The effect of financial education on students' consumer choices: Evidence from a randomized experiment

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ABSTRACT

Financial education is often considered to be a necessary condition in order to stimulate better consumer choices. We investigate this claim by analyzing the impact of a financial education course on consumer choices made by 688 students of the 8th and 9th grade. We combine a randomized controlled trial with a discrete choice experiment to analyze how financial education and other critical factors of a purchase decision like price, credit availability, information on product quality, and promotion affect consumer decisions at a young age. We find that students favor purchase options with free gifts and positive consumer reviews. They also prefer cash payments over credit. However, we do not find evidence that this behavior is triggered by financial education. Financial education does not automatically result in better consumer choices, even if the financial education course increased students' financial literacy.

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1. Introduction

Individuals are more and more responsible for making financial decisions that determine their well-being. Consequently, financial literacy is considered to be a key competence. Financial literacy positively affects household decisions such as household consumption (Dinkova et al., 2018), savings decisions (Babiarz and Robb, 2014), credit management (Disney and Gathergood, 2013), and retirement planning (van Rooij et al., 2012). Taking sound financial decisions has become increasingly complicated given that the information environment in which individuals have to make financial decisions has become more complex.

International surveys indicate that many adults and young people have low financial literacy levels (Klapper et al., 2015; OECD, 2016, 2017). Financial education has been considered as a means to eradicate financial illiteracy and improve financial well-being. These financial education initiatives range from school-based courses (e.g. Batty et al., 2015; Bover et al., 2018; Bruhn et al., 2016; Frisancho, 2020; Lührmann et al., 2015) to initiatives outside the school context (e.g. Berg and Zia, 2017;

Bruhn et al., 2014; Collins, 2013). Many of these initiatives focus on improving financial knowledge or stimulating positive financial behaviors (e.g., saving, responsible debt management, …). However, the extent to which financial education programs lead to better consumer choices[1] is largely overlooked, despite the implications of such decisions on disposable income, savings and possibly indebtedness.

According to consumer theory, consumption decisions are driven by utility maximization based on consumer preferences and their budget constraint (Mas-Colell and Whinston, 1995). Several underlying mechanisms are at play here. The price of a product matters given that a lower price increases the likelihood that a consumer will buy a particular good. The decision to buy is also affected by the availability of credit. The budget constraint can be temporarily alleviated if consumers can buy on credit. Consumers also consider information regarding the quality of the product provided that consumers can only maximize their utility if they are well-informed about the expected utility of a product. In addition, consumers' decisions are influenced by prevailing promotions. Promotions in the form of gifts, for instance, may not only increase the value of a product but could also lead to impulsive buying behavior.

Despite De Beckker et al. (2020), who show that financial literacy might have a heterogeneous impact on the underlying mechanism of consumer decisions, there is little conclusive evidence concerning the impact of financial education on consumer decisions. However, in the academic literature (Fernandes et al., 2014; Kaiser and Menkhoff, 2017; Kaiser et al., 2020) and in policy documents (e.g. OECD, 2015; U.S. Congress 2010) it is often implied that general financial literacy education will alter the choices that people make. It is exactly this claim that the present paper examines.

This paper contributes to the existing literature by examining how financial education impacts the way individuals assess critical aspects of consumers' choices, such as price, credit availability, information regarding the product's quality and promotional offers. More specifically, we investigate whether financial education influences the price elasticity of consumers. Further, we test whether financial education makes consumers less susceptible to promotions and more attentive to the costs of consumer credit or the quality of a product. We use a randomized controlled trial (RCT) combined with a discrete choice experiment (DCE) to estimate the causal effect of financial education on consumer choices and reveal the underlying mechanism in these choices[2].

In the DCE, we ask students to make a hypothetical[3] choice between two products. In particular, students have to choose between two smartphones with identical technical characteristics. However, the two choice sets differ with respect to price, credit availability, information about the quality of the product and the availability of a promotion (free gift). To illustrate, students have to trade off a product with a low price and no information on the quality with a more expensive product that has received many positive quality reviews.

Although all students fill out the DCE questions, using a RCT, the experiment is conducted by providing an intensive four-hours financial literacy course to only a random sample of classes of the 8th and 9th grade in Flemish schools[4]. The classes from the control and treatment group were recruited through an open call on a government platform. The course material focused on general concepts in financial literacy education, including saving and investing. At the end of the course students were expected to be more knowledgeable about financial concepts (like interest and inflation); to be able to draw up a budget to plan regular spending and saving. Furthermore, students were expected to better understand the benefits of saving for long-term goals or to cover unexpected expenses. In addition, they were expected to be more knowledgeable about the characteristics of certain savings and investment products.

