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The Effects of Game-Based Financial Education: New Survey Evidence from Lower Secondary School Students in Finland

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Abstract

We study the effects of game-based approaches using a sample of lower secondary school students in Finland. Our sample consists of 640 students in around 40 schools in different areas of the country. We focus on three different game-based interventions using a pre- and post-interventions survey design. We compare the effects of interventions (and their combinations) to a control group. We find robust effects with respect to knowledge gains from game-based approaches. We find that the interest of students towards economic issues also increases more with the intervention group than with the control group. However, the effects on self-reported financial behaviors are weak.

1 Introduction

There has been a considerable debate on the effectiveness of financial education in general. The doubts have been twofold: i) whether financial education influences financial behavior; ii) whether financial education even influences financial knowledge (e.g. Willis, 2008; Mandell and Klein, 2009; Walstad et al., 2010; Fernandes et al., 2014; Lusardi and Mitchell, 2014). Recently, a large number of studies have been set up to investigate this issue. Kaiser and Menkhoff (2017) summarize these in their meta-analysis, where they find that there is robust evidence of financial education impacting financial knowledge. They also find support for the proposition that financial education influences behavior, thought the effects are smallish and often focused on certain types of behaviors.

According to Amagir et al. (2018), the typical ways how increases in financial literacy are assessed in the school context are: 1) increases in knowledge, and 2) changes in (self-reported) financial behavior and / or 3) attitudes. In assessing knowledge gains, typically the studies in the secondary school context find improvements after educational interventions. The majority of studies reported also changes in attitudes, whereas findings relating to behavioral changes were scarce. This might be related to the fact that schoolchildren rarely do any independent important economic decisions.

While the focus of discussions has been largely in terms whether financial education has an impact or not, less focus has been put on the question what actually works in financial education. Among the few exceptions are Lusardi et al. (2017) who investigate the use of visual tools and narratives in financial education, and Kaiser and Menkhoff (2018) who find that active learning approaches work better than traditional lectures in a sample of entrepreneurs. Neither of these studies took place in a school setting.

On the other hand, there is a perception, especially among practitioners, that games can be an important tool in teaching and learning financial literacy (e.g. Maynard et al. 2012). However, there has been very little academic research on this subject.

The Finnish educational system has received a lot of positive attention related to the achievements in PISA rankings since the early 2000s. More recently, the relative position has somewhat declined. As a response, there has been an increased emphasis on phenomenon-based learning and digitalization in teaching in the new curriculum plan for primary and secondary schools. Economic and financial literacy can be regarded as examples of cross-disciplinary themes. In practice, however, they take place mostly within the social studies education.

To increase the effectiveness of financial education, there has been an increased interest to game-based approaches in Finnish schools. Appropriately for that context, *the aim of this study is to evaluate the effects of game-based approaches on financial literacy compared to the situation where there are only traditional teaching methods.* Therefore, this study does not compare the effects of a stand-alone program vs. no program, but the effects of delivery mode. This has influence e.g. on the interpretation of coefficients. More specifically, the methods that we investigate relate to the paradigm of active or experiential learning, which has been regarded as very promising and effective in economic education (Collins and Odders-White, 2015; Amagir et al. 2018).

2 Background

One challenge in studying the issue of financial / economic literacy is the definition of the subject. Financial literacy typically relates to personal financial management skills applicable at the level of individuals and households. There is also a much less used concept of economic literacy (Walstad and Soper, 1988; Hansen et al., 2002), which relates to the application of key economics principles to economic analysis in various issues, also beyond personal financial management, for instance related to informed voting behavior in economic policy contexts.

In Finnish schools, financial literacy is not taught as a separate subject. It is part of a module in "economic knowledge", which in turn is part of social studies curriculum. The learning goals of the module include elements both in personal financial management and in broader macroeconomic context. In addition, economic issues are taught in diverse fields of study such as study guidance counselling, home economics and mathematics. Still the teaching mostly takes place within the social studies. The teachers in that field are mostly specialized in history, and not economics. One outcome of this is that teaching is actually not very much informed by economic analysis as exemplified by the Council of Economic Analysis voluntary content standards for K-12 analysis (Siegfried et al., 2010), although these issues are partly covered in the Finnish national curriculum (Alanko, 2019).

According to the national curriculum for the grades 7-9, after having the economic knowledge module within social studies the students should be able to apply economic knowledge in the domain of personal financial management, entrepreneurship and informed career choice, planning for the future, and democratic participation. The curriculum also includes certain attitudinal elements, like applying ethical thinking in economic choice. These normative and attitudinal issues are not graded, however.

In our study, we focus on the development of economic capabilities of 9th grade students, who have a mandatory module of economic knowledge. The focus of the study is on whether game-based approaches result in better learning achievement that standard teaching approaches, i.e. the absence of gamified teaching. The classes are divided into an intervention group where the classes participate in game-based in teaching, and a control group that is supposed to have a more traditional approach to learning. In this approach, it is notable that there exists considerable heterogeneity due to different teaching styles of social science educators. Some teachers may well use games in their teaching even if part of the control group. Within the intervention group, the vigor at which teachers incorporate game-based approaches in their teaching is likely to differ among teachers. It is also possible that many teachers in the control group are likely to use active learning approaches, whereas the teaching of many teachers in the intervention group may be more traditional. We aim to overcome these differences by having sufficient statistical power in enabling us to make proper inference.

We focus on three distinct game-based programs. The programs have rather different foci, as two of them are geared towards personal financial management and one is a business game.

Me and My Globe is a business-game physical learning environment. Students represent a business organization and have several functions. For instance, they make purchase decisions and try to optimize production processes, apply for loans and make investment decisions, and sell their products, all in a simulated environment. The skills that are required in the game include knowledge about some basic accounting decisions, mathematics, human interaction and foreign language skills (as some sales pitches are made in English).[1]

Students play this game in designated physical environment using digital tools (tablets). They work in teams of five students, which allows for some functional specialization according to student capabilities. The visit to the physical learning environment is preceded by some general lessons on business management and on other decision skills that are required for the game play.

