Financial decisions matter: promoting positive financial behaviour, financial satisfaction, and financial well-being

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Chapter 2

The effect of financial education on pupils' financial knowledge and skills: Evidence from a Solomon four-group design

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Financial knowledge and skills are crucial elements for consumers to effectively participate in today's social and economic life. The financial environment, including its digitalization, has become much more difficult and unpredictable, placing certain consumers at risk of (considerable) financial problems. The societal consequences are severe. In the Netherlands, for example, the number of households with financial problems costs Dutch society an estimated €10 billion per year (Madern, 2014).

There is therefore growing interest in measures and interventions to increase financial knowledge and skills, preferably at an early age. A promising path is to provide early education to children to improve their ability to make effective financial decisions later on in adulthood. Research has indicated that adults who received financial education at a young age are more capable of managing their financial resources than those who did not (CYFI, 2013). Studies moreover found that it is feasible to teach primary school children about finances because they can understand basic matters in the financial and economic field (Batty, Collins, & Odders-White, 2015; Kobliner, 2017; Otto, Schots, Westerman, & Webley, 2006; Webley, 2005). Together, these findings underscore the importance and feasibility of financial education at an early age to equip children with the necessary knowledge and skills to make responsible and effective financial decisions later in life (CYFI, 2013; OECD, 2005).

As parents, caregivers, or guardians are not always able (e.g., due to lack of knowledge, skills, time, or motivation) to teach their children about financial matters, the Organization for Economic Co-operation and Development (OECD, 2005) recommends that financial education be built into school curricula during children's compulsory schooling. Several countries, including the Netherlands, have followed this recommendation and started to include financial education in their school program. The benefits of financial education are apparent at both the individual and collective level. At the individual level, financial education helps consumers to become financially capable and make sound financial decisions

for themselves and their families (Mundy, 2011; Sledge, Tescher, & Gordon, 2010; Xiao & O'Neill, 2016). This is essential because failing to make sound financial decisions can lead to excessive debts. When debts increase, scarce monetary resources can profoundly impact consumers' ability to manage other aspects of their lives, such as finding a job, buying a house, and planning for the future (Lane, 2016; Mullainathan & Shafir, 2013; Social Science and Parliamentary Affairs Team, 2010). Moreover, excessive debts can result in severe stress, poor physical and mental health, and even domestic violence and suicide (Chapman & Freak, 2013; Drentea, 2000; Lane, 2016). Financial education may also contribute to higher average earnings, increased labor productivity, and lower likelihood of social problems (Hanushek & Kimko, 2000; Krueger & Lindahl, 2001). At the collective level, financial education contributes to financial stability and economic growth and, if accessible to all members of society, it can moreover promote socio-economic equality (Green & Preston, 2001; Lusardi & Mitchell, 2014).

The effect of financial education on financial knowledge and skills

Financial education can be defined as:

> the process by which financial consumers/investors improve their understanding of financial products, concepts and risks and, through information, instruction and/or objective advice, develop the skills and confidence to become more aware of financial risks and opportunities, to make informed choices, to know where to go for help, and to take other effective actions to improve their financial well-being (OECD, 2005, p. 4).

By providing financial education in the learning-teaching trajectory at schools or through courses, workshops, or e-learning, children can gain at least a basic level of financial knowledge and skills.

The need for financial education has been widely recognized. Nonetheless, little is known yet about what makes financial education programs effective and what financial competencies these programs can improve. Previous research regarding the effect of financial education programs on financial knowledge, skills, attitude, and behavior has been inconclusive because these programs were diverse in their duration, timing, content, design, and target group (Atkinson, Messy, Rabinovich, & Yoong, 2015; Bruhn, Leão, Legovini, Marchetti, & Zia, 2013; Fernandes, Lynch, & Netemeyer, 2014; Kaiser & Menkhoff, 2017; Miller, Reichelstein, Salas, & Zia, 2014; O'Prey & Shephard, 2014; OECD, 2013). Specifically for primary school pupils, it was reported that financial education has a positive effect on financial knowledge, skills, attitude, and behavior (Batty et al., 2015; Kalwij et al., 2019; Sherraden, Johnson, Guo, & Elliott, 2011).

A Dutch national financial education program

The Dutch Ministry of Finance together with the educational publisher Zwijsen developed a large-scale national financial education program for Dutch primary schools with the aim to make children financially self-empowered.[1] This program consisted of four modules for the first and second graders and five modules for the third, fourth, and fifth graders. The modules were based on the financial competencies as defined by the National Institute for Family Finance Information of the Netherlands (2013), and formed a continuous learning line in primary schools, linked to specific behavioral objectives.[2] The modules also applied activity-based learning techniques[3], thereby enabling pupils to experience real-life examples to immediately apply what they learned in practice. Moreover, the modules were

[1]A financially self-empowered consumer can be defined as someone who "makes well-considered choices in such a way that his or her finances are balanced, both in the short and long term" (Nationaal Instituut voor Budgetvoorlichting [National Institute for Family Finance Information], 2013, p. 10). See Simonse (2017), for further details on the financial education program.
[2]See Wijzer in geldzaken [Money Wise platform] (2019), for details on all modules.
[3]See, for example, Festus (2013) and Lippman (2016), for further details on activity-based learning.

consistent with the cognitive, social, and psychological development stage of the pupils. Overall, the modules aimed at developing pupils' knowledge and skills. In the school year 2016/2017, about 21,000 classes ordered the modules, suggesting a reach of approximately 450,000 pupils in primary school (Simonse, 2017). With potentially many children participating in the program, it becomes even more important to investigate whether or not the modules are effective and to understand the reasons for their (in)effectiveness, which forms the central aim of the present study.

The present study

The present study reports the effectiveness of two of the modules of the financial education program discussed above.

