another word for the amount that is in a bank account?



1. A cashier at the supermarket,
2. A re-stocker at the supermarket,
3. *The manager (boss) of the supermarket.*

1. *Balance,*
2. Giro,
3. IBAN.

A

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Why does the manager of a supermarket earn more than the cashier?

1. Because the manager is more clever,
2. Because the manager is a man,
3. *Because the manager has more responsibilities.*

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From what age can you have a side job such as distributing advertising brochures?  
*(from the age of 13)*

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<sup>†</sup>Correct answers in italics

TABLE A3

*Cash Quiz: Savings, Borrowing, Risk, and Reward<sup>†</sup>*

	Version	Grade 5	Grade 6
CQ7	B	The supermarket has different sorts of chocolate sprinkles. Some packages are boring and others have nice games at the back. One of the packages has a photo of your favorite movie star. What do you do when you would like to spend your money wisely? 1. You buy the biggest package, 2. You buy the most fun package, 3. <i>You buy the cheapest package.</i>	When is it not smart to make use of the special offer "buy two, get one free"?  1. <i>When you need only one product,</i> 2. <i>When you need two products,</i> 3. <i>When you need three products.</i>
	A	The supermarket has chocolate sprinkles in different packages. Some packages are boring and others have nice games at the back. Why are there sometimes nice games at the back of a package of chocolate sprinkles? <i>(They hope to sell more if the package is attractive.)</i>	Is it always smart to make use of the special offer "buy two, get one free"?  <i>(no, depends on how many products you need)</i>
CQ8	B	Computer games are on sale. At shop A the games of €18 are now half price. At shop B you pay €19 for two games. And at shop C all games are today €8.  In which shop are the games cheapest? <i>(shop C)</i>	You play a free online game. Just when you are getting good at it, you cannot continue. You can only continue when you buy points by sending a text message. What is the wise thing to do? 1. You send a text message, 2. <i>You stop playing,</i> 3. <i>You ask your parents for advice.</i>
	A	Your favorite action figures are on sale! At shop A all figures of €6.50 are half price. At shop B you pay for three figures €12. A figure costs €6.15 in shop C but has a special offer of three for the price of two.  In which shop are action figures cheapest? <i>(shop A)</i>	Kay downloads a game on his cell phone. It appears to be a free game. But when Kay starts playing it turns out to be a pay-to-win game. What is a pay-to-win game? 1. A game for which you have to pay when you download it, 2. <i>A game for which you can buy attributes such as access to a higher level. You pay with real money,</i> 3. A game in which you have to pay real money to your adversary to able to win.
CQ9	B	You buy a mobile phone. What more do you need to buy before you can make calls?  <i>(a subscription or prepaid card)</i>	You would like to buy a new cell phone. On the internet are two attractive offers. 1. A free cell phone and a two-year subscription for €29 per month, 2. A cell phone for €100 and a two-year subscription for €23 per month. What is the best offer? <i>(offer 2)</i>
	A	A specific book is on the internet two euros cheaper than in the store. You order the book on the internet. But when you want to pay the book costs more than in the store. How is that possible?  <i>(shipping costs)</i>	You would like to buy a new cell phone. You can choose between several offers. 1. A free cell phone and a two-year subscription for €35 per month, 2. A cell phone for €100 and a two-year subscription for €23 per month, 3. A cell phone for €150 and a one-year

subscription for €15 per month. You can extend this subscription for one more year. What is the best offer? (*Offer 3*)