Me and My Globe is operated through Economic Information Office (EIO), which is owned by the Confederation of Finnish Industries. EIO also runs a educational progam Me and My City, which is for primary school students and it is well-known in Finland (Kalmi, 2018a). The program for the secondary school has been much more recent, the pilot phase starting in 2016. Still, it has spread quite rapidly, and the aim is to make it national in scope in a few years.

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[1] See description at https://www.edutat.fi/me-myglobe/

Oma Onni is a web-based learning environment, where the material is produced by the students of a vocational school (see Kalmi, 2018b). This material includes games, quizzes, videos and other activating material. Most of the learning of secondary school students take place over the internet. However, the students of the vocational institute make also a visit to the lower secondary schools. In addition of being web-based, another feature of the program is that it represents a form of peer learning, as the lower secondary school students learn from vocational school students, who are only a few years older. The focus of the program is clearly on personal financial management.[2]

Oma Onni is sponsored by foundations that own Oma Säästöpankki, a bank with its roots in local savings banks. It is produced by the vocational school SEDU in Seinäjoki, Western Finland. It has been in operation since 2010 and the learning contents have been continuously updated.

Money Flow Challenge is a mobile game with five different levels. It includes topics such as consumption, savings, investment and mortgage decisions. Students learn to make rational, utility-based decisions concerning personal financial management. This particular learning environment does not require much infrastructure compared to the two other ones, mainly a mobile device that can be used for playing the game. Also the hours used for the study of this game were lower than in the two other case. Students usually were exposed to Money Flow Challenge in two hours of classes, whereas Me and My Globe and Oma Onni took around 4-6 hours of classes. Money Flow Challenge is also the most recent of the programs, having started in 2014.[3]

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[2] See https://omaonni.fi/ (in Finnish only).
[3] See https://www.planago.com/moneyflowchallenge/ (in Finnish only).

Game-based teaching is not unusual in Finnish schools, but is regularly used in many disciplines. Within economics, one limiting factor has surely been lack of easy access to games teaching economics. The European Central Bank and its member banks, including the Bank of Finland, have been somewhat exceptional in introducing games that are suitable for secondary school students, usually focusing on monetary policy. Another popular game is the "Saldo" quiz, that has been launched by a consortium of actors including Finance Finland (the federation of finance sector in Finland) and the Finnish branch of the Junior Achievement. These are by far the most popular games outside our interventions. However, they differ from the interventions being relatively short and easy to use interventions, taking usually up only a fraction of the class hour. Somewhat surprisingly, an almost identical proportion of students in the intervention group (36%) reported having used other games than those belonging to our interventions than proportion of students in the control group (38%). In other words, participation in the game-based interventions did not seem to be associated with lower use of other games.

3   Study design and methods

3.1   Survey data

We conducted pre- and post-intervention surveys on economic knowledge, savings behavior, planning ahead and impulse shopping among the 9th year students. The survey was partly based on a previous questionnaire used in the Oma Onni –program in analyzing student learning (Kalmi, 2018b). However, Oma Onni- program focuses solely on personal finance, whereas some programs included in our study, as well as the learning goals of the Finnish curriculum are broader, including also issues of "economic literacy" (for instance, firms, macroeconomics and economic policy). Therefore, we broadened these questions so that one-half of the knowledge questions

covered questions related to personal finance and the other half of the questions concerned firms and macroeconomics. Moreover, the questionnaire was divided into knowledge questions and into questions dealing with behavior and attitudes. The question sets in the two surveys were identical regarding the financial behavior, but the financial knowledge questions were different in the two surveys. The two surveys and their questions were pre-tested with vocational education students. Examples of survey questions are provided in the Appendix.

The first survey was conducted in autumn 2017 with the intention that no economics education takes place before the survey. The second survey took place in spring 2018 after the educational interventions and other economics teaching following the curriculum. However, some classes had already started economics education before they took the first survey, while some classes had their final lessons in economics only after the second survey was taken. Therefore, we obtained the teaching schedules from the teachers and control for these differences in our empirical setting.

We also conducted a survey among the parents in which asked for background information such as parental education and tested for parent's own financial knowledge with the "three big" questions of financial literacy (Lusardi and Mitchell, 2014; see the Appendix). The additional parental survey was voluntary for the parents. We had a response rate of 76% of those who gave a research permit.

The ways how the programs were allocated to different schools differed somewhat among programs. Me and My Globe and Oma Onni were allocated with direct agreements between the program providers and municipal school authorities. Me and My Globe has the aim to be a nation-wide provider of financial education and it is widely used in different municipalities, even though the program for the secondary schools was relatively new. Oma Onni is in turn tied to the operating

area of the savings bank behind the program. In neither of these cases, the researchers could affect the allocation of the programs. Differently, in Money Flow Challenge there was the possibility to randomize its use. We offered it to 14 schools. A constraint was that we did not offer it to schools that already had two interventions, to prevent an overload of economic education programs in our groups. In the end, about one-half of the subjects to whom it was offered took it.

We selected 12 towns to work with, with the idea that we would find a reasonable representation of schools with and without programs. Initially, around 60 schools from 12 different towns agreed to participate in the study but some of them dropped out during the year. In the final data, we have pupils from 41 schools in 11 towns. Furthermore, because parental consent letters were required, the sample size is limited to 640 students from around 3000 students, who responded to both surveys. 433 of the responded students received game-based teaching along with usual economics education, while 207 students received only the usual education and form our control group. Some students participated in two game-based interventions, while others took part in one intervention. Table 1 presents the number of students in different groups in the final data.

Table 1 here

Our pre- and post-intervention surveys contained questions on financial knowledge, attitudes and behavior as well as students' background characteristics. Table 2 presents definitions of the variables used in the empirical analysis.

Table 2 here

Because some of the schools and classes dropped out between the first and second survey and parental consent was required, our final sample is shaped by a two stage selection process and,

thus, may not present the initial target group of the study. Furthermore, some parents selected to not to respond to the parental survey. Table 3 analyzes these attrition processes by showing students' initial level of financial knowledge according to the group. The table shows that over 3700 students took the pre-survey and that students for whom we obtained the parental consent performed significantly better in the pre-survey. Similarly, receiving response to the parental survey appears to correlate with student's higher financial knowledge. The plausible reason for this is that parents who take more active interest in their children's school performance are both more likely to respond to parental surveys and encourage the children to attain higher levels of school performance.