Our contribution to the financial education literature is threefold. First, we provide valuable insights on what approach may work for primary school children. Proper assessment of the modules' effectiveness is important because the obtained insights can be used to adapt the current financial education program, if and where necessary, and to design new financial education programs for this target group. Second, it was important to collect information about the program in a methodologically correct way. To do so, we applied a Solomon four-group design because it allows us to distinguish between the effects caused by repeated testing (the pretest sensitization or the pretest effect; Chua, 2012) and the intervention effects. Earlier research often failed to implement this design, thereby resulting in a possible misinterpretation of the findings as it is difficult to determine whether the found effects stemmed from multiple measurement or from the intervention itself (e.g., Batty et al., 2015; Kalwij et al., 2019). Third, it was crucial to use a statistical analytic tool to investigate the program's effectiveness in an accurate manner. We used mixed model analyses as these allow for the modeling of multi-levels within the dataset and are asymptotically efficient with

minimum variance despite missing data points. Previous research has typically not applied this tool, thus making it difficult to consider both fixed and random effects[4] (e.g., Huck & Sandler, 1973; Yu, 2018).

Materials and methods

Participant recruitment and intervention

The present study used the Solomon four-group quasi-experimental[5] design (Solomon, 1949). The groups were defined based on whether or not pupils participated in the intervention, intervention group vs. control group and on the number of assessments the pupils took, 3-measures group vs. 2-measures group (see Table 1).

Table 1. *The Solomon four-group quasi-experimental design*

Time (column) / Group (row)	Pre-Assessment	Intervention Module Responsible Spending	Post-Assessment 1	Intervention Module Performing Transactions	Post-Assessment 2
3-measures Intervention	Yes	Yes	Yes	Yes	Yes
3-measures Control	Yes	No	Yes	No	Yes
2-measures Intervention	No	Yes	Yes	Yes	Yes
2-measures Control	No	No	Yes	No	Yes

The 3-measures group was assessed before and after each module was completed in the intervention group. Thus, the analytic design was a 2 Intervention (Intervention vs. Control) × 3 Time (Pre-Assessment vs. Post-Assessment 1 vs. Post-Assessment 2) factorial design. The 2-measures group was assessed after each module was completed in the intervention group. Hence, the analytic design was a 2 Intervention (Intervention vs. Control) × 2 Time (Post-Assessment 1 vs. Post-Assessment 2) factorial design.

[4]Fixed effects remain constant across pupils and schools, while random effects vary across pupils and schools.
[5]Our study had a quasi-experimental design because the schools in the intervention groups were already using the financial education program, while the schools in the control groups were not using the financial education program yet.

Due to the difference in the analytic designs of the two groups, separate analyses were conducted. For all pupils included in our sample, parental permission was obtained. Pupils participated in Pre-Assessment in October 2016 to assess their start level of knowledge and skills. Post-Assessment 1 was taken in December 2016, after the intervention groups completed the Responsible Spending module. Post-Assessment 2 was taken in March 2017, after the intervention groups completed the Performing Transactions module.

The present study comprised 124 randomly selected primary schools in the Netherlands. The sample included 1,390 pupils at 64 schools in Pre-Assessment, 2,424 pupils at 120 schools in Post-Assessment 1, and 2,171 pupils at 114 schools in Post-Assessment 2. The pupils were between the ages of 9 and 13 years ($M_{age} = 10.38$ years, $SD = 0.68$), all of whom were in the fifth grade of primary school.[6] The group of pupils in each assessment occasion was comparable in socioeconomic status scores. The sample characteristics are depicted in Tables 2A and 2B.

[6]We collected data from pupils in the fifth grade for two reasons. First, they were relatively older and therefore money played a more concrete role in their lives. Second, it was not possible to use data from pupils in the sixth grade due to their busy school schedule (school camp, musical, and final exam) and, as a result, insufficient time to conduct the research.

Table 2A. *Sample characteristics*

	Pre-Assessment *N* (%)	Post-Assessment 1 *N* (%)	Post-Assessment 2 *N* (%)
Gender			
Girl	713 (51.3%)	1,231 (50.8%)	1,097 (50.5%)
Boy	677 (48.7%)	1,193 (49.2%)	1,074 (49.5%)
Spoken language			
Dutch	1,170 (84.2%)	2,110 (87.0%)	1,877 (86.5%)
Other	220 (15.8%)	314 (13.0%)	294 (13.5%)
Pocket money			
Yes	1,115 (80.2%)	1,889 (77.9%)	1,698 (78.2%)
No	275 (19.8%)	535 (22.1%)	473 (21.8%)
Money from doing chores			
Yes	867 (62.4%)	1,544 (63.7%)	1,444 (66.5%)
No	523 (37.6%)	880 (36.3%)	727 (33.5%)
Talking about money at home			
Yes	1,095 (78.8%)	1,937 (79.9%)	1,802 (83.0%)
No	295 (21.2%)	487 (20.1%)	369 (17.0%)
Talking about money in class			
Yes	792 (57.0%)	1,714 (70.7%)	1,788 (82.4%)
No	598 (43.0%)	710 (29.3%)	383 (17.6%)

All primary schools in the Netherlands were classified according to their four-digit postal code (without the two uppercase letters). Each postal code area (with approximately 4,000 citizens) was linked to an area-level socioeconomic status score[7] from the Sociaal en Cultureel Planbureau [The Netherlands Institute for Social Research] (2018) according to its inhabitants' income level, education level, and occupation. The primary schools were then grouped into low, medium, and high socioeconomic status scores (see Table 2B). In each of the three socioeconomic status groups, the Education Research Department of the Executive Agency (Dienst Uitvoering Onderwijs or DUO)[8] of the Dutch Ministry of Education, Culture, and Science recruited fifth grade teachers through a simple random sample selection procedure. These teachers were then asked whether or not they used the financial education program. Based on their responses, the schools were divided into two groups. The schools

[7]The socioeconomic status score used was for 2014 because this indicator is derived every four years by the Netherlands Institute for Social Research.
[8]DUO Education Research specializes in research for schools in primary and secondary education and secondary vocational education.

that used the program served as the intervention group and the schools that did not use the program served as the control group.

Table 2B. *Sample characteristics*

	Pre-Assessment *M* (*SD*)	Post-Assessment 1 *M* (*SD*)	Post-Assessment 2 *M* (*SD*)
Socioeconomic status			
Low	-0.06 (0.24)	-0.12 (0.43)	-0.12 (0.44)
Medium	0.46 (0.17)	0.50 (0.16)	0.48 (0.18)
High	1.45 (0.50)	1.43 (0.47)	1.45 (0.48)

Pupils in the intervention group participated in two modules of the financial education program. The Responsible Spending module[9] is taught in December and includes topics such as making choices with a limited budget, the effects of peer pressure and advertising, and estimating the prices of products (see Appendix A, for all learning objectives). The Performing Transactions module[10] is taught in March and helps children to get acquainted with cash and digital money, develop a proactive attitude toward money matters, and investigate the security features of money (see Appendix B, for all learning objectives). It was not possible to counterbalance our research design because these modules are taught according to a relatively fixed learning-teaching trajectory of the schools that participate in the program.