<sup>†</sup>Correct answers in italics

TABLE A4

*Cash Quiz: Financial Landscape<sup>†</sup>*

	Version	Grade 5	Grade 6
CQ10	B	Milou would like to buy beads of €30 to make her own jewelry. She saved already €18.50. She receives €2.50 pocket money per week.  In how many weeks can Milou buy the beads? ( <i>in 5 weeks</i> )	Job saves for a game computer of €260. His mother pays a quarter of the amount. He has €177 in his bank account. Job gets €4.50 pocket money per week. In how many weeks can Job buy his game computer? ( <i>In 4 weeks</i> )
	A	Milou would like to buy beads of €30 to make her own jewelry.  She has three notes of €5, two coins of €2, and six coins of €0.20 in her piggy bank. She receives €2.50 pocket money per week. In how many weeks can Milou buy the beads? ( <i>in 4 weeks</i> )	Job saves for a game computer of €260. His mother pays a quarter of the amount. He has €177 in his bank account. At the end of each month he gets €20 pocket money. Of that he also pays his monthly cell phone subscription of €8. In how many months can Job buy his game computer? ( <i>In 2 months</i> )
CQ11	B	You play with a tablet of a friend. You drop it on the floor in a clumsy moment. The tablet is broken. Who has to pay for the damages?  1. You,  2. <i>Your parents</i> ,  3. Your friend or his parents	Your friend goes into town. You cannot join her but you would like to buy a new book. You do not have cash at hand. There is a large sum of money in your account. What is the wise thing to do? 1. Give you debit card to your friend so she can buy the book for you, 2. <i>At a later stage, go to the bookstore yourself so you can buy the book</i> , 3. Ask your friend to buy the book for you and pay her the amount back later.
	A	You are skateboarding on a bicycle lane. You forgot to pay attention and hit a biker who falls. Luckily there are no injuries but the bike is damaged. The accident was your fault. Who has to pay for the repairs of the bike?  1. The biker,  2. You,  3. <i>Your parents</i> .	You receive an email with the request for your bank account number, pin and other personal information. The email appears to be from your bank. What is the wise thing to do? 1. Reply to the email and provide all requested information, 2. <i>Not to reply to the email and show it to your parents</i> , 3. Delete the email and don't tell anyone about it.
CQ12	B	When do you have debts?	To borrow money from the bank costs money. Is that true?

1. When you buy something that you only need to pay for in a year's time,
2. When you borrow money of someone,
3. *Both 1 and 2.*

Please motivate your answer.

---

A

If you have debts, then you have

1. borrowed money and paid it back,
2. borrowed money but not yet got it back,
3. *borrowed money but not yet paid it back.*

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What is the money called that the bank puts in your bank account?

1. *Interest,*
  2. Deposit,
  3. Fee.
- 

†Correct answers in italics

## APPENDIX B

Table B1

*Effects of the Financial Education Program (Cash Quiz) on Don't Know (DK) Responses*

Equations (3) & (5)	<i>Homogeneous treatment effect</i>		<i>Heterogeneous treatment effect</i>								<i>Test, H0: homogeneous treatment effect</i>	
			boys grade 5	girls grade 5	boys grade 6	girls grade 6			gender	grade		
	p.e.	s.e	p.e.	s.e	p.e.	s.e	p.e.	s.e	p.e.	s.e	p-value	p-value
Number of "Don't know" (DK) answers Q2-Q9	-0.13	(0.10)	-0.09	(0.19)	-0.18	(0.16)	-0.10	(0.17)	-0.11	(0.12)	0.92	0.95
DK on Q2 Bank balance	-0.03	(0.03)	-0.12*	(0.05)	0.04	(0.05)	-0.03	(0.07)	0.00	(0.06)	0.08	0.22
DK on Q3 Loan repayment	-0.02	(0.02)	0.00	(0.03)	-0.03	(0.03)	-0.01	(0.03)	-0.03	(0.02)	0.38	0.94
DK on Q4 Advertisement in free online games	-0.01	(0.02)	0.03	(0.03)	-0.05	(0.05)	-0.03	(0.03)	0.03	(0.03)	0.11	0.12
DK on Q5 Free online game, always for free?	-0.01	(0.02)	0.04	(0.03)	0.00	(0.03)	0.03	(0.03)	-0.09*	(0.04)	0.04*	0.15
DK on Q6 Budget diary	-0.08	(0.03)	-0.09	(0.06)	-0.04	(0.04)	-0.13*	(0.06)	-0.08	(0.05)	0.47	0.82
DK on Q7 Euro coins	-0.02	(0.01)	-0.01	(0.03)	-0.04	(0.02)	-0.03*	(0.01)	0.02	(0.02)	0.05	0.03*
DK on Q8 Balls for sports club	0.02	(0.02)	0.07	(0.06)	-0.04	(0.05)	0.03	(0.03)	0.03	(0.04)	0.41	0.48
DK on Q9 Interest rate	0.01	(0.03)	-0.01	(0.05)	-0.02	(0.07)	0.07	(0.04)	0.00	(0.03)	0.51	0.49