The results of the paper imply that the financial literacy course was an effective tool as it increased students' financial literacy scores by 0.46 standard deviations (SD). However, this effect did not trickle down to the decision-making process. The improved financial literacy did not significantly affect the choices that students made.

The paper is structured in the following manner. Section 2 provides a brief overview on financial education for youth. Section 3 explains the research design and methodology. Section 4 goes into more detail on the data. Section 5 discusses the results and Section 6 concludes.

2. Literature and context

2.1. Financial education for youth

In recent years, an increasing number of countries has developed and implemented a national strategy for financial education (OECD, 2015). The focus hereby is often on school-based financial education initiatives which targeted youth. Multiple reasons have justified the reason for focusing on youth. Firstly, the youth financial literacy level is low (Lusardi et al., 2010).

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[1] In this paper, we define better consumer choices as decisions in which consumers show a higher price sensitivity, more prudent credit behaviour (i.e. lower likelihood to buy on credit), more informed decisions (i.e. taking into account positive and negative reviews in the buying decision), and a lower likelihood to be seduced by promotions.

[2] DCE is a well-stablished and popular technique to reveal behavioural choices (Lancsar et al., 2017; Lancsar and Louviere, 2008).

[3] Although the choices in a DCE are hypothetical, definitely at the studied age group, this is the second best to reveal actual buying behavior.

[4] Participation in the experiment is based on self-selection at teacher level (i.e. interested teachers voluntarily subscribe their class), which might result in upper bound estimates for the non-participating schools. However, within the group of participating and eligible schools, we randomly assigned schools to the control and treatment group. This guarantees a high internal validity of the results and allows us to interpret the results in a causal way. Table 1 provides basic descriptive statistics which show only few significant differences between control and treatment groups. In addition, student and school characteristics were included as controls in our analysis, whenever possible.

Secondly, attitudes towards financial decisions, namely shopping and saving are formed at a young age and mistakes at young age may have cumulative effects throughout one's life (Lusardi et al., 2017). Lastly, integrating financial literacy in the school curriculum has a significant advantage, that is, all groups in society are covered, including those from a lower socio-economic status (low SES) (Hastings et al., 2013)[5].

The effectiveness of financial education is widely debated. Some researchers emphasize the positive effects of financial education programs (e.g. Fox et al., 2005) while others highlight the high cost joined with effective financial education (e.g. Willis, 2011). Considering the meta-studies that quantitatively examine the effect of different financial education interventions, we come to the following conclusions. First, financial education seems to achieve its goal of increasing financial literacy. Kaiser and Menkhoff (2017) evaluate 126 impact evaluation studies and find that financial education has a strong and positive impact on financial knowledge with an effect size of 0.26 SD. However, the effect on financial behavior is somewhat smaller with an effect size of 0.09 SD. Second, the impact of financial education on financial behavior depends on the type of financial behavior targeted. Miller et al. (2015) indicate that borrowing behavior is much more difficult to change through traditional financial education than saving behavior. Third, the size of the effect of financial education on financial knowledge and financial behavior is significantly dependent on the research design. The effects for correlation studies are significantly higher than those of more rigorous experimental designs such as randomized controlled trials (RCT) (Fernandes et al., 2014; Kaiser and Menkhoff, 2017; Miller et al., 2015). As indicated by Duflo et al. (2006), true random experiments (i.e. RCT) are more reliable than correlation studies as they do not suffer from self-selection bias. The randomization guarantees that we can look directly at that outcomes, as both treated and untreated students will be equal in expectation (Rubin, 1974).

Randomized evaluations of school-based financial education programs document some improvements in financial knowledge (Bover et al., 2018; Bruhn et al., 2016; Iterbeke et al., 2020; Maldonado et al., 2021), credit behavior (Frisancho, 2020), budgeting behavior (Bruhn et al., 2016), and saving behavior (Berry et al., 2018; Bover et al., 2018; Bruhn et al., 2016).