Table 3 further illustrates that those students that followed through also the second survey performed significantly better already in the pre-survey, which may reflect unobservable school or teacher characteristics. However, we tested and did not find evidence that these selection processes would arise differently in the treatment and control group. Thus, we conclude that while our final sample includes students with higher initial level of financial knowledge than the whole population of 9th graders, the attrition process does not endanger our treatment effect estimation.

Table 3 here

Table 4 presents summary statistics for the treatment and control group based on the first survey before any intervention had taken place. The initial level of financial knowledge does not differ statistically significantly between the two groups. The groups are similar also with respect to variables reflecting family background. However, the groups differ with respect to some observable background characteristics, e.g., the control group has more Swedish speaking students, lower average math grades and teaching of economics had already started in more classes.

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There are also some initial differences in students' attitudes towards saving and personal finance. These are observable characteristics that we can control for in our empirical setting.

Table 4 here

3.2 Estimation methods

Next, we specify a regression model to investigate the effect of game based economics education on financial knowledge and behavior. As we explained before, the programs were not randomly placed in municipalities, so a difference-in-difference estimation strategy will be appropriate. We compare the change in outcome between the first and second survey across treatment and control groups while controlling for students and classes' background characteristics. The basic specification is the following:

$$y_{i,t} = \alpha + \beta intervention_i + \gamma Post_t + \delta \left(intervention * Post \right)_{it} + \phi controls_{it} + \varepsilon_{it},$$

where y refers to outcome variable, which is either the level of financial knowledge or selected financial behavior outcome. The variable *Intervention* indicates whether student *i* was in the treatment or control group. Furthermore, in some of the specifications we divide the treatment group further depending on whether the student participated in one or two interventions. The variable *Post* is a time variable that separates between pre-survey and post-survey. Our main interest is in the interaction of the variables *Intervention* and *Post*, which will reveal the treatment effect of game based education interventions. Control variables include background variables related to student, class and family characteristics. Prior studies have observed that students' numeracy and cognitive skills as well as socio-economic background are related to financial

knowledge and behavior (e.g. Lührmann et al., 2015), thus we control for these characteristics. These include gender, mother tongue, math grade and average grade, having a bank account and receiving pocket money. We also include as family background characerics the number of books at home and parental financial literacy. We also control for school level fixed effects by including school dummies. The control variables are measured in the first survey to avoid any influence from treatments to the control variables.

The difference-in-difference estimation rests on the assumption that absent intervention both treatment and control group students would have similar development in their financial knowledge. All students follow the same curriculum in Finnish schools and thus parallel trend assumption should hold. However, some of the classes had already started their economics education prior to the first survey and some classes finished their economics lessons only after the second survey. These differences may cause the parallel trends assumption to not hold. However, for most classes we have this information available and we can thus add a control variable as well as a time interaction to allow for different time trends for these students. Therefore, observations where this information is not available are dropped in some of the regressions.

We use two variants of the intervention variable. First, we identify students who actually participated and received the treatment, i.e., we estimate the average treatment effect on treated (ATT). Second, we can also identify the classes and students who according to pre-assignment should have received the treatment but eventually did not. Thus, we can also estimate the average effect of intention to treat (ITT). The treatment and intended treatment groups differ for Me and My Globe and Money Flow Challenge interventions but not for Oma Onni group. Money Flow Challenge was randomly offered to schools, but some teachers self-selected not to use it in their teaching. The participation in Me and My Globe was pre-assigned at the municipality level,

however, some schools or classes did not participate, e.g., due to schedule reasons. If treatment participation reflects teachers' self-selection, the participation can be correlated with the knowledge and behavioral outcomes that we study. Therefore, ATT results could be biased and ITT results provide an unbiased picture. However, because many teaching approach choices are in fact self-selected, the ATT results are nevertheless relevant for policy and practice, although the causal mechanisms of results may remain uncertain.

4 Results

4.1 Financial knowledge

Table 5 presents the estimation results from difference-in-differences estimations regarding students' financial knowledge. First, we analyze students' overall performance in the financial knowledge questions (specifications 1-5). Then, we separately analyze how their knowledge developed in the two subfields of our survey: personal finance (specifications 6-7) and macroeconomics (specifications 8-9). All the control variables are measured at the time of the first survey and thus control variables related to financial behavior haven't been influenced by the potential treatment.

We have two variants of the intervention variable. First, we identify students who actually participated in the programs (ATT). These results are presented in Table 5. Second, we identify students who were intended to participate in the intervention programs (ITT). These results are presented in the Appendix Table 1. If these two sets of results differ, we can conclude that self-selection process into the treatment biases the results and ITT results should be considered to reveal more robust causal effect of game based education intervention.

Table 5 here

From Table 5, we can observe that, after controlling for student background, the treatment group performed somewhat worse than the control group in the pre-survey. However, the treatment effect estimate is positive and significant suggesting that the treatment group caught up and performed better than the control group in the second survey. The treatment group had on average 3.5 correct answers more than the control group in the second survey (out of 60). We also observe that male students, students with higher grade average and those who discuss financial matters at home with parents performed better.

In specification 2, we consider that the teaching started and finished at different times in different classes. We observe that classes where teaching had already started performed significantly better in the pre-survey and subsequently improved their scores less in the follow-up survey. There is also some indication that classes that had not finished all of their economics lessons before they took the follow-up survey performed worse in follow-up survey. However, including these controls does not influence the main coefficient of interest (*post * treatment*).