Note: n=1,452. p.e. = parameter estimate; s.e. = standard error (in parentheses). \* denotes statistical significance at the 5% level.

TABLE B2

*Treatment Effect of the Financial Education Program (Cash Quiz) with Discussion of the Pretest, Other Financial Themes, and Degree of Cash Quiz Difficulty Controlled for*

Variables difficulty level and discussing pretest or financial topics:		<i>Excluded</i>				<i>Included</i>			
		boys grade 5	girls grade 5	boys grade 6	girls grade 6	boys grade 5	girls grade 5	boys grade 6	girls grade 6
Treatment effects									
Number of correct answers	p.e.	0.18	0.25	0.28	0.48*	0.18	0.26	0.27	0.47*
	s.e.	(0.19)	(0.30)	(0.26)	(0.15)	(0.26)	(0.32)	(0.27)	(0.22)
Q2 Bank balance	p.e.	0.01	-0.07	0.06	0.05	0.02	-0.06	0.04	0.04
	s.e.	(0.08)	(0.09)	(0.07)	(0.07)	(0.08)	(0.08)	(0.07)	(0.09)
Q3 Loan repayment	p.e.	0.09	0.11	-0.05	-0.05	0.06	0.09	-0.12	-0.11
	s.e.	(0.06)	(0.07)	(0.08)	(0.06)	(0.09)	(0.09)	(0.08)	(0.06)
Q4 Advertisement in free online games	p.e.	0.01	0.06	0.01	0.04	0.02	0.07	0.04	0.06
	s.e.	(0.07)	(0.06)	(0.06)	(0.03)	(0.07)	(0.05)	(0.06)	(0.03)
Q5 Free online game, always for free?	p.e.	-0.02	0.22*	0.08	0.23*	-0.05	0.19*	0.05	0.20*
	s.e.	(0.07)	(0.08)	(0.07)	(0.05)	(0.07)	(0.07)	(0.07)	(0.05)
Q6 Budget diary	p.e.	0.12*	-0.05	0.15*	0.16*	0.16*	-0.01	0.18*	0.20*
	s.e.	(0.06)	(0.07)	(0.07)	(0.07)	(0.05)	(0.07)	(0.06)	(0.07)
Q7 Euro coins	p.e.	-0.05	-0.01	-0.01	0.07	-0.08	-0.03	-0.03	0.04
	s.e.	(0.10)	(0.14)	(0.05)	(0.06)	(0.10)	(0.12)	(0.09)	(0.09)
Q8 Balls for sports club	p.e.	-0.12	-0.03	0.05	0.01	-0.10	-0.02	0.11	0.07
	s.e.	(0.07)	(0.08)	(0.06)	(0.09)	(0.08)	(0.07)	(0.06)	(0.09)
Q9 Interest rate	p.e.	0.14	0.02	-0.02	-0.04	0.15	0.03	0.01	-0.02
	s.e.	(0.08)	(0.13)	(0.08)	(0.04)	(0.08)	(0.11)	(0.09)	(0.05)

Note: n=1,008. Unreported test results for endogenous sample selection from this source of non-responses suggest that only Q2 might be problematic, meaning that the Q2 outcomes should be interpreted with caution.

p.e. = parameter estimate; s.e. = standard error (in parentheses). \* denotes statistical significance at the 5% level.