In sum, financial education at school is observed to be effective in enhancing financial knowledge along with financial behaviors which includes credit behavior, budgeting behavior and saving behavior. Until now, despite the common assumption in the relevant literature (e.g. OECD, 2015), no evidence is available on whether financial education has a direct impact on consumer decisions. Nevertheless, previous studies have suggested a potential indirect link between financial literacy and some of the underlying mechanisms of consumer decisions such as price, credit availability, information about the quality of the product, and the availability of a promotion (free gift). For instance, with respect to price changes there is evidence that individuals with a higher level of financial literacy are more price sensitive as they compare prices of different products more often (OECD, 2016). Financial literacy also has an effect on the use of credit. Higher levels of financial literacy are not only related with lower use of credit (Lusardi and Tufano, 2015) but also with a lower cost of credit (Disney and Gathergood, 2013). In other words, individuals with a higher level of financial literacy will probably be more reluctant to buy a good on credit compared to less literate persons. Moreover, more literate individuals tend to more carefully consider all relevant information (OECD, 2016). In the same respect there might be differences in how the inclusion of a free gift relates to the likelihood that an individual buys a good. For consumers with lower levels of financial literacy, the inclusion of free gifts may even contribute to impulsive buying (Lam and Lam, 2017).

2.2. School context and curriculum

This paper focuses on secondary schools in Flanders, the Northern region of Belgium. The schools in Flanders belong to one of three educational networks: the official educational network organized by the Flemish community, the government-aided public education organized by municipal and provincial authorities; and subsidized private schools (mainly Catholic schools). The majority of the schools in Flanders belong to the latter network.

Secondary education is organized for students between 12 and 18 years. The curriculum is divided into three stages and each stage consists of two grades. The first grade is characterized by a common curriculum. After the second grade (equivalent to grade 8 in the US) students are split over four study tracks: (1) academic, (2) technical, (3) vocational, and (4) artistic[6]. While the academic track prepares students for higher academic education, the other options focus more on technical skills in order to prepare students for professional higher education or the labor market.

3. Method

3.1. Research design

We use a randomized controlled trial (RCT) to measure the causal effects of financial education on students' consumer decisions. The outcomes of interest are measured by a discrete choice experiment (DCE). The DCE measures students' pref-

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[5] This is particularly relevant as children from families with a higher socio economic status (SES) are more exposed to financial literacy at home. Luhr (2018) for instance indicate that working class parents often feel unequipped to teach financial skills and shelter their children from financial matters. This is in line with findings of Lusardi et al. (2010) who showed that parents' education level is positively related with children's level of financial literacy.

[6] Officially students are split into tracks at the start of the ninth year. However, in the eighth grade students already have to choose some elective courses that prepare for a particular track.

	June-August	First half Sept.	Second half Sept.	Oct.-Nov.	End Nov.
Treatment schools	Registration of schools	Randomization to treatment condition	Pre-test	4-hour financial education course	Post-test
Control schools	Registration of schools	Randomization to control condition	Pre-test		Post-test

Fig. 1. Timeline of the experiment.

erences on hypothetical consumer choices, while the RCT provides insights in how a financial education course affects students' financial literacy levels and their consumer choices.

To avoid contamination effects among classes in the same school, the randomization is performed at school level. Hence, schools in the treated group provide financial education based on material they receive during the experiment while control schools do not (See Section 3.2 for details on the financial education material).

Schools are recruited through an open call in June 2018 via the Belgian government financial literacy agency (Wikifin.be). Schools are randomly assigned to a treatment and control group by using a stratified randomization procedure[7]. Fig. 1 provides an overview of the timeline of the experiment. In order to evaluate the effectiveness of the course and to assess the buying behavior, students take two tests. Before the intervention, students of the treatment and control group complete a pre-test that measures their base levels of financial literacy. Next, students in the treatment group follow the 4 h financial education course in the period October-November 2018. Afterwards, they take a post-test to determine their financial literacy level and take part in the DCE to assess their consumer choice preferences. A similar post-test and DCE was taken by the control group.

In the baseline survey socio-economic data of the students is collected. This includes information on students' gender, age, home language, self-reported scores on Dutch and math in the previous term, and the number of times a student travels. The latter is a proxy for socio-economic status (SES). We complement the student's characteristics with school-specific characteristics such as the type of school (private or publicly funded schools) and the grade and track of students. Financial literacy is measured by a multiple choice test consisting of ten questions[8] covering the calculation of monthly savings (Q1), understanding of inflation (Q2), relationship between interest and inflation (Q3), compounded interest calculation (Q4), relationship between risk and return (Q5 and Q6), careful bank card use (Q7), reliability of information (Q8), and saving strategies (Q9 and Q10). Part of the questionnaire is based on traditional financial literacy questions drawn from Lusardi et al. (2010). Other questions are inspired by sample questions of the PISA studies on financial literacy (OECD, 2014; 2017). The PISA questionnaire focuses on students aged 15 years, which closely resembles the respondents in our study.