In specification 3, we include parents' financial literacy score as control variable. The estimate is positive and weakly significant indicating that parent and student's financial knowledge are linked. However, in specification 4, where we include school level controls, the parental financial literacy score is no longer statistically significant. Overall, the school level controls do not impact our treatment effect estimates. Based on previous literature, we also expected that parental education would be important control variable explaining student performance. In our results, this was however not the case and thus we did not include parental education among the control variables. We suspect that the lack of explanatory power may be due to the fact that obtaining the parental

consent and answer in the parental survey already correlate strongly with family's socioeconomic background and thus parental education does not contain additional explanatory power.[4]

In specification 5, we separately study the treatment effect of one game based intervention and two interventions. The estimate of one intervention is positive, but the estimate of two interventions is much higher and strongly significant. We also tested whether the treatment effect of two interventions is twice as high as that of one intervention. The null hypothesis of twice as high effect was not rejected.

In specifications 6-9, we study whether the interventions impact personal finance and macroeconomic knowledge differently. Overall, we observe that the interventions significantly improve students' knowledge in both subfields. Among the three different intervention programs, some had a stronger focus on personal finance and some on macroeconomics and firms. These different emphases were however not reflected in the results, when we estimated the treatment effects of different intervention programs. Overall, the results for the different programs were not statistically significantly different and thus we do not report program level results.[5]

In the Appendix Table 1, we switch to the Intention to Treat Definition of treatment. Studying the effect of intention to treat does not change our main conclusions. In fact, the treatment effect estimates are closely similar or in some cases even higher than in Table 5. Specifically, the effect of single intervention is now statistically significantly positive (specifications 5, 7 and 9).

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[4] Other variables we included in some trials (not reported here) were a dummy variable for other games used and a measure for the number of hours used in teaching economics. These were not statistically significant and did not influence the main coefficient of interest.

[5] The number of participants in some programs was also relatively small, and this may have contributed to the lack of statistically significant differences between programs.

4.2   Financial behavior and attitudes

Student's level of financial knowledge correlates significantly with most aspects of self-reported financial behavior (correlations available from the authors). However, when we analyze whether the education intervention altered students' financial behavior, we observe that the treatment effects are negligible and statistically insignificant with only few exceptions. Table 6 presents the estimation results from difference-in-differences estimations regarding the behavioral variables. The outcome variables are binary variables and thus we use probit estimation and report average marginal effects in Table 6. In these estimations, we use the following control variables: gender, language, math grade, average grade and whether the student has over 100 books at home.[6]

Table 6 here

Based on the results in Table 6, we can observe that students in the treatment group report savings in the follow-up survey more often than the control group. However, the statistical significance is quite weak and insignificant when we separate between one and two interventions. We also observe that students that participated in two treatments are more likely to find saving profitable in the follow-up survey.

In Table 7, we report further treatment effect estimates for financial behavior. These variables are ordinal variables. The first four variables (Finds personal finance easy, Plans the use of money, Impulse shopping, Interest) take values between 1 and 5, where 1 means that the student strongly

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[6] We do not include as control variables: whether the student talks about financial matters at home, has bank account or receives pocket money from parents, because these reflect student's behavior and are potential outcome variables. However, these behavioral variables were found to be unaffected by the treatment.

disagrees with the statement and 5 that the student strongly agrees with the statement. The final variable is formed by aggregating all the five savings related variables in Table 6. Thus, this variable takes values between 0 and 5, where higher values indicate that the student has answered positively to more savings questions. The results are based on ordered probit estimation. In order to save space, we only report the marginal effects for the treatment variables. The marginal effects describe the increase in likelihood that student belongs to a particular group.

According to Table 7, we can observe that the game based financial education interventions positively affect students' self-reported interest in economic issues. We observe that the treatment group students start from a lower level of interest in the first survey, but they catch up by the time of the second survey. These results apply both to students who received one treatment and those who received two treatments. With respect to the other behavioral variables we do not observe statistically significant treatment effects, although in general the signs of marginal effects are in line with our prior expectations. If we would use the intervention to treat approach, the results would again be roughly similar.

Table 7 here

Overall, we find that higher financial knowledge is significantly correlated with students' financial behavior such as savings decisions, interest in economic issues, planning ahead and self-confidence in matters related to economic issues. However, even though the game based education interventions improve students financial knowledge, we find only very weak impact on their financial behavior.

5 Conclusions

In this paper, we have studied the impact of game-based interventions in teaching economics in the Finnish lower secondary schools relative to traditional teaching methods. Our findings indicate that learning outcomes are better with game-based interventions, when the relevant measure is knowledge of economics. This applies both to personal finance questions, as well as to the more macro-oriented or firm-level questions. Moreover, it appears that a combination of interventions work better than single interventions. There is also evidence that game-based interventions positively impact the interest of students in economic issues. However, the influence on (self-reported) behaviors are weak.

While similar results have been obtained in prior literature, a novelty of these findings are that instead of focusing on a situation of where there is an games intervention vs. an absence of intervention, these findings relate to comparisons between two different types of teaching approaches. The findings strongly support pedagogical innovations in the field of personal finance and economics. The use of game-based learning approaches, that are a subset of active learning approaches, show promise in making studying economics simultaneously more practical and fun.

Methodologically, there remains the challenge that student behaviors are hard to measure for under-aged students who do not make important economic decisions independently. Future studies could investigate how interventions could influence learning within game-based simulations.

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Table 1. Sample size by group

Group	Number of students	
Control group	207	
Treatment group	433	
1 intervention		250
2 interventions		183
Total	640	

Notes: 640 students took both surveys. 342 students were lost to attrition at the follow-up survey.