Accepted Article

APPENDIX C  
SAVINGS BEHAVIOR

TABLE C1  
*Determinants of the Probability of Willingness to Save*

	Q1 Equation (2)		$\Delta$ Q1 Equation (3)	
Dependent variable: Probability of willingness to save				
Girl	p.e.	0.00	0.01	
	s.e.	(0.01)	(0.01)	
Age $\leq$ 10	p.e.	0.03*	0.03	
	s.e.	(0.02)	(0.02)	
Age $\geq$ 12	p.e.	-0.01	0.00	
	s.e.	(0.02)	(0.02)	
Grade 6	p.e.	0.00	-0.01	
	s.e.	(0.02)	(0.02)	
Receives pocket money	p.e.	0.06*	0.06*	
	s.e.	(0.02)	(0.02)	
Does chores for money	p.e.	0.03*	0.03*	
	s.e.	(0.01)	(0.01)	
Has interest in money matters	p.e.	0.01	0.01	
	s.e.	(0.02)	(0.02)	
( $\Delta$ ) Q2 Bank balance	p.e.		0.01	0.02
	s.e.		(0.01)	(0.02)
( $\Delta$ ) Q3 Loan repayment	p.e.		0.02	0.01
	s.e.		(0.02)	(0.02)
( $\Delta$ ) Q4 Advertisement in free online games	p.e.		0.02	-0.01
	s.e.		(0.02)	(0.03)
( $\Delta$ ) Q5 Free online game, always for free?	p.e.		0.00	-0.02
	s.e.		(0.02)	(0.02)
( $\Delta$ ) Q6 Budget diary	p.e.		0.00	0.03
	s.e.		(0.02)	(0.02)
( $\Delta$ ) Q7 Euro coins	p.e.		0.00	0.01
	s.e.		(0.02)	(0.02)
( $\Delta$ ) Q8 Balls for sports club	p.e.		0.02	0.01
	s.e.		(0.01)	(0.02)
( $\Delta$ ) Q9 Interest rate	p.e.		0.02	0.03
	s.e.		(0.01)	(0.02)
Treatment (Cash Quiz)	p.e.		0.04*	0.04*
	s.e.		(0.02)	(0.02)
Constant	p.e.	0.81*	0.77*	-0.02
	s.e.	(0.02)	(0.03)	(0.01)
Number of children (n)		2321	2321	1452
H0: joint significance ( $\Delta$ ) Q2-Q9 (p-value)			0.23	0.50
H0: joint significance ( $\Delta$ ) Q8 & Q9 (p-value)			0.03*	0.25

Note: All financial literacy variables are in levels in the first two columns and in first differences in the last two columns (denoted by  $\Delta$ ). p.e. = parameter estimate; s.e. = standard error (in parentheses). \* denotes statistical significance at the 5% level.