3.2. Intervention

The financial education course evaluated in the experiment is not integrated in other courses but developed as a separate course that schools can give during the non-mandatory part of the curriculum. The financial education material is developed by senior secondary school teachers of the research team and is designed as an online learning path for eight and nine graders. The online learning environment minimizes the role of teachers and is chosen to avoid that (differences in) interventions of teachers would influence the results of our experiment. Specifically, teachers only give a short introduction at the start in which they explain the purpose of the course and the learning path.

The average age of students in our sample is 13 years, which is also the age at which most Flemish teenagers receive their first pocket money (Wikifin.be, 2016). It thus marks the age at which they can make their first consumer decisions that are paid by their own money.

The course deals with budgetary choices in everyday life. Afterwards, students are expected to be familiar with concepts like interest and inflation, have insight in different saving and investment products, understand the benefits of saving for long-term goals or unanticipated expenses, and grasp the risks of credit. The learning path consists of five modules with multiple exercises, information sheets and a formative test. The exercises contain videos, interactive learning games, and case studies adapted to the living environment of students from the eighth and ninth grade. Each set of exercises is followed by

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[7] The stratified randomization improves the balance between treatment and control condition on certain characteristics such as educational network (private or public), grades, school size, and education tracks offered.

[8] The exact questions can be found in Appendix A. As the answers on the questions might also be time and context specific, we would like to note that the questions have been pre-tested by a team of secondary school teachers. They revised and tested the questions in their class.

Attribute	Level
Cash price	€300
	€325
	€350
Credit availability	Cash payment
	Payment plan (instead of paying the cash price you pay 5% of the cash price for the next 24 months)
Information	No reviews available
	Positive reviews
	Negative reviews
Promotion	No gifts
	Free gift (a pair of earsets with market value €20)

Fig. 2. Description of attributes and their levels.

an information sheet that summarizes the learning material in the specific module. Finally, a formative test is provided to check whether the student has reached the learning goals. During the learning path the students receive immediate online feedback and extra information, if necessary[9].

3.3. Discrete choice experiment

The DCE aims to elicit purchase preferences[10]. Students are asked to assume that they intend to buy a new smartphone. Students are then presented with different alternative purchase options (i.e. alternatives) that differ with respect to several purchasing conditions (i.e. attributes) like price, credit availability, product reviews, and promotional activities.[11] More specifically, students are presented with various choice sets in which they can choose between two purchase options, or, alternatively choose to opt-out. The purchase options and the specific levels of the attributes vary over choice sets in the experimental design (see Fig. 2) and can be summarized as follows:

1. **Price**: The price ranges from €300 to €350 with intervals of €25.
2. **Credit availability**: Students have to choose a smartphone that differs in terms of payment. Some alternatives contain a (direct) cash payment, others offer a payment plan that requires paying 5% of the cash price during 24 months. The latter thus temporarily relieves the (current) budget constraint, but includes some cost of credit.
3. **Information**: This attribute includes three levels: no (online) reviews available, mainly positive (online) reviews, or mainly negative reviews. This attribute provides the student with some information on the quality of the product.
4. **Promotion**: This attribute has two levels: no gifts or a free gift in the form of a pair of earsets with a market value of €20.

The research design implies that there are 36 possible alternatives and 630 unique choice sets[12]. Presenting students with all possible choices (full factorial design) is almost impossible and would lead to answering fatigue. Hence, it is better to follow a fractional factorial design in which only a selected number of combinations is presented to students. In order to reduce the number of choice sets to a manageable amount we apply a statistically efficient design called D-efficient. This technique generates a number of choice sets that satisfies the following criteria: (1) orthogonality (minimal correlation between different attribute levels); (2) level balance (each attribute level should appear approximately an equal number of times in the DCE); and (3) minimal overlap (minimal repetition of attribute levels across alternatives within a choice set). The chosen method provides minimal variation around the parameter estimates by minimizing the estimated standard errors. This results in a research design with two blocks and each containing 5 choice cards. Each student was randomly presented with one of the two blocks. Fig. 3 presents an example of a choice card.

3.4. Empirical specification

In line with previous RCT literature, we first estimate the impact of the financial education course. In a standard RCT, the impact of the financial education course on financial literacy levels of students is obtained from comparing the mean finan-

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[9] Previous research showed that the learning effect of feedback is stronger when provided immediately (Van der Kleij, et al., 2015).