Pupils completed a test regarding their financial competencies of responsible spending and performing transactions effectively in each assessment occasion (see Appendix C). The teachers were instructed not to provide answers and not to discuss the test with the pupils over the course of the study. The validity of the test was studied in the development stage by specialists in the field of financial education, namely the Ministry of Finance of the Netherlands, the educational publisher Zwijsen, and research staff at Leiden University.

[9]In the financial education program, this module is labeled 'Holidays'.
[10]In the financial education program, this module is labeled 'World of Money'.

Assessed variables

Responsible spending. We calculated pupils' scores on five questions with regard to responsible spending (multiple choice questions as shown in Appendix D). These questions measured pupils' knowledge of commercials and the distinction between name brands and counterfeiting brands, as well as their skills level of recognizing prices related to name brands compared to counterfeiting brands, managing money, and signaling the choices of their peers. For each correct answer, pupils were assigned one point and therefore their knowledge and skills scores in responsible spending could range from zero to five. A higher score indicated more knowledge and skills in responsible spending.

Performing transactions effectively. We calculated pupils' scores on six questions with regard to performing transactions effectively (multiple choice questions as shown in Appendix E). These questions measured pupils' knowledge of (paying with) a debit card and a checking account, as well as their skills of understanding the consequences of inserting an incorrect pin code and recognizing whether or not a banknote is authentic. For each correct answer, pupils were assigned one point and therefore their knowledge and skills scores in performing transactions effectively could range from zero to six. A higher score indicated more knowledge and skills in performing transactions effectively.

Control variables

Spoken language. Pupils were asked to indicate (yes or no) whether or not they always spoke Dutch at home. This variable was dummy coded 1 for pupils who always spoke Dutch at home and 0 for the other pupils.

Talking about money at home. Pupils were asked to indicate (yes or no) whether or not they talked about money at home (e.g., about pocket money, what you can buy, and who

pays for what).[11] This variable was dummy coded 1 for pupils who talked about money at home and 0 for the other pupils.

Talking about money in class. Pupils were asked to indicate (yes or no) whether or not they talked about money in class (e.g., about pocket money, commercials, or how you can manage money in a safe manner).[12] This variable was dummy coded 1 for pupils who talked about money in class and 0 for the other pupils.

Pocket money. Pupils were asked to indicate (yes or no) whether or not they received pocket money. This variable was dummy coded 1 for pupils who received pocket money and 0 for the other pupils.

Money from doing chores. Pupils were asked to indicate (yes or no) whether or not they earned money from doing chores. This variable was dummy coded 1 for pupils who earned money from doing chores and 0 for the other pupils.

Peer pressure. Pupils rated on a three-point scale (0 = often, 1 = sometimes, or 2 = never), to what extent they were sensitive to peer pressure caused by (1) commercials, (2) friends, (3) the desire to be the first, (4) the desire to copy celebrities, and (5) the fear of not belonging to a group. Pupils' responses were reverse scored and then averaged so that their scores could range from zero to two. A higher mean indicated more peer pressure.

Gender. Pupils could indicate their gender by circling the appropriate picture (girl or boy). This variable was dummy coded 1 for girls and 0 for boys.

Age. Pupils could indicate their age by filling in their age in years. This variable was continuous.

Pupil. This was an individual-level variable identifying each pupil.

[11]If pupils answered 'yes', they were asked to what extent they talked about money at home. They could check one of the following boxes: (1) almost every day, (2) once a week, (3) every other week, (4) once a month, and (5) it differs.
[12]If pupils answered 'yes', they were asked to what extent they talked about money at home. They could check one of the following boxes: (1) almost every day, (2) once a week, (3) every other week, (4) once a month, and (5) it differs.

School. This was a cluster-level variable identifying the primary school to which a pupil belonged.

Data analysis

Missing data. Little's (1988) test yielded a statistically significant result, $\chi^2 = 1{,}395.22$, $df = 358$, $p < .001$, suggesting that our data were not missing completely at random. Rather, our data seemed to be either missing at random or missing not at random. To handle the missing values, we used two techniques. The first technique was multiple imputations, which uses maximum likelihood to generate five plausible values for the missing values to capture the correct values (Graham & Hofer, 2000; Rubin, 1987).[13] These five plausible values were averaged and integrated into a single dataset for our analyses. The second technique was the expectation-maximization algorithm, which maximizes the expectation of the log-likelihood function of the missing values, given the available values in the dataset (Borman, 2006; Dempster, Laird, & Rubin, 1977; Haugh, 2015). Although multiple imputations and expectation-maximization algorithm assume that the data are missing at random, both techniques are often unbiased for missing not at random data (e.g., Schafer & Graham, 2002).

In the present study, we report the results based on expectation-maximization algorithm. If results based on multiple imputations differ, we indicate this in a footnote. Results were practically equivalent for both techniques, thereby indicating that the missing values did not affect the accuracy and efficiency of our estimates.

Mixed model analysis. All analyses were performed with the GAMLj module of jamovi statistical platform (Selker, Love, & Dropmann, 2019; The jamovi project, 2019). To assess the intervention effects, mixed model analyses were used. All mixed models were built

[13] See Kang (2013), for an overview of the benefits of multiple imputations.

with pupils and schools as the cluster variables, and time and group as the factors. The effects of time, group, and their interaction were estimated as fixed effects. Furthermore, random intercepts across pupils, random intercepts across schools, and random slopes of time across schools were included. The random component was chosen in preliminary analyses based on maximal random component approach and after pruning out random coefficients whose variance or covariances prevented convergence of the model estimation (Barr, Levy, Scheepers, & Tily, 2013). For each model, a second estimation was carried out with spoken language, talking about money at home, talking about money in class, pocket money, money from doing chores, peer pressure, gender, and age as the covariates. Backward elimination of non-significant (at alpha 0.05) covariates was operated to simplify the results.