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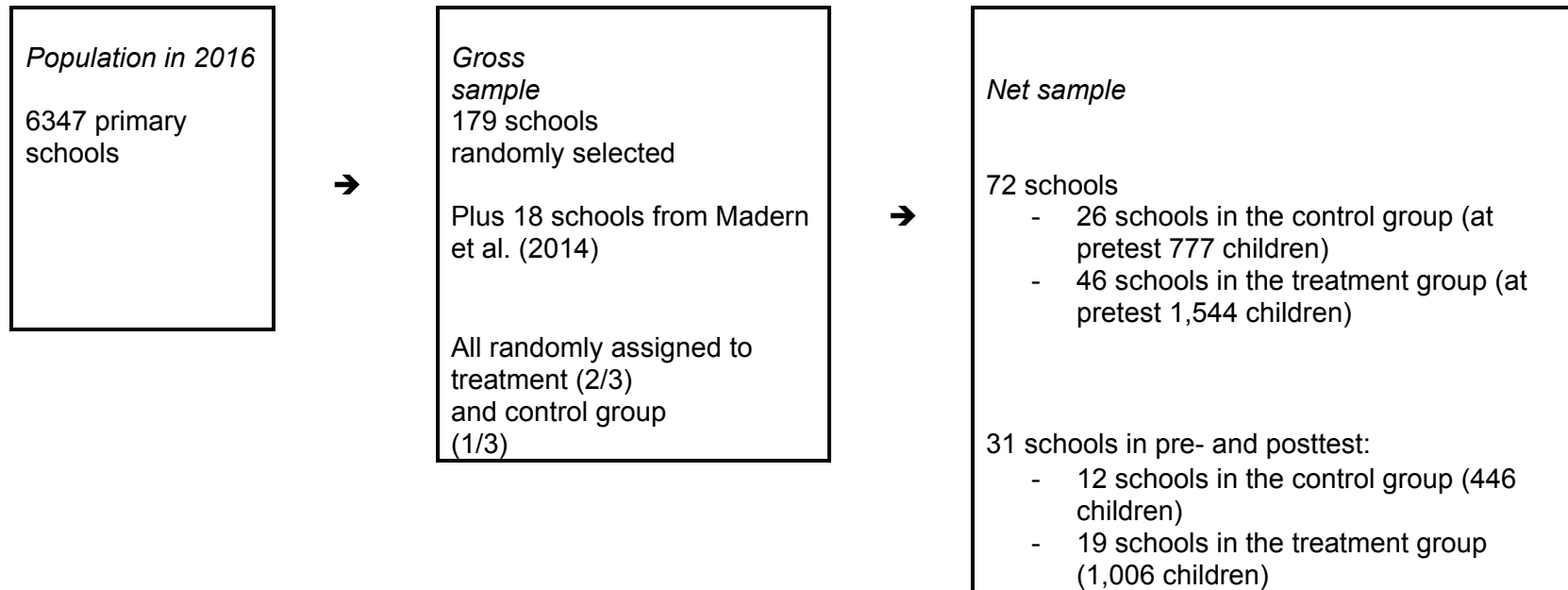
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FIGURE 1

*Selection of Primary Schools and Assignment to Treatment and Control Groups*

Note: Primary schools in the treatment group play the Cash Quiz game (our financial education program). Our final sample includes all children who took both the pretest and posttest or the pretest only, with 192 children who took only the posttest excluded for lack of background characteristics (collected in the pretest).

TABLE 1

*Pre- and Posttest Responses*

Questions and statements (correct answers in <i>Italic</i> )	Cells			
	Percentage (points) of correct answers			
	Control group	pre- to posttest change	Treatment group	pre- to posttest change
	pretest %	%-point	pretest %	%-point
Q2. How do you call the amount that you see when you open your bank account on a computer or a bank-app? (i) IDEAL (ii) <i>Balance</i> (ii) IBAN (ii) Giro (ii) I don't know	42.3	6.5	42.1	8.4
Q3. What is true? Jan borrows money from a bank: (i) Jan has to pay the money he borrowed back (ii) <i>Jan has to pay the money he borrowed back and he has to pay extra money (interest)</i> (iii) Jan has to pay a part of the money back. (iv) Jan does not need to do anything. (v) I don't know	63.2	9.0	58.5	12.9
Q4. Advertisement is forbidden in free online games. (i) True (ii) <i>False</i> (iii) I don't know	87.1	2.5	84.4	4.2
Q5. If you play free online games it could be possible you have to pay money. (i) <i>True</i> (ii) False (iii) I don't know	57.0	5.6	58.0	14.8
Q6. What is a budget diary? (i) <i>A book in which you write down all your income and daily expenses</i> (ii) A book in which you keep all important papers (iii) A book in which you keep all your bills, to make it possible to pay then at once at the end of the month (iv) I don't know	30.4	17.9	26.4	31.0
Q7. What is the minimum number of euro coins needed to pay €1.25 without needing any change? (i) 2 coins (ii) <i>3 coins</i> (iii) 4 coins (iv) 5 coins (v) I don't know	68.1	9.9	62.4	13.4
Q8. Your sports club needs 20 new balls. Which special offering is cheapest? (i) <i>One ball costs €20 and each fifth ball is for free</i> (ii) One ball costs €20 and you get a 10% discount (iii) I don't know	56.1	7.0	54.9	4.6
Q9. Suppose Minou has €100 euro in her savings account. The interest rate is 2% per year. She leaves the money in her account for five years and does not withdraw money. How much will she have in her savings account after five years? (i) <i>More than €102.-</i> (ii) Exactly €102.- (iii) Less than	68.1	1.6	59.1	2.4