Table 2. Definition of variables

Variable	Description
Swedish	1 if student answered the survey in Swedish, 0 otherwise
Math grade	Student's previous math grade
Average grade	The grade average in the previous school report
Talks about money	1 if student talks about financial matters with parents, 0 otherwise
Bank account	1 if student has a bank account, 0 otherwise
Pocket money	1 if student receives pocket money from parents, 0 otherwise
Over 100 books	1 if there are over 100 books at home, 0 otherwise
Parent's financial literacy	Number of correct answers in parental financial literacy test (0-3)
Economic/financial knowledge	Number of correct answers (out of 60)
Personal finance knowledge	Number of correct answers in questions related to personal finance (out of 30)
Macroeconomic knowledge	Number of correct answers in questions related to macroeconomy and firms (out of 30)
Teaching started	1 if the teaching of economics had started before class took the first survey, 0 otherwise
Teaching continues	1 if the teaching of economics had not finished before class took the follow-up survey, 0 otherwise
Income	1 if student has earned income, 0 otherwise
Knows how much money on account	1 if student knows how much money he/she has on the bank account, 0 otherwise
Saves regularly	1 if student saves regularly for some purpose, 0 otherwise
Savings	1 if student saves money on bank account, at home or otherwise, 0 otherwise
Saves extra money	1 if student saves money that he/she receives from parents, 0 otherwise
Finds saving easy	1 if student finds saving easy or quite easy, 0 otherwise
Finds saving profitable	1 if student finds saving money profitable, 0 otherwise
Planning ahead	1 if student finds that planning ahead is the best way to achieve goals, 0 otherwise
Finds personal finance easy	Student finds personal finance easy, values 1-5.
Plans the use of money	Student plans ahead the use of money, values 1-5
Impulse shopping	Student buys impulsively, values 1-5.
Interest	Student finds economic issues interesting, values 1-5.
Saving questions combined	Sum of the five savings related questions, values 0-5.

Table 3. Attrition process and students' financial knowledge in pre-survey.

	Mean	SD	Difference in means test p-value	Obs
No parental consent	28.970	10.028		2758
Parental consent	30.839	9.693	0.000*	982
Parental consent and parental survey	31.114	9.701	0.095†	764
Parental consent and 1st survey only	29.696	9.934		342
Parental consent and both surveys	31.450	9.513	0.008‡	640

* Difference to no parental consent group, † difference to no response in parental survey group,
‡ difference to parental consent and 1st survey only group

Table 4. Baseline (pre-survey) summary statistics

	Control group*		Treatment group**		Difference in means test p-value
	Mean	SD	Mean	SD	
Financial knowledge	31.913	9.396	31.229	9.571	0.392
Personal finance knowledge	15.444	4.258	15.594	4.503	0.685
Macroeconomic knowledge	16.469	5.933	15.635	6.065	0.100
Male	0.454	0.499	0.510	0.500	0.183
Swedish	0.150	0.358	0.035	0.183	0.000
Math grade	7.903	1.397	8.219	1.351	0.007
Average grade	8.197	0.932	8.348	0.895	0.053
Talks about money	0.536	0.500	0.58	0.494	0.303
Bank account	0.787	0.410	0.788	0.410	0.998
Pocket money	0.454	0.499	0.462	0.499	0.854
Over 100 books	0.551	0.499	0.529	0.500	0.605
Parent's financial literacy‡	2.479	0.832	2.477	0.802	0.972
Teaching started†	0.237	0.427	0.089	0.285	0.000
Teaching continues†	0.164	0.372	0.164	0.371	0.985
Income	0.667	0.473	0.603	0.490	0.115
Knows how much money on account	0.855	0.353	0.834	0.373	0.482
Saves regularly	0.614	0.488	0.543	0.499	0.089
Savings	0.961	0.193	0.945	0.229	0.334
Saves extra money	0.585	0.494	0.520	0.500	0.122
Finds saving easy	0.763	0.426	0.727	0.446	0.328
Finds saving profitable	0.961	0.193	0.958	0.199	0.860
Planning ahead	0.841	0.367	0.843	0.364	0.939
Finds personal finance easy	3.981	0.812	3.852	0.911	0.073
Plans the use of money	3.382	1.155	3.293	1.150	0.365
Impulse shopping	2.184	0.937	2.349	0.993	0.042

Interest	3.783	1.082	3.506	1.194	0.004
Saving questions combined	3.884	1.139	3.693	1.208	0.052

Notes. *207 observations, **433 observations, † 152 observations in control group and 348 observations in treatment group, ‡ 146 observations in the control group and 342 observations in the treatment group

Table 5. Financial knowledge. Average treatment effect on treated.

	Financial knowledge					Personal finance		Macroeconomics	
	1	2	3	4	5	6	7	8	9
Post	0.507	1.283	1.088	1.088	0.778	-0.750	-0.877	1.838**	1.655*
	(0.688)	(0.970)	(1.288)	(1.319)	(1.298)	(0.603)	(0.607)	(0.851)	(0.858)
Treatment	-1.885**	-1.783**	-1.569	-9.194*		-0.418		-1.151*	
	(0.761)	(0.880)	(1.021)	(5.085)		(0.469)		(0.668)	
Post*Treatment	3.567***	3.382***	3.449***	3.449***		1.591**		1.858**	
	(0.817)	(1.022)	(1.296)	(1.327)		(0.622)		(0.860)	
Treatment (1)					-1.072		-0.282		-0.790
					(1.074)		(0.495)		(0.707)
Post*Treatment(1)					2.099		1.038		1.061
					(1.310)		(0.645)		(0.867)
Treatments(2)					-2.433*		-0.646		-1.787**
					(1.300)		(0.603)		(0.837)
Post*Treatments(2)					5.846***		2.572***		3.274***
					(1.549)		(0.742)		(1.039)
Post*Teaching started		-3.620***	-3.480***	-3.480***	-2.585**	-1.224	-0.857	-2.256***	-1.727**
		(1.121)	(1.258)	(1.289)	(1.256)	(0.752)	(0.754)	(0.743)	(0.748)
Post*Teaching continues		-1.269	-2.348*	-2.348*	-1.796	-1.442**	-1.217**	-0.905	-0.579
		(1.226)	(1.230)	(1.260)	(1.260)	(0.593)	(0.601)	(0.884)	(0.900)
Teaching started		6.090***	6.336***	4.085*	6.010***	1.838***	1.751***	4.498***	4.259***
		(1.080)	(1.086)	(2.433)	(1.106)	(0.576)	(0.583)	(0.680)	(0.697)
Teaching continues		-0.951	-0.257	3.159	-0.456	0.330	0.278	-0.587	-0.734
		(1.170)	(1.209)	(2.051)	(1.215)	(0.558)	(0.560)	(0.812)	(0.816)
Male	2.348***	1.784**	1.995**	1.251	1.955**	0.440	0.408	1.555***	1.546***
	(0.630)	(0.692)	(0.778)	(0.800)	(0.777)	(0.355)	(0.353)	(0.508)	(0.512)
Swedish	-2.583**	-3.355***	-3.634***	-14.647**	-3.593***	-1.970***	-1.937***	-1.664*	-1.655*
	(1.068)	(1.206)	(1.279)	(6.208)	(1.285)	(0.568)	(0.574)	(0.885)	(0.888)
Math grade	0.433	0.348	0.448	0.681	0.439	0.271	0.264	0.177	0.175
	(0.359)	(0.392)	(0.455)	(0.478)	(0.453)	(0.211)	(0.209)	(0.291)	(0.292)
Average grade	3.580***	3.646***	3.594***	3.759***	3.604***	0.963***	0.971***	2.631***	2.633***
	(0.554)	(0.598)	(0.660)	(0.722)	(0.658)	(0.309)	(0.307)	(0.447)	(0.447)
Talks about money	2.417***	2.350***	2.169***	2.058***	2.135***	1.168***	1.142***	1.001**	0.994**
	(0.605)	(0.650)	(0.741)	(0.733)	(0.746)	(0.344)	(0.347)	(0.476)	(0.476)