[10] For more information on the setup of a discrete choice experiment and its analysis we refer to Lancsar et al., (2017) and Lancsar and Louviere (2008).

[11] At the start of the experiment we ask the participants to imagine that they are contemplating the purchase of a smartphone and that they are considering two smartphones that have identical technical characteristics. However, the purchasing conditions are different. Although different students might have different smartphones in mind, in general, a student will consider smartphones based on the technical functionalities he or she values (Instagram adepts would select phones with excellent cameras, etc), so this implies that the smartphones a specific student has in mind during the experiment would have more or less the same technical characteristics.

[12] In our experiment there are 2 attributes with 2 levels and 2 attributes with 3 levels. The number of possible alternatives is calculated as follows: 2^2 x 3^2 = 36. With 36 unique alternatives and each choice set including two alternatives, there would be [(36 x 35)/2] = 630 unique choice sets.

	Option A	Option B
Imagine that you want to buy a new smartphone. Based on technical characteristics you have selected two devices which seem interesting to you. In what follows you will get different choice sets with two options. The devices differ with respect to price, credit availability, information on the quality of the product, and promotion. For each of the choice sets, please select which of the two options you prefer ("Option A" or "Option B"). Alternatively, if you are not satisfied with either of the two options, please select "neither of these options". There are no wrong answers, answer every question based on your personal preferences.		
Cash price	€325	€350
Credit availability	Cash Payment	Instead of paying the cash price you pay €17 for the next 24 months
Information	No reviews available	Positive reviews
Promotion	Free gift (pair of earsets with market value €20)	No gifts
Which option do you prefer? • Option A • Option B • Neither of these options		

Fig. 3. Example of a choice card.

cial literacy score of the treatment group to the mean scores of the control group (e.g. Bruhn et al., 2016; Lührmann et al., 2015). Therefore, we estimate the following intent-to-treat (ITT) OLS regression:

$$y_{is}^1 = \alpha + \beta_1 Treatment_{is} + \beta_2 y_{is}^0 + \beta_3' \sum S_s + \beta_4' \sum X_i + \varepsilon_{is} \qquad (1)$$

where y_{is}^1 represent the standardized post-test score of student i in school s, $Treatment_{is}$ indicates whether a student i in school s is assigned to the control or the treatment group; y_{is}^0 denotes the pre-test score for student i in school s; S_s refers to school characteristics for school s (e.g. private or public school, fraction of 8th grade students, study track) and X_i represents individual characteristics of student i (e.g. gender, age, native speaker[13], Dutch and math grade, and socio-economic status). We cluster standard errors at school level to capture potential spill-over effects within schools.

Further, we examine the impact of the financial education course on students' consumer decisions (i.e. examine how people make choices and what characteristics (attributes) matter in this choice). In the DCE, students are assumed to choose their preferred option, i.e. the consumption bundle that provides them the highest utility. Utility is derived from the attributes of each bundle. Alternatively, students can opt out if none of the options is satisfactory. By varying the choices that students can make (i.e. the levels of the attributes in the choice sets) we can estimate the effect of each attribute level on the probability that a bundle is chosen. To examine the causal impact of financial education on students' consumer decisions, we introduce interaction terms between the treatment indicator (i.e. randomly assigned to the financial education course or not) and each attribute. The DCE combined with the treatment dummy from the RCT experiment can be specified as follows:

$$U_{ijt} = \beta_i' A_{ijt} + Treatment * (\beta_i' A_{ijt}) + ASC + \varepsilon_{ijt} \qquad (2)$$

where U_{ijt} is the utility of student i from alternative j in choice task t, A_{ijt} is a vector of attributes that relates to the chosen alternative, β_i is unobserved for each i and varies in the population with density $f(\beta)$, ASC represents the attribute fixed effects and captures the effect of unobserved factors for each of the alternatives and ε_{ijt} is an unobserved random term that is independent and identically distributed (IID) extreme value over choice situations, students, and alternatives. To account for potential spill-over effects, we cluster the standard errors at school level. The reference group for each attribute corresponds to €300, cash payment, no reviews and no gifts. The reference group for *Treatment* is the control group composed of students who did not receive financial education.