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€102.- (iv) I don't know

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Number of children	777	446	1544	1006
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Note: (i) Pretest percentages do not significantly differ between children who only took the pretest and those who took the pre- and posttest, and, with the exception of Q9, do not significantly differ between the control and treatment groups once background characteristics are controlled for (see Table 3 for statistical tests), (ii) For most questions, the answer categories are reversed in the posttest, (iii) Q7 uses €2.70 in the posttest, and Q9 uses an interest rate of 3% interest rate and an amount of 103 in the posttest.

TABLE 2

*Descriptive Statistics*

Number of correct answers, Q2-Q9 (row percentages)										
	None	1	2	3	4	5	6	7	All eight	Number of children
All groups and times	0.8	2.6	7.5	13.3	17.0	19.9	18.3	13.5	7.2	3773
Control group, pretest	1.3	3.6	7.3	13.5	18.2	20.5	17.0	12.6	6.1	777
Control group, posttest	0.2	1.1	2.9	12.6	15.0	18.4	22.0	17.7	10.1	446
Treatment group, pretest	1.1	3.5	10.6	16.1	18.6	20.0	16.7	9.3	4.2	1544
Treatment group, posttest	0.1	1.1	4.8	9.0	14.5	20.2	20.3	18.9	11.2	1006
Savings behavior (row percentages) Q1: You would like to buy something nice but do not have the money for it. What would you do?										
	Buy something less nice	Save for it	Ask parents	Don't know						
All groups and times	1.1	89.9	6.6	2.5						
Control group, pretest	1.4	90.9	5.5	2.2						
Control group, posttest	0.7	90.4	6.1	2.9						
Treatment group, pretest	1.2	88.0	7.8	2.9						
Treatment group, posttest	0.9	91.7	5.6	1.9						
Explanatory Variables	Girls	Age ≤ 10	Age 11	Age ≥ 12	Grade 6	Receives pocket money	Chores for money	Interest in money matters	Number of "Don't know" answers Q2-Q9, boys	Number of "Don't know" answers Q2-Q9, girls
	%	%	%	%	%	%	%	%	Mean	Mean
All groups and times	50.6	31.4	47.5	21.1	46.0	76.0	61.0	23.6	1.2	1.4
Control group, pretest	52.5	29.1	48.9	22.0	52.8	80.3	60.7	22.1	1.4	1.5
Control group, posttest	52.2	30.5	49.6	20.0	52.5	80.9	60.5	19.7	1.0	1.0
Treatment group, pretest	49.7	32.3	47.5	20.3	42.0	73.1	61.3	24.6	1.4	1.8
Treatment group, posttest	49.9	32.1	45.6	22.3	44.0	75.0	61.1	25.0	0.8	1.0

Note: Pre- and posttest questions Q2-Q9 are as formulated in Table 1. Children who took the posttest also took the pretest. Age refers to age at time of the pretest, and the questions related to pocket money, chores, and interest in money matters are only asked during the pretest. The Q1 answer categories are (i) I buy

something less nice for which I now have the money, (ii) I save money so I can buy it later, (iii) I ask for money from my parents or someone else, and (iv) I don't know.