Bank account	1.836**	1.243	0.090	0.548	0.065	0.280	0.260	-0.190	-0.196
	(0.739)	(0.760)	(0.780)	(0.835)	(0.783)	(0.369)	(0.372)	(0.518)	(0.519)
Pocket money	0.492	0.431	0.500	0.580	0.505	0.141	0.146	0.359	0.360
	(0.583)	(0.649)	(0.724)	(0.749)	(0.726)	(0.333)	(0.333)	(0.473)	(0.473)
Over 100 books	0.674	0.713	0.272	0.159	0.283	0.336	0.344	-0.064	-0.061
	(0.586)	(0.643)	(0.748)	(0.767)	(0.751)	(0.345)	(0.346)	(0.494)	(0.495)
Parent's financial literacy			0.840*	0.495	0.811*	0.533**	0.510**	0.307	0.301
			(0.443)	(0.459)	(0.453)	(0.216)	(0.218)	(0.288)	(0.294)
Constant	-4.869	-4.456	-5.583	0.423	-5.369	3.154	3.263*	-8.737***	-8.632***
	(3.463)	(3.610)	(3.971)	(6.764)	(3.955)	(1.978)	(1.969)	(2.528)	(2.528)
School dummies included				x					
N	1280	1000	752	752	752	752	752	752	752
Adjusted R-squared	0.200	0.213	0.230	0.270	0.235	0.141	0.145	0.249	0.252

Notes. * $p<0.10$, ** $p<0.05$, *** $p<0.01$

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Table 6. Financial behavior. Average treatment effect on treated.

	Income		Bank account		Knows how much money on account		Pocket money		Saves regularly	
Post	0.036	0.036	0.069*	0.069*	0.049	0.049	0.014	0.014	0.021	0.021
	(0.048)	(0.047)	(0.038)	(0.038)	(0.035)	(0.035)	(0.049)	(0.049)	(0.049)	(0.049)
Treatment	-0.058		0.007		-0.013		0.034		-0.063	
	(0.041)		(0.032)		(0.029)		(0.042)		(0.042)	
Post*Treatment	-0.005		-0.016		-0.013		-0.028		-0.044	
	(0.057)		(0.046)		(0.042)		(0.059)		(0.059)	
Treatment (1)		-0.127***		-0.026		-0.041		0.023		-0.101**
		(0.044)		(0.034)		(0.031)		(0.047)		(0.046)
Post*Treatment(1)		0.035		0.015		-0.004		-0.006		-0.013
		(0.063)		(0.051)		(0.046)		(0.066)		(0.065)
Treatments(2)		0.051		0.061		0.036		0.049		-0.008
		(0.049)		(0.039)		(0.036)		(0.051)		(0.051)
Post*Treatments(2)		-0.065		-0.064		-0.029		-0.058		-0.086
		(0.069)		(0.056)		(0.052)		(0.071)		(0.070)
Male	0.092***	0.087***	-0.015	-0.017	0.002	-0.002	0.011	0.011	0.101***	0.099***
	(0.028)	(0.028)	(0.023)	(0.023)	(0.020)	(0.020)	(0.029)	(0.029)	(0.029)	(0.029)
Swedish	0.063	0.082	0.079*	0.086*	0.078*	0.086*	0.158***	0.158***	0.110*	0.118**
	(0.054)	(0.054)	(0.047)	(0.047)	(0.045)	(0.045)	(0.055)	(0.055)	(0.056)	(0.056)
Math grade	-0.042***	-0.046***	0.002	0.001	0.002	0.001	-0.015	-0.015	-0.020	-0.022
	(0.016)	(0.016)	(0.013)	(0.013)	(0.012)	(0.012)	(0.017)	(0.017)	(0.017)	(0.017)
Average grade	0.065**	0.069***	0.010	0.011	0.008	0.009	-0.024	-0.024	0.039	0.041
	(0.025)	(0.025)	(0.020)	(0.020)	(0.018)	(0.018)	(0.026)	(0.026)	(0.026)	(0.026)
Over 100 books	-0.003	0.001	0.038*	0.040*	0.010	0.012	0.043	0.043	-0.018	-0.016
	(0.028)	(0.027)	(0.022)	(0.022)	(0.020)	(0.020)	(0.029)	(0.029)	(0.028)	(0.028)
Pseudo R-squared	0.014	0.025	0.014	0.018	0.010	0.017	0.011	0.011	0.016	0.018

Notes. Marginal effects after probit estimation. 1280 observations * p<0.10, ** p<0.05, *** p<0.01

Table 6. Continues.