A positive sign for the coefficient β_i indicates that the attribute has a positive influence in the decision of a student to choose a certain bundle. The reverse is true for a negative sign. The higher the coefficient, the more important the effect of this attribute. The interaction between *Treatment* and β_i provides evidence for a causal impact of financial education on students' choices. Significant coefficients for these interactions suggest that the treatment, i.e. the financial education course, is able to change the importance of attributes in the choice for a certain bundle. The data from the DCE are analyzed through a mixed logit model, which allows for random heterogeneity among students (contrary to traditional conditional logit models developed by McFadden (1974)). The calculated standard deviations of the mean coefficients provide information on the extent to which students' preferences for certain attributes differ.

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[13] Dutch is the native language in Flanders.

Table 1
Descriptive statistics.

	Control		Treatment		*p*-value
Number of schools	10		10		
Number of students	329		358		
Number of classes	29		37		
Private education	0.75		0.98		0.020
Fraction of 8th grade students	0.55		0.59		0.845
Share by track					
Academic	310	(0.94)	190	(0.53)	
Technical	19	(0.06)	125	(0.35)	0.011
Vocational	0	(0.00)	44	(0.12)	
Student characteristics					
Gender (female)	0.52		0.45		0.435
Age (year)	13.35	(0.79)	13.67	(0.82)	0.113
Language (Dutch)	0.91		0.85		0.168
Dutch grade (5)	3.92	(0.83)	3.69	(0.87)	0.071
Math grade (5)	3.74	(1.03)	3.33	(1.12)	0.029
Socio-economic status (4)	3.04	(0.92)	2.79	(1.04)	0.015
Financial literacy					
Pre-test financial literacy (10)	4.81	(0.09)	4.46	(0.10)	0.213
Post-test financial literacy (10)	4.83	(0.10)	5.38	(0.10)	0.121

Note: Standard errors are reported in parentheses with the exception of the track where relative values of the total share are given. Private education represents the share of students in our sample of private (mainly catholic) schools. In grade 8, students have to choose a preparatory track which we assign to one of the three tracks. Gender represents the relative share of girls in our sample. Age represents the average age of the participating students. Dutch is a dummy which indicates whether a student speaks Dutch at home or not. Dutch and math grade refer to the results of the previous year. These are self-reported and measured as a five-point Likert scale in five categories: $< 50\%$, 50–60%, 60–70%, 70–80%, $>80\%$. We proxy socio-economic status by the number of travels abroad in the past year: (0, 1, 2, >2). The financial literacy score is based on a set of 10 questions (see Appendix A for more details). The value for financial literacy in this table is a raw score ranging between 0 and 10. The p-value refers to an OLS regression where the characteristic is regressed on a treatment indicator with standard errors clustered at school level.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4. Data

4.1. Descriptive statistics

Table 1 presents the descriptive statistics for schools and students before any treatment takes place. The final sample consists of 688 students from 20 schools, covering 66 classes. To test for differences between control and treatment groups, we present the p-value of the socio-economic characteristic on the treatment indicator based on a regression with standard errors clustered at school level in the last column of Table 1.

Given that certain school and students' socio-economic characteristics are not always balanced between control and treatment group we control for these observed characteristics in the intent-to-treat estimation later on in the results section. These differences are not surprising as the randomization was done at school level and the Flemish education system is characterized by high inequalities. Overall, students are, on average, 13 years old and the sample is balanced with respect to gender. The majority of the students speak Dutch, which is the language in which the education is given. Half of the students are 8th graders. There are no significant differences between control and treatment group in terms of these characteristics.

The most important differences between control and treatment group can be summarized as follows. First, the number of students who attend private education is lower in the control group than in the treatment group. Second, 94% of the students in the control group follow the academic track, compared with 53% in the treatment group. Nevertheless, the academic track is the dominant track in the treatment and control group. Third, students in the control group score themselves significantly higher regarding their knowledge of Dutch and math than students in the treatment group. In view of the lack of standardized exams in Flemish education, we ask students to provide a self-assessment of their language (Dutch) and math skills on a 5-point scale. Fourth, students in the control group belong to a somewhat higher socio-economic status group. We proxy socio-economic status by the number of times a student has travelled abroad during the last year[14].

We observe that the overall financial literacy level at baseline is low with an average score of 4.63 out of 10.[15] For the post-treatment test, we note that students in the treatment group, in contrast to students in the control group, improve and obtain a higher financial literacy score than observed at baseline[16]. This supports the assumption that financial literacy can be improved through financial education.

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[14] It has been shown by Maldonado et al., 2021 that this variable serves as a good proxy for socio-economic status (SES) of students.

[15] The averages mentioned in this paragraph are calculated for the entire sample of students. The entire sample consists of a combination of 329 students from the control and 359 students from the treatment group.