For both responsible spending and performing transactions, the 3-measures group and the 2-measures group were analyzed separately. First, the 3-measures group was analyzed comparing the intervention group with the control group in their knowledge and skills over time (i.e., Pre-Assessment vs. Post-Assessment 1 vs. Post-Assessment 2). The intervention effect was evaluated based on the statistical significance and the direction of the Intervention × Time interaction and by evaluating the mean differences between groups before and after the module, using simple effects analysis. Second, the analyses were replicated in the 2-measures group (i.e., Post-Assessment 1 vs. Post-Assessment 2). Third, if intervention effects were found, we used simple effects analysis to explore whether these effects were robust to the way children dealt with money (i.e., spoken language, pocket money, money from doing chores, talking about money at home, and talking about money in class).

Results

The following results report on the effectiveness of the two modules of the Dutch Financial Education Program. The first section reports on the descriptive statistics of the continuous variables used. The second section reports on the intervention effect for the Responsible Spending module when comparing the intervention group to the control group over three assessment occasions (Pre-Assessment, Post-Assessment 1, and Post-Assessment 2). This is the 3-measures group. The third section reports on the intervention effect for the Responsible Spending module when comparing the intervention group to the control group over two assessment occasions (Post-Assessment 1 and Post-Assessment 2). This is the 2-measures group. The fourth section reports on the intervention effect for the Performing Transactions module when comparing the intervention group to the control group over three assessment occasions as described above. The fifth section reports on the intervention effect for the Performing Transactions module when comparing the intervention group to the control group over two assessment occasions as described above.

Descriptive statistics

Table 3 reports the average knowledge and skills scores in responsible spending and performing transactions effectively, and the average peer pressure scores for the 3-measures group and the 2-measures group. For all three variables, scores for both groups were very similar.

Table 3. *Means and standard deviations of the continuous variables*

	3-measures group *M* (*SD*)	2-measures group *M* (*SD*)
Knowledge and skills in responsible spending	4.15 (0.86)	4.13 (0.85)
Knowledge and skills in performing transactions effectively	2.72 (1.24)	2.79 (1.25)
Peer pressure	0.44 (0.31)	0.45 (0.32)

3-Measures group for the knowledge and skills in responsible spending

A 2 Intervention (Intervention vs. Control) × 3 Time (Pre-Assessment vs. Post-Assessment 1 vs. Post-Assessment 2) random coefficients Analysis of variance (ANOVA) was estimated as described above to examine the effectiveness of the Responsible Spending module. The proportion of the variance accounted for by the fixed and random effects was statistically significant, R^2 conditional = .40 (Johnson, 2014). The Intervention × Time interaction was not a statistically significant predictor of knowledge and skills in responsible spending. Thus, no intervention effect was found for the Responsible Spending module when comparing the intervention group to the control group over time. Adding the covariates to this model using backward elimination demonstrated that: (1) girls scored higher knowledge and skills in responsible spending than boys and (2) pupils who always spoke Dutch at home scored higher knowledge and skills in responsible spending than pupils who did not always speak Dutch at home (see Figure 1 and Table 4).

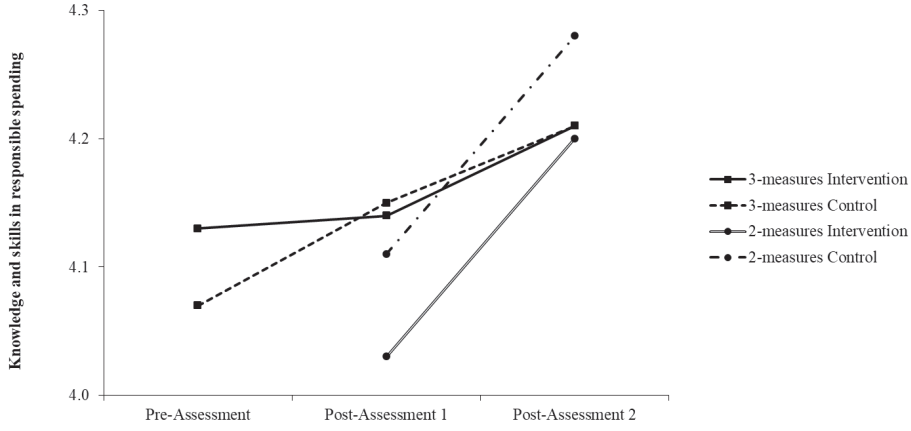

Figure 1. Fixed effects plot for the knowledge and skills in responsible spending. Pupils' knowledge and skills scores in responsible spending ranged from 0 to 5.

Table 4. *Mixed model analysis for the 3-measures group for knowledge and skills in responsible spending*[14]

Variable	*F*	Num *df.*	Den *df.*	*ICC*
Model 1				0.38[a]/0.03[b]
Intervention	0.05	1	65.4	
Time	6.52**	2	98.4	
Intervention × Time	0.63	2	98.5	
Model 2				0.38[a]/0.03[b]
Intervention	0.24	1	65.1	
Time	6.31**	2	96.3	
Intervention × Time	0.64	2	96.3	
Gender	23.97***	1	1,668.5	
Spoken language	11.46***	1	2,501.2	

Note. [a]ICC of the random intercept for pupils; [b]ICC of the random intercept for schools. The Satterthwaite method was used for the degrees of freedom; ** $p < .01$; *** $p < .001$

The main effect of Time was assessed for the two groups separately. For the intervention group, there was an effect of Time, $\chi^2(2) = 6.04$, $p = .049$, which resulted from a minor increase of performance between Post-Assessment 1 and Post-Assessment 2, $\Delta_{Means} = 0.069$, $z = 2.147$, $p = .032$, but no increase between Pre-Assessment and Post-Assessment 1, $\Delta_{Means} = 0.010$, $z = 0.233$, $p = .816$. Similarly, for the control group, the significant effect of Time, $\chi^2(2) = 7.70$, $p = .021$, stemmed from an increment between Post-Assessment 1 and Post-Assessment 2, $\Delta_{Means} = 0.069$, $z = 2.762$, $p = .006$, which was not present between Pre-Assessment and Post-Assessment 1, $\Delta_{Means} = 0.076$, $z = 1.349$, $p = .177$. Hence, both groups did not improve from the baseline assessment to the first post-assessment (after the Responsible Spending module took place); they only improved from the first post-assessment to the second post-assessment (after the Performing Transactions module took place). The increments, however, were similar for the intervention and the control group. This confirms the lack of an intervention effect for the Responsible Spending module (see Figure 1).[15]

[14]Time was not significant in model 1 and 2, when MI was used as a technique for treating missing data.
[15]Results based on MI showed that the increments for the intervention and control group were not significant. This also indicates the lack of an intervention effect for the Responsible Spending module.