TABLE 3

*Financial Literacy Determinants and Endogenous Selection into Control or Treatment Group or Panel<sup>†</sup>*

Equation (1)		Girl	Age≤10	Age≥12	Grade 6	Receives pocket money	Does chores for money	Interest in money matters	Constant	Endogenous selection into treatment group <sup>††</sup> H0: no selection p-value	Panel attrition selection <sup>††</sup> H0: no selection p-value	R <sup>2</sup>
Number of correct answers	p.e.	-0.36*	0.09	-0.32*	1.35*	0.41*	0.11	-0.20*	3.82*	0.34	0.83	0.13
	s.e.	(0.07)	(0.09)	(0.10)	(0.13)	(0.10)	(0.08)	(0.09)	(0.13)			
Q2 Bank balance	p.e.	-0.08*	0.04	0.01	0.17*	0.09*	0.04	-0.04	0.28*	0.33	0.76	0.04
	s.e.	(0.02)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.03)	(0.04)			
Q3 Loan repayment	p.e.	-0.09*	-0.01	-0.08*	0.21*	0.07*	-0.02	-0.03	0.54*	0.35	0.91	0.05
	s.e.	(0.02)	(0.03)	(0.02)	(0.03)	(0.03)	(0.02)	(0.02)	(0.04)			
Q4 Advertisement in free online games	p.e.	0.01	0.05*	0.00	0.07*	0.00	0.00	-0.03	0.81*	0.11	0.17	0.01
	s.e.	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)	(0.03)			
Q5 Free online game, always for free?	p.e.	-0.06*	-0.04	-0.06*	0.09*	0.06	0.04	-0.04	0.53*	0.35	0.54	0.02
	s.e.	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.04)			
Q6 Budget diary	p.e.	0.01	0.01	0.02	0.14*	0.05*	0.02	-0.01	0.16*	0.33	0.92	0.03
	s.e.	(0.02)	(0.02)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.03)			
Q7 Euro coins	p.e.	0.04	0.00	-0.08*	0.21*	0.05	0.01	0.02	0.50*	0.28	0.97	0.04
	s.e.	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.03)			
Q8 Balls for sports club	p.e.	-0.12*	0.02	-0.07*	0.18*	0.06*	0.02	-0.03	0.49*	0.82	1.00	0.04
	s.e.	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.03)			
Q9 Interest rate	p.e.	-0.07*	0.02	-0.06*	0.27*	0.03	-0.01	-0.04	0.53*	0.03*	0.72	0.07
	s.e.	(0.02)	(0.02)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.03)			

<sup>†</sup>Results are based on the 2,321 pretest responses only. <sup>††</sup> Following Nijman and Verbeek (1992), we add dummy variables into equation (1) for whether or not the child is in the panel and whether or not the child is in the treatment group.

Note: p.e. = parameter estimate; s.e. = standard error (in parentheses). \* denotes statistical significance at the 5% level.

TABLE 4

*Effects of the Financial Education Program (Cash Quiz) on Number of Correct Answers and Probability of Correct Answers by Gender and Grade*