[16] Given the test is a low-stakes test, there is little to no incentive for students to cheat on the test, or for teachers to teach to the test. Moreover, we believe that the change in test scores for the control group between the pre-test and the post-test is marginal, provides evidence that students did not recall the exact answers and that there is no learning effect from the test itself.

Table 2
Intent-to-treat analysis.

	Financial literacy	
Treatment	0.378**	0.459**
	(0.134)	(0.162)
Pre-test financial literacy	0.422***	0.336*** (0.031)
	(0.026)	
Controls	No	Yes
Observations	20,640	20,640
R^2	0.198	0.256

Note: Financial literacy score is standardized with mean 0 and standard deviation of 1. Estimates are the result of an intent-to-treat (ITT) OLS regression of specification (1). Standard errors clustered at school level are reported in parentheses. Controls: type of school, grade, track, gender, age, home language, Dutch grade, math grade, socio-economic status (SES).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4.2. Attrition

This section discusses the occurrence of attrition at various stages and its importance. Fig. B1 in Appendix shows that attrition happened before the pre-test as well as before the post-test. At randomization, teachers from 24 schools registered. After randomization, 1175 students took part in the pre-test (595 in the control group and 580 in the treatment group). From those students, 687 students also took the post-test (329 in the control group and 359 in the treatment group).

We test the internal validity of our experiment through two analyses. First, we check whether there is selective-attrition or in other words a tendency that some students are more likely to drop out between pre- and post-test than others. We check for selective-attrition by regressing an attrition indicator (dummy indicating whether there are missing observations) on a treatment indicator and controls. The results presented in Table B1 in Appendix, suggest that there is no selective-attrition. Second, we check for significant differences in socio-economic characteristics between complying (students who filled in both the pre- as well as the post-test) and non-complying students (students who filled in the pre-test, but did not participated in the post-test) in each condition. The results, presented in Table B2 in Appendix, do not show significant differences between compliers and non-compliers, except for language spoken at home and private education in the treatment condition.

5. Results

5.1. Effect of the financial education course

We start by estimating the impact of the financial education course. Table 2 shows the intent-to-treat estimates for financial literacy. We estimate the model as specified by Eq. (1). The regression in the first column includes only the treatment dummy and the pre-treatment value of the outcome. The regression in the second column additionally controls for several school and student characteristics (i.e. type of school, grade, track, gender, age, home language, Dutch grade, math grade and SES).

The results provide evidence that the financial education course is effective. Controlling for all observed heterogeneity in terms of school and student characteristics, the financial education course increases students' financial literacy scores by 0.46 standard deviations on average[17]. The relatively large magnitude of this effect is probably due to the fact that the post-test is taken immediately after the end of the financial education course. As reported in the meta-analysis on the impact of school financial education that was carried out by Kaiser and Menkhoff (2020), a longer delay between the financial education and the measurement of the outcome would probably have led to a lower impact. If they focus only on the effects immediately (up till one month) after treatment they observe an impact of 0.43 SD on financial knowledge, which decays to 0.12 SD after 12 months[18]. This observation is in line with one of the conclusions of Fernandes et al. (2014) who state that learning effects typically depreciate over time because people do not always remember what they have learnt.

5.2. Financial education and consumer choices

In this section, we analyze the impact of financial education on consumer choices. Table 3 presents the results of the mixed logit model as specified by Eq. (2). First, consider the effect of the baseline attributes (i.e., without the interaction

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[17] As a robustness check we re-estimate specification (1) but exclude questions 2, 8 and 9 from our financial literacy score. The results are similar as our original findings. More details can be found in Table C1 in Appendix.

[18] The estimated effect is significant up to 3 months after treatment. The long run effects (more than 12 months) are positive but less certain. However, it should be noted that there are also less studies that focus on long run effects which has an impact on its significance.

Table 3

Estimates from mixed logit model.