2-Measures group for the knowledge and skills in responsible spending

A 2 Intervention (Intervention vs. Control) × 2 Time (Post-Assessment 1 vs. Post-Assessment 2) random coefficients ANOVA was estimated as described above to examine the effectiveness of the Responsible Spending module. The proportion of the variance accounted for by the fixed and random effects was statistically significant, R^2 conditional = .34. The Intervention × Time interaction was not a statistically significant predictor of knowledge and skills in responsible spending. Thus, no intervention effect was observed for the Responsible Spending module when comparing the intervention group to the control group over time. Adding the covariates to this model using backward elimination showed that pupils who always spoke Dutch at home scored higher knowledge and skills in responsible spending than those who did not always speak Dutch at home (see Table 5).

Table 5. *Mixed model analysis for the 2-measures group for knowledge and skills in responsible spending*[16]

Variable	*F*	Num *df.*	Den *df.*	*ICC*
Model 1				0.32[a]/0.00[b]
Intervention	2.73	1	1143.9	
Time	14.60***	1	50.7	
Intervention × Time	0.00	1	51.0	
Model 2				0.32[a]/0.00[b]
Intervention	2.35	1	1,054.6	
Time	14.92***	1	50.1	
Intervention × Time	0.03	1	50.5	
Spoken language	5.77*	1	1,846.7	

Note. [a]ICC of the random intercept for pupils; [b]ICC of the random intercept for schools. The Satterthwaite method was used for the degrees of freedom; * $p < .05$; *** $p < .001$

[16]Gender, spoken language, and peer pressure were significant in model 2, when MI was used as a technique for treating missing data. These results suggest that scores on knowledge and skills in responsible spending were higher for girls, children who always spoke Dutch at home, and children who experienced more peer pressure.

Similar to the 3-measures sample, we found a main effect of Time. For the intervention group, the performance of Post-Assessment 2 was better than Post-Assessment 1, $\Delta_{Means} = 0.171$, $z = 3.32$, $p = .002$, but this increment was comparable for the control group, $\Delta_{Means} = 0.165$, $z = 2.31$, $p = .025$. Thus, corroborating the earlier results, we found no effect of the intervention for the Responsible Spending module.[17]

3-Measures group for the knowledge and skills in performing transactions effectively

A 2 Intervention (Intervention vs. Control) × 3 Time (Pre-Assessment vs. Post-Assessment 1 vs. Post-Assessment 2) random coefficients ANOVA was estimated as described above to examine the effectiveness of the Performing Transactions module. The proportion of the variance accounted for by the fixed and random effects was statistically significant, R^2 conditional = .52. The Intervention × Time interaction was a statistically significant predictor of knowledge and skills in performing transactions effectively. Thus, an intervention effect was found for the Performing Transactions module when comparing the intervention group to the control group over time. Adding the covariates to this model showed that: (1) pupils who earned money from doing chores scored higher knowledge and skills in performing transactions effectively than those who did not earn money from doing chores, and (2) pupils who talked about money at home scored higher knowledge and skills in performing transactions effectively than those who did not talk about money at home (see Table 6).

[17]Results based on MI showed that the increment for the control group was not significant. Because the increments for the control and intervention group were comparable, this also indicates the lack of an intervention effect for the Responsible Spending module.

Table 6. *Mixed model analysis for the 3-measures group for knowledge and skills in performing transactions effectively*

Variable	*F*	Num *df.*	Den *df.*	*ICC*
Model 1				0.42[a]/0.11[b]
Intervention	5.64*	1	52.9	
Time	75.13***	2	60.3	
Intervention × Time	10.01***	2	60.3	
Model 2				0.42[a]/0.11[b]
Intervention	5.43*	1	52.8	
Time	73.46***	2	60.0	
Intervention × Time	9.92***	2	60.0	
Money from doing chores	10.83**	1	3,426.1	
Talking about money at home	13.55***	1	3,563.2	

Note. [a]ICC of the random intercept for pupils; [b]ICC of the random intercept for schools. The Satterthwaite method was used for the degrees of freedom; * $p < .05$; ** $p < .01$; *** $p < .001$

To probe the Intervention × Time interaction, simple effects of Intervention at different times were estimated. To avoid computational issues, the simple effects were tested with the χ^2 test (Lenth, 2019). The groups did not differ in their means neither at Pre-Assessment, $\chi^2(1) = 0.843$, $p = .359$, nor at Post-Assessment 1, $\chi^2(1) = 0.001$, $p = .973$, but they differed at Post-Assessment 2, $\chi^2(1) = 20.83$, $p < .001$, with the intervention group showing better performance than the control group (see Figure 2). Thus, the two groups were not different at the baseline assessment and the first post-assessment (following the Responsible Spending module); they were different only after the intervention (the Performing Transactions module) took place.

In addition, to better understand the effect of pretesting, it is interesting to probe the effect of Time for the two groups separately. For the intervention group, there was a clear effect of Time, $\chi^2(2) = 180.9$, $p < .001$, with an increase of performance between Pre-Assessment and Post-Assessment 1, $\Delta_{Means} = 0.337$, $z = 5.592$, $p < .001$, and a larger increase between Post-Assessment 1 and Post-Assessment 2, $\Delta_{Means} = 0.668$, $z = 8.221$, $p < .001$. For the control group, the significant effect of Time, $\chi^2(2) = 37.9$, $p < .001$, was due to an increment between Pre-Assessment and Post-Assessment 1, $\Delta_{Means} = 0.434$, $z = 5.248$, $p < .001$, which was not present between Post-Assessment 1 and Post-Assessment 2,

$\Delta_{Means} = 0.063$, $z = 0.555$, $p < .579$. Thus, both groups improved from the baseline assessment to the first post-assessment, but only the intervention group improved also from the first post-assessment to the second post-assessment. This shows the presence of an intervention effect for the Performing Transactions module over and beyond possible effects of repeated assessments (see Figure 2).