	Savings		Saves extra money		Finds saving easy		Finds saving profitable		Planning ahead		Talks about money	
Post	-0.038*	-0.038*	0.026	0.026	0.010	0.010	-0.010	-0.010	-0.024	-0.024	0.075	0.074
	(0.022)	(0.022)	(0.047)	(0.047)	(0.042)	(0.042)	(0.019)	(0.018)	(0.035)	(0.035)	(0.047)	(0.047)
Treatment	-0.021		-0.097**		-0.066*		-0.003		-0.015		0.036	
	(0.020)		(0.041)		(0.036)		(0.016)		(0.031)		(0.041)	
Post*Treatment	0.046*		-0.000		0.022		0.020		0.028		0.033	
	(0.027)		(0.057)		(0.050)		(0.023)		(0.042)		(0.057)	
Treatment (1)		-0.018		-0.089**		-0.050		0.005		-0.020		0.007
		(0.022)		(0.045)		(0.040)		(0.019)		(0.034)		(0.045)
Post*Treatment(1)		0.040		-0.017		0.004		-0.005		0.007		0.052
		(0.030)		(0.064)		(0.056)		(0.025)		(0.047)		(0.064)
Treatments(2)		-0.024		-0.108**		-0.088**		-0.011		-0.005		0.079
		(0.024)		(0.049)		(0.043)		(0.018)		(0.037)		(0.049)
Post*Treatments(2)		0.053		0.023		0.047		0.067**		0.062		0.005
		(0.033)		(0.069)		(0.060)		(0.032)		(0.052)		(0.069)
Male	0.023*	0.023*	0.115***	0.115***	0.100***	0.100***	-0.020*	-0.022*	-0.037*	-0.039*	0.063**	0.062**
	(0.013)	(0.013)	(0.028)	(0.028)	(0.025)	(0.025)	(0.012)	(0.012)	(0.021)	(0.021)	(0.028)	(0.028)
Swedish	0.017	0.018	-0.056	-0.056	-0.056	-0.058	0.050	0.051	-0.038	-0.032	-0.011	-0.004
	(0.026)	(0.027)	(0.053)	(0.053)	(0.045)	(0.045)	(0.032)	(0.032)	(0.037)	(0.037)	(0.053)	(0.053)
Math grade	-0.004	-0.004	0.003	0.003	0.017	0.018	-0.005	-0.005	0.028**	0.027**	-0.001	-0.003
	(0.007)	(0.007)	(0.016)	(0.016)	(0.014)	(0.014)	(0.006)	(0.006)	(0.012)	(0.012)	(0.016)	(0.016)
Average grade	0.029**	0.029**	0.135***	0.135***	0.082**	0.081**	0.023**	0.023**	0.034*	0.035*	0.014	0.016

	(0.012)	(0.012)	(0.025)	(0.025)	(0.022)	(0.022)	(0.010)	(0.010)	(0.019)	(0.019)	(0.026)	(0.026)
Over 100 books	0.008	0.008	0.014	0.014	0.016	0.015	-0.010	-0.008	0.013	0.014	0.056**	0.057**
	(0.013)	(0.013)	(0.028)	(0.028)	(0.024)	(0.024)	(0.011)	(0.011)	(0.021)	(0.021)	(0.028)	(0.028)
Pseudo R-squared	0.034	0.034	0.052	0.052	0.051	0.052	0.047	0.064	0.050	0.054	0.015	0.017

Notes. Marginal effects after probit estimation. 1280 observations * $p<0.10$, ** $p<0.05$, *** $p<0.01$

Table 7. Financial behavior. Average treatment effect on treated. Ordered probit estimation.

		Finds personal finance easy	Plans the use of money	Impulse shopping	Interest in economic issues	Saving questions combined
	0					0.006**
	1	0.003*	0.008	-0.047**	0.031***	0.013**
Treatment	2	0.032**	0.048	-0.018**	0.067***	0.035**
	3	0.015**	0.001	0.006**	0.003***	0.030**
	4	0.006	-0.025	0.047**	-0.018***	-0.002
	5	-0.057**	-0.031	0.012**	-0.083***	-0.082**
	0					-0.001
	1	-0.001	-0.001	0.016	-0.028**	-0.001
Post*Treatment	2	-0.014	-0.006	0.006	-0.060**	-0.004
	3	-0.006	-0.000	-0.002	-0.003*	-0.003
	4	-0.003	0.003	-0.016	0.016*	0.000
	5	0.024	0.004	-0.004	0.074**	0.009
	0					0.006**
	1	0.008	0.009	-0.036	0.032***	0.014**
Treatment (1)	2	0.026	0.056*	-0.013	0.067***	0.036**
	3	0.012	0.001	0.004	0.003**	0.031**
	4	0.005	-0.030*	0.036*	-0.018**	-0.002
	5	-0.045	-0.036*	0.009	-0.084***	-0.085**
	0					0.000
	1	-0.001	-0.003	0.001	-0.024*	0.000
Post*Treatment(1)	2	-0.005	-0.021	0.000	-0.052*	0.000
	3	-0.003	-0.000	-0.000	-0.002	0.000
	4	-0.001	0.011	-0.001	0.014	-0.000
	5	0.010	0.013	-0.000	0.064*	-0.000
	0					0.006*
	1	0.004*	0.006	-0.064***	0.030***	0.012*
Treatments(2)	2	0.041**	0.036	-0.024**	0.065***	0.033**
	3	0.020**	0.001	0.008**	0.003**	0.028**
	4	0.008*	-0.019	0.064***	-0.017**	-0.002
	5	-0.073**	-0.023	0.016**	-0.081***	-0.078**
Post*Treatments(2)	0					-0.002

	1	2	3	4	5
1	-0.002	0.002	0.037	-0.033**	-0.003
2	-0.025	0.014	0.014	-0.071**	-0.009
3	-0.012	0.000	-0.004	-0.003*	-0.007
4	-0.005	-0.007	-0.037	0.019*	0.000
5	0.044	-0.009	-0.009	0.088**	0.021
Pseudo R-squared	0.037 0.037	0.018 0.018	0.026 0.026	0.031 0.032	0.021 0.021

Notes. Marginal effects after ordered probit estimation. 1280 observations * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix Table 1. Financial knowledge. Average effect of intention to treat.