ATTRIBUTES	Mean	SE	SD
Cash price	−0.002	(0.003)	
Credit availability (ref: cash payment)			
Payment plan	−0.603***	(0.177)	[1.323***]
Information (ref: no reviews available)			
Positive reviews	1.409***	(0.191)	[0.733***]
Negative reviews	−1.070***	(0.290)	[1.728***]
Promotion (ref: no gifts)			
Free gift	0.750***	(0.154)	[−0.617***]
ASC	1.129	(0.974)	
ATTRIBUTES * TREATMENT			
Cash price * Treatment	0.0004	(0.001)	
Payment term (ref: cash payment)			
Payment plan * Treatment	0.065	(0.334)	[0.911***]
Information (ref: no reviews available)			
Positive reviews * Treatment	0.048	(0.226)	[−1.056***]
Negative reviews * Treatment	0.204	(0.337)	[0.817**]
Promotion (ref: no gifts)			
Free gift * Treatment	−0.182	(0.220)	[0.942***]
No. of observations	10,320		
No. of respondents	688		

Note: Estimates are the result of mixed-logit regression of specification (2). Treatment is a dummy variable which equals 1 if a student has received the financial education course. Standard errors clustered at school level are reported in parentheses. Standard deviations are in brackets. While the standard errors provide information on estimate uncertainty, the calculated standard deviations indicate the extent to which students' preferences for certain attributes differ.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

with the treatment dummy)[19]. We observe that students value the information provided by other consumers in the form of online reviews. Positive reviews result in a higher likelihood of choosing a specific option, while the reverse is true for negative reviews. Moreover, students seem sensitive towards promotions, as they are more likely to choose the option that includes a free gift. Finally, students account for the cost of credit and prefer cash payment above a payment plan. No significant effect is found for price. Although this suggests that students are price inelastic, at least over the price interval considered in the experiment, this finding can be partially explained by the fact that students strongly prefer to have a smartphone at that age, making the price less relevant. Alternatively, price differences may also be seen as a signal for quality differences or a compensation for small differences in the underlying features of the smartphone. The latter could contribute to an insignificant impact[20].

Next, we consider the effect of the financial education course by including the interaction of the treatment dummy with the different attributes[21]. Overall, we observe that the treatment does not affect how attributes like price, credit availability, information on the quality of the product and promotions are valued. This suggests that the financial education course increased students' level of financial literacy but this did not trickle down further: students did not change their buying behavior.

In order to provide some further detail on the size of the impact of the different attributes on consumer choices we run a predictive probability analysis. Table 4 shows how the choice is affected if one of the attributes changes. The baseline offer is defined as a smartphone with a price of €300 that needs to be paid cash, with no reviews available and no gifts included. As already indicated before in Table 3 there is no significant impact of price. In contrast, the impact of online reviews is sizable. Compared to the option where there are no reviews, the probability that a student chooses the option with positive reviews increases with almost 61%. In the case of negative online reviews, the likelihood of choosing the option decreases with almost 49%. Finally, the inclusion of a gift increases the likelihood to buy with almost 36%.

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[19] In the main text we only discuss the average impact of each attribute level. Assuming a normal distribution, mixed logit models provide output (mean and standard deviation (SD)) which allows to calculate the percentage of students for whom a specific attribute level has a positive/negative impact on the preference for a certain choice alternative. If you apply this, you find that 32% of the students prefer a payment plan, while 68% will avoid a payment plan (mean: −0.603; and SD: 1.323). Positive reviews (mean: 1.409; and SD: 0.733) are preferred by 97% of the students and avoided by 3%. Negative reviews (mean: −1.070; SD: 1.728) are avoided by 73.31%, while 26.79% are not scared off by negative reviews. Free gifts (mean: 0.750; SD: −0.617) are only a stimulus to buy the product for 11.21%, while 89% will not take this into account as an added value.

[20] We would like to thank the reviewer for raising this point. Further research might investigate the impact of price changes with respect to perceptions in quality.

[21] We acknowledge that the choice of students and their preferences for certain attributes might as well be influenced by their time preferences, their current budget, their need of a smartphone, and whether they already have earsets at home. In this experimental setting we did not collect data on these potential extra controls. However, we believe that thanks to the randomization of students the characteristics are randomly distributed among control and treatment group. Hence, it will have no impact on the main outcome that the financial education course has only an impact on financial literacy and not on consumer decisions.

Table 4
Predictive probability analysis.

	Change in choice probability
Cash price	
325	−2.09%
	(−8.23%; 4.05%)
350	−4.19%
	(−1.65%; 8.08%)
Credit availability	
Payment plan	−29.28%***
	(−45.16%; −13.40%)
Information	
Positive reviews	60.73%***
	(48.92%; 72.53%)
Negative reviews	−48.92%***
	(−70.58; −27.27%)
Promotion	
Free gift	35.84%***
	(22.68%; 49.00%)
ATTRIBUTES * TREATMENT	
Cash price	
325 * Treatment	0.05%
	(−2.35%; 3.30%)
350 * Treatment	0.10%
	(−4.69%; 6.60%)
Payment term	
Payment plan * Treatment	