Furthermore, we explored whether the way children dealt with money influenced their gain in performing transactions knowledge and skills. Within the intervention group, the effect of time was assessed for: (1) children who always spoke Dutch at home vs. those who did not always speak Dutch at home, (2) children who talked about money at home vs. those who did not talk about money at home, (3) children who talked about money in class vs. those who did not talk about money in class, (4) children who received pocket money vs. those who did not receive pocket money, and (5) children who received money from doing chores vs. those who did not receive money from doing chores. There was an effect of time for all groups, that is, for the group that always spoke Dutch at home, $\chi^2(2) = 57.8$, $p < .001$, and for the group that did not always speak Dutch at home, $\chi^2(2) = 21.2$, $p < .001$; for the group that talked about money at home, $\chi^2(2) = 61.1$, $p < .001$, and for the group that did not talk about money at home, $\chi^2(2) = 22.1$, $p < .001$; for the group that talked about money in class, $\chi^2(2) = 53.2$, $p < .001$, and for the group that did not talk about money in class, $\chi^2(2) = 30.0$, $p < .001$; for the group that received pocket money, $\chi^2(2) = 58.8$, $p < .001$, and for the group that did not receive pocket money, $\chi^2(2) = 27.0$, $p < .001$; for group that received money from doing chores, $\chi^2(2) = 47.4$, $p < .001$, and for the group that did not receive money from doing chores, $\chi^2(2) = 46.4$, $p < .001$. Thus, the intervention effect for the Performing Transactions module was present regardless of the way children dealt with money.

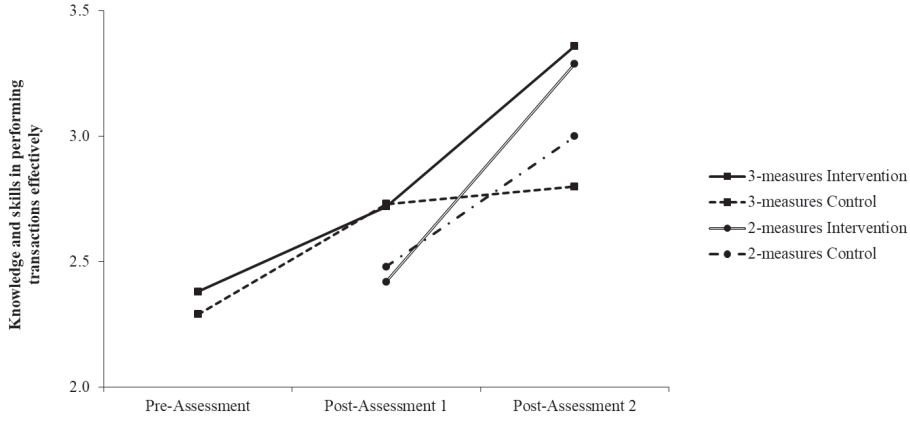

Figure 2. Fixed effects plot for the knowledge and skills in performing transactions effectively. Pupils' knowledge and skills scores in performing transactions effectively ranged from 0 to 6.

2-Measures group for the knowledge and skills in performing transactions effectively

A 2 Intervention (Intervention vs. Control) × 2 Time (Post-Assessment 1 vs. Post-Assessment 2) random coefficients ANOVA was estimated as described above to examine the effectiveness of the Performing Transactions module. The proportion of the variance accounted for by the fixed and random effects was statistically significant, R^2 conditional = .50. The Intervention × Time interaction was a statistically significant predictor of knowledge and skills in performing transactions effectively. Thus, an intervention effect was found for the Performing Transactions module when comparing the intervention group to the control group over time. Adding the covariates to this model using backward elimination suggested that: (1) pupils who were older scored higher knowledge and skills in performing transactions effectively than those who were younger and (2) pupils who talked about money at home scored higher knowledge and skills in performing transactions effectively than those who did not talk about money at home (see Table 7).

Table 7. *Mixed model analysis for the 2-measures group for knowledge and skills in performing transactions effectively*

Variable	*F*	Num *df.*	Den *df.*	*ICC*
Model 1				0.40[a]/0.08[b]
Intervention	2.09	1	62.5	
Time	95.68***	1	60.8	
Intervention × Time	6.75*	1	61.5	
Model 2				0.40[a]/0.07[b]
Intervention	2.59	1	61.8	
Time	80.41***	1	64.9	
Intervention × Time	6.70*	1	61.5	
Age	4.16*	1	1,781.9	
Talking about money at home	30.64***	1	2,170.0	

Note. [a]ICC of the random intercept for pupils; [b]ICC of the random intercept for schools. The Satterthwaite method was used for the degrees of freedom; * $p < .05$; *** $p < .001$

The simple effects of group at different times showed that the two groups were not different at Post-Assessment 1 (before the Performing Transactions module took place), $\chi^2(1) = 0.191$, $p = .664$, whereas they were clearly different at Post-Assessment 2 (after the Performing Transactions module took place), $\chi^2(1) = 6.466$, $p = .014$. This effect replicated the results obtained for the 3-measures sample.

Furthermore, similar to the 3-measures sample, we found an effect of assessment repetition. For the control group, in fact, Post-Assessment 2 showed a better performance than Post-Assessment 1, $\Delta_{Means} = 0.508$, $z = 4.45$, $p < .001$, but the improvement was almost twice as large for the intervention group, $\Delta_{Means} = 0.874$, $z = 10.50$, $p < .001$. Thus, replicating the previous results, we found an effect of the intervention for the Performing Transactions module which went over and beyond the mere effect of re-assessment.

We moreover explored whether the way children dealt with money influenced their improvement in performing transactions knowledge and skills. Similar to the 3-measures sample, there was an effect of time for all groups, that is, for the group that always spoke Dutch at home, $\chi^2(1) = 102.5$, $p < .001$, and for the group that did not always speak Dutch at home, $\chi^2(1) = 24.8$, $p < .001$; for the group that talked about money at home, $\chi^2(1) = 101.2$, $p < .001$, and for the group that did not talk about money at

home, $\chi^2(1) = 31.9$, $p < .001$; for the group that talked about money in class, $\chi^2(1) = 106.4$, $p < .001$, and for the group that did not talk about money in class, $\chi^2(1) = 23.2$, $p < .001$; for the group that received pocket money, $\chi^2(1) = 90.8$, $p < .001$, and for the group that did not receive pocket money, $\chi^2(1) = 56.3$, $p < .001$; for the group that received money from doing chores, $\chi^2(1) = 88.0$, $p < .001$, and for the group that did not receive money from doing chores, $\chi^2(1) = 64.2$, $p < .001$. Hence, similar to the 3-measures sample, the intervention effect for the Performing Transactions module was present regardless of the way children dealt with money.