	Financial knowledge					Personal finance		Macroeconomics	
	1	2	3	4	5	6	7	8	9
Post	0.288	1.106	0.485	0.485	0.286	-0.913	-1.016	1.399	1.302
	(0.765)	(1.004)	(1.331)	(1.361)	(1.350)	(0.642)	(0.650)	(0.898)	(0.891)
Treatment	-2.010**	-1.970**	-2.324**	2.779		-0.737		-0.919	
	(0.832)	(0.930)	(1.082)	(3.723)		(0.495)		(2.712)	
Post*Treatment	3.531***	3.371***	3.951***	3.951***		1.681**		2.270**	
	(0.876)	(1.049)	(1.335)	(1.366)		(0.652)		(0.905)	
Treatment (1)					-1.951*		-0.668		-1.283*
					(1.155)		(0.539)		(0.765)
Post*Treatment(1)					3.196**		1.295*		1.901**
					(1.386)		(0.702)		(0.914)
Treatments(2)					-2.688**		-0.793		-1.894**
					(1.267)		(0.581)		(0.826)
Post*Treatments(2)					4.688***		2.059***		2.629***
					(1.510)		(0.729)		(1.009)
Post*Teaching started		-3.949***	-3.428***	-3.428***	-2.843**	-1.230*	-0.930	-2.198***	-1.913**
		(1.087)	(1.229)	(1.258)	(1.295)	(0.746)	(0.773)	(0.740)	(0.776)
Post*Teaching continues		-1.020	-2.119*	-2.119*	-1.875	-1.343**	-1.219**	-0.775	-0.657
		(1.234)	(1.239)	(1.268)	(1.251)	(0.598)	(0.601)	(0.908)	(0.896)
Teaching started		6.239***	6.225***	4.444*	5.935***	1.788***	1.733***	4.269**	4.202***
		(1.061)	(1.081)	(2.384)	(1.138)	(0.580)	(0.600)	(1.802)	(0.717)
Teaching continues		-1.091	-0.381	2.202	-0.502	0.292	0.273	0.628	-0.775
		(1.176)	(1.212)	(1.971)	(1.225)	(0.562)	(0.572)	(1.316)	(0.819)
Male	2.350***	1.797***	2.019***	1.248	2.019***	0.451	0.447	1.162**	1.572***
	(0.630)	(0.691)	(0.779)	(0.800)	(0.779)	(0.355)	(0.355)	(0.522)	(0.509)
Swedish	-2.655**	-3.405***	-3.725***	-1.826	-3.724***	-2.003***	-1.969***	-2.730	-1.755**
	(1.093)	(1.207)	(1.282)	(3.196)	(1.293)	(0.575)	(0.582)	(2.365)	(0.892)
Math grade	0.436	0.351	0.476	0.648	0.475	0.290	0.280	0.264	0.195
	(0.358)	(0.389)	(0.453)	(0.480)	(0.452)	(0.209)	(0.207)	(0.305)	(0.291)
Average grade	3.580***	3.648***	3.578***	3.778***	3.578***	0.949***	0.961***	2.739***	2.618***
	(0.555)	(0.598)	(0.659)	(0.726)	(0.656)	(0.308)	(0.305)	(0.464)	(0.446)
Talks about money	2.424***	2.360***	2.182***	2.022***	2.182***	1.171***	1.161***	0.922*	1.021**

	(0.605)	(0.650)	(0.741)	(0.735)	(0.751)	(0.345)	(0.349)	(0.473)	(0.479)
Bank account	1.832**	1.242	0.076	0.544	0.076	0.267	0.253	0.079	-0.177
	(0.738)	(0.761)	(0.782)	(0.833)	(0.780)	(0.370)	(0.369)	(0.546)	(0.519)
Pocket money	0.498	0.436	0.498	0.528	0.498	0.137	0.136	0.337	0.362
	(0.583)	(0.649)	(0.723)	(0.746)	(0.724)	(0.333)	(0.334)	(0.488)	(0.472)
Over 100 books	0.678	0.721	0.274	0.157	0.274	0.331	0.342	-0.128	-0.067
	(0.585)	(0.643)	(0.748)	(0.769)	(0.754)	(0.345)	(0.347)	(0.502)	(0.497)
Parent's financial			0.835*	0.565	0.834*	0.527**	0.513**	0.195	0.321
			(0.440)	(0.456)	(0.449)	(0.215)	(0.218)	(0.294)	(0.290)
Constant	-4.675	-4.274	-4.970	-11.517**	-4.871	3.425*	3.457*	-9.212**	-8.328***
	(3.472)	(3.626)	(3.972)	(5.295)	(3.979)	(1.975)	(1.982)	(3.580)	(2.537)
School dummies					x				
Observations	1280	1000	752	752	752	752	752	752	752
Adjusted R-squared	0.199	0.213	0.232	0.270	0.231	0.139	0.139	0.287	0.249

Notes. * $p<0.10$, ** $p<0.05$, *** $p<0.01$

Appendix. Student and parental survey questions (examples)

Knowledge questions:

(correct responses in bold)

A person who is 15 years old can independently sign a work contract (in Finland)

Correct / incorrect / do not know

You can pay with debit card only in your home country (in Finland)

Correct / **incorrect** / do not know

You can effectively manage investments risks by investing as much as possible into a single asset.

Correct / **incorrect** / do not know

Home insurance is a mandatory insurance.

Correct / **incorrect** / do not know

In a market economy buyers and sellers decide, what is produced in the economy.

Correct / incorrect / do not know

Parental survey:

Assume that you have 100 euros in a savings account with 2% annual interest rate. You do not put any money into account, nor do withdraw any

money. How much do you have in your account after five years?

a) 102 euro
b) **More than 102 euro**
c) Less than 102 euro
d) do not know

Assume that there is 1% interest paid on the savings account and inflation is 2% annually. After one year, can you buy with this money

a) the same amount as today
b) more than today
c) **Less than today**
d) Do not know

Buying shares in one company is less risky than buying shares in a mutual fund that invest in company stock.

a) correct
b) **incorrect**
c) do not know