Equations (3) & (5)		<i>Homogeneous treatment effect</i>		<i>Heterogeneous treatment effect</i>								<i>Test, H0: homogeneous treatment effect</i>	
				Boys grade 5		Girls grade 5		Boys grade 6		Girls grade 6		<i>Gender</i>	<i>Grade</i>
		p.e.	s.e.	p.e.	s.e.	p.e.	s.e.	p.e.	s.e.	p.e.	s.e.	p-value	p-value
Number of correct answers Q2-Q9	Treatment	0.32*	(0.11)	0.16	(0.15)	0.38	(0.24)	0.18	(0.21)	0.51*	(0.15)	0.40	0.87
	Trend	0.60*	(0.09)	0.62*	(0.11)	0.73*	(0.18)	0.67*	(0.18)	0.39*	(0.11)		
Q2 Bank balance	Treatment	0.02	(0.03)	0.01	(0.06)	-0.03	(0.07)	-0.01	(0.06)	0.10	(0.06)	0.45	0.34
	Trend	0.07*	(0.02)	0.03	(0.05)	0.12	(0.06)	0.14*	(0.05)	-0.02	(0.04)		
Q3 Loan repayment	Treatment	0.04	(0.04)	0.08	(0.05)	0.14*	(0.06)	-0.03	(0.06)	-0.04	(0.05)	0.69	0.02*
	Trend	0.09*	(0.03)	0.06	(0.04)	0.07	(0.04)	0.07	(0.04)	0.15*	(0.05)		
Q4 Advertisement in free online games	Treatment	0.02	(0.02)	-0.01	(0.05)	0.04	(0.04)	0.04	(0.05)	0.00	(0.03)	0.54	0.52
	Trend	0.02	(0.02)	0.05	(0.04)	0.00	(0.04)	0.02	(0.04)	0.03	(0.02)		
Q5 Free online game, always for free?	Treatment	0.09*	(0.04)	-0.02	(0.06)	0.12	(0.06)	0.09	(0.06)	0.19*	(0.06)	0.14	0.26
	Trend	0.06	(0.03)	0.10	(0.06)	0.07	(0.05)	0.03	(0.04)	0.03	(0.05)		
Q6 Budget diary	Treatment	0.13*	(0.04)	0.13*	(0.05)	0.04	(0.07)	0.16*	(0.05)	0.21*	(0.07)	0.45	0.21
	Trend	0.18*	(0.03)	0.15*	(0.04)	0.25*	(0.06)	0.19*	(0.04)	0.12*	(0.04)		
Q7 Euro coins	Treatment	0.04	(0.05)	0.00	(0.07)	0.07	(0.10)	-0.03	(0.06)	0.06	(0.05)	0.48	0.92
	Trend	0.10*	(0.04)	0.19*	(0.06)	0.13	(0.08)	0.10	(0.05)	0.00	(0.04)		
Q8 Balls for sports club	Treatment	-0.02	(0.03)	-0.10	(0.06)	-0.01	(0.06)	0.03	(0.05)	-0.03	(0.07)	0.33	0.20
	Trend	0.07*	(0.02)	0.09	(0.05)	0.10	(0.05)	0.04	(0.04)	0.05	(0.05)		
Q9 Interest rate	Treatment	0.01	(0.04)	0.07	(0.06)	0.02	(0.09)	-0.06	(0.06)	0.01	(0.05)	0.52	0.34

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Trend	0.02	(0.04)	-0.05	(0.05)	0.00	(0.08)	0.08	(0.05)	0.02	(0.03)
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Notes: n=1,452. p.e. = parameter estimate; s.e. = standard error (in parentheses). \* denotes statistical significance at the 5% level.

TABLE 5

*Homogeneous and Heterogeneous Treatment Effects of the Financial Education Program (Cash Quiz) on the Probability of Willingness to Save*

Equations (3) & (5)	p.e.	(s.e.)
<i>All</i>	0.04*	(0.02)
Boys grade 5	0.08*	(0.03)
Girls grade 5	0.07*	(0.03)
Boys grade 6	0.03	(0.04)
Girls grade 6	0.01	(0.03)
Test, H0: homogeneous treatment		
Effect, gender; <i>p</i> -value	0.88	
Test, H0: homogeneous treatment		
Effect, grade; <i>p</i> -value	0.20	

Notes: n=1,452. p.e. = parameter estimate; s.e. = standard error (in parentheses). \* denotes statistical significance at the 5% level (see Appendix C for the full set of estimations under homogeneous treatment).