Discussion

The present study examined the effectiveness of two modules (Responsible Spending and Performing Transactions) of a large-scale national financial education program in Dutch primary schools. Our results indicated that the Performing Transactions module increases fifth graders' knowledge and skills. Earlier work has shown a positive effect of financial education in the context of traditional pretest/post-test designs (Batty et al., 2015; Kalwij et al., 2019). The present finding echoes this effect based on the Solomon four-group design, which more tightly controls for any baseline effects of repeated testing. This finding underscores our argument that financial education programs, when they are well-designed and properly implemented, can increase children's financial knowledge and skills.

Interestingly, our results showed that fifth graders' knowledge and skills were not enhanced by the Responsible Spending module. This could indicate that children already had this knowledge or that the questions were relatively easy for them. In Pre-Assessment, children already answered most questions correctly. Still, there was an effect of time after the intervention for the Performing Transactions module took place, suggesting that this module helped children to answer the questions regarding responsible spending knowledge and skills

better. This suggestion, however, was not plausible because the increment in performance was similar for both the intervention and the control group. We therefore argue that the slight improvement in performance was related to children being exposed to responsible spending matters during the period between the first post-assessment (December 2016) and the second post-assessment (March 2017). For example, because they accompanied their parents, guardians, or caregivers to buy items at the supermarket or presents at stores for Christmas (December), New Year's Eve (January), or Valentine's Day (February).

To ensure that our intervention effects were robust to children-specific characteristics, the results concerning the program were obtained using analyses in which children's spoken language, gender, age, sensitivity to peer pressure, and their situation concerning talking about money at home, talking about money in class, pocket money, and money from doing chores were included as additional predictors. This allowed us to statistically control for these variables, but also to examine the relations of these variables with children's knowledge and skills in responsible spending and performing transactions effectively.

The relation between control variables and financial knowledge and skills

Our results demonstrated that children who always speak Dutch at home displayed higher financial knowledge and skills. These results could indicate that children who speak Dutch on a daily basis have higher knowledge and skills concerning financial matters or that these children are better able to understand the questions in the test and, therefore, provide more correct answers. It could be that these children understand financial matters better because they are able to connect what they have seen through television and in stores (items named in Dutch) to the questions they were asked. To our best knowledge, prior research never assessed the relationship between spoken language and financial knowledge and skills.

The fact that we did observe a positive relation between these variables may stimulate more research on this topic.

Our results moreover indicated that, as compared to children who do not talk about money at home, those who do talk about money at home displayed higher financial knowledge and skills. These results corroborate earlier findings (e.g., Romo & Vangelisti, 2014) and generalize these findings to a Dutch primary school context. Children who learn about financial matters from their parents', guardians', or caregivers' experiences are better able to relate those experiences to the questions they were asked.

In addition, as compared to children who do not earn money from doing chores, those who do earn money from doing chores are displaying higher financial knowledge and skills scores. This finding replicates some studies (e.g., Ramsey & Cruze, 2014), but contradicts others (e.g., Organization for Economic Co-operation and Development (OECD), 2014). In our opinion, earning money from doing chores can be viewed as part of activity-based learning, thereby enabling children to deal with money matters in practice and, hence, contributing positively to their financial learning process.

Our results additionally showed that the intervention effect for the Performing Transactions module was present regardless of whether or not children always spoke Dutch at home, whether or not children received pocket money, whether or not children talked about money at home, whether or not children talked about money in class, and whether or not children received money from doing chores. This suggests that the intervention effect of the Performing Transactions module was robust to the way children dealt with money.

Potential limitations and directions for future research

For practical and cost-related reasons, we restricted the test of the effectiveness of the Dutch financial education program to two of the five modules and focused on a subset of the targeted age group (fifth graders). The modules are provided at different time points during the school year according to the school's learning-teaching trajectory. In addition, no less than 124 primary schools and 2,650 pupils participated in our research. Hence, it was not feasible to carry out a study to cover all modules and all age groups. Further research, however, could examine the effectiveness of the remaining modules of the program and across different age groups.

Our research shows that knowledge and skills in performing transactions effectively can be learned well through a financial education module. An unanswered question is whether such knowledge and skills will affect children's actual financial behavior. Although we cannot answer this question with our presently reported results, a recent study showed that financial knowledge predicts several positive financial behaviors (Dare et al., 2020). Another question is whether children are able to acquire all financial competencies in an equally easy way. We did not find evidence that knowledge and skills in responsible spending can be increased by a financial education module. Apparently, fifth graders were exposed to responsible spending matters during the period December 2016 to March 2017 (before the Performing Transactions module took place). Why this exposure helped them to answer the responsible spending questions, but not those concerning performing transactions effectively could be related to the higher level of difficulty of the latter financial competency. Future studies could investigate whether or not the Responsible Spending module is effective at increasing the knowledge and skills of children in younger age groups (lower grades of primary school).

Last, in the present study, we assessed the short-term effect of the modules (covering Pre-Assessment in October 2016 to Post-Assessment 2 in March 2017) on children's financial knowledge and skills. We argue that if children receive financial education according to a continuous learning line in primary school (i.e., nonstop from first grade to sixth grade), it may improve their ability to make effective financial decisions later in life. Further research could investigate whether such constant early financial education can improve children's financial behavior in adulthood. Moreover, it could be assessed whether specific modules have a medium or long-term effect. For example, the Responsible Spending module focused on teaching children about the different factors that can influence their financial choices, thus it could have an effect on children's knowledge and skills in the medium or long term when they really have to make those choices.

Practical implications and conclusions

The present study contributes to the limited body of primary school-based financial education literature (e.g., Atkinson et al., 2015; Kalwij et al., 2019; OECD, 2013) by using a Solomon four-group design and mixed model analyses with variables that control for children-specific characteristics, thereby enabling us to draw more accurate conclusions.

Policymakers and educators can draw two main lessons from our results. The first lesson concerns the design of financial education programs in primary schools. It seems that programs that enable children to apply what they learn using daily life examples may improve their knowledge and skills regarding certain financial matters. This lesson is supported by recent research which argues that experiential learning (learning through experience) is a promising method to develop children's financial knowledge and skills (see Amagir, Groot, Van den Brink, & Wilschut, 2018, for further details).

Even though the two modules examined in the present study were designed and implemented in a similar way, we only found evidence for the effectiveness of one of the modules. As we remarked earlier, it appears that not all financial competencies can be learned well through a financial education module. This finding triggers the second lesson regarding the content of financial education programs in primary schools. It is important to measure the start level of children's knowledge and skills prior to implementing a financial education program. To investigate their start level of financial knowledge and skills, a pilot study (through a test) can be carried out in the development stage of the program. During this pilot study, it is crucial to investigate which financial competencies the program needs to focus on. It is furthermore of utmost importance to talk with the parents, caregivers, or guardians, to understand what financial areas they are (already) discussing with or teaching their children. Once the financial education program is developed, its effectiveness should moreover be assessed in the short term to allow for evidence-based improvement of the program. Doing so enables policymakers and educators to design and implement proper new financial education programs and, if necessary, to modify existing programs for this target group.

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Appendices

Appendix A. *Learning objectives of the Responsible Spending module*

1. Children understand that different desires lead to different choices.
2. Children understand that different factors can influence their choice.
3. Children realize that paying for a brand also involves paying for its brand name.
4. Children are aware of peer pressure and that it can influence their purchases.
5. Children know that there are cheaper and more expensive product types.
6. Children can make choices based on a limited budget.
7. Children can explain why companies advertise their products.
8. Children can estimate the value of money and products.

Note. Source: National Institute for Family Finance Information, 2013.

Appendix B. *Learning objectives of the Performing Transactions module*

1. Children get acquainted with a number of financial concepts related to paying with cash and a debit card.
2. Children get acquainted with the possibilities of a checking account.
3. Children know how to pay with a debit card in a safe manner.
4. Children recognize the standard symbols that are related to money.
5. Children investigate the authenticity of banknotes.
6. Children develop a proactive attitude toward financial matters.

Note. Source: National Institute for Family Finance Information, 2013.

Appendix C. *The test*

The test consisted of twenty-five questions. There were eleven questions to measure respondents' financial knowledge and skills scores. Five of these questions were related to the Responsible Spending module and six questions pertained to the Performing Transactions module. The remaining questions corresponded to the background of respondents (age, gender, and spoken language), the name of their school, in what way they dealt with money (whether they discussed financial matters in class or at home, whether they received pocket money, or earned money from doing chores), and to what extent they were sensitive to peer pressure (caused by commercials, friends, the desire to be the first, the desire to copy celebrities, and the fear of not belonging to a group).[18]

[18]The complete test can be provided upon request.

Appendix D. *Test questions of the intervention module Responsible Spending*

Question	Possible responses
1. Why do companies advertise? Choose 1 answer.	• To show you nice articles. • **Because they want you to buy their articles.** • To help you choose the best articles. • I do not know.
2. You see below 2 pictures of 1.5 liters bottles of cola and two prices. Connect each picture with the correct price ticket.	**AH cola is €0.85** **Coca-Cola is €1.90**
3. One cola bottle is more expensive than another cola bottle. Because … Choose 1 answer.	• The bottle looks nicer. • There is more cola in that bottle than in the other bottle. • **It is a brand name.** • Everyone wants cola. • I do not know.
4. You received €20 for your birthday. That is why you go with your parents to the mall to choose gifts. Below you can see all the products you can choose from. You can choose as many products as you want, but beware, you only have €20! Your parents want you to choose at least two gifts (so the €20 does not have to be spent entirely). Choose which presents you select.	• Kite €13 • Football €7 • Spring ball €12 • Diving glasses €9 • A game €10 • A book €12.50 • Nail polish €4 • Pawns €4 • Felt tip pens €2 **Two or more gifts should be selected that together cost (less than) €20.**
5. Do you think you chose the same presents as your classmates? Choose 1 answer.	• Yes, because I like the same things as my class. • No, because no advertising has been made for it. • **No, because boys and girls like other things.** • I do not know.

Note. Correct responses are printed in bold. For questions that regarded multiple answers, pupils had to choose all correct answers to be assigned one point.

Appendix E. *Test questions of the intervention module Performing Transactions*

Question	Possible responses
1. Pim goes to town with a friend. Pim just got a debit card from the bank and wants to buy something in town. He is at the cashier, but he forgot how to insert his pin code and on which buttons he has to press afterward. Which of the following answers do you think is the best answer? Choose 1 answer.	• Ask the cashier and let her do it with his pin code • **Go back home and ask his parents how he can pay with his debit card** • Ask the woman behind him if she wants to pay for him • I do not know
2. What happens if you insert the wrong pin code 3 times in the store?	• You get a tip • Your debit card will be taken away from you • **Your debit card will be blocked** • I do not know
3. Choose what words have to do with paying with a debit card. You can choose multiple answers.	• **The so-called Money Mule in Dutch (i.e., individuals who allow their bank account to be used against remuneration for criminal activities)** • **Checking account** • **Pin code** • **Electronic payment** • Change • **Overdrawing checking account** • **Exact payment** • Savings account • **Pin pad** • **Bankcard**
4. Imagine you want to pay with a debit card, where does the money come from? Choose 1 answer.	• **A checking account associated with a debit card.** • Savings account. • That money is in the debit card. • I do not know.
5. What is a checking account? Choose 1 answer.	• An account that you have to pay in a shop or restaurant • **A bank account that you need to be able to pay with your debit card** • A bank account with which you can pay without a debit card • I do not know
6. How can you see/feel/smell that a banknote is real (and not fake) (the security features)? You can choose multiple answers.	• **The word EYPΩ is on the banknote** • **A watermark** • **A signature on the banknote** • The ink has a rose scent • There must be an image of King Willem-Alexander on the banknote • **A silver-colored bond with the euro sign** • I do not know

Note. Correct responses are printed in bold. For questions that regarded multiple answers, pupils had to choose all correct answers to be assigned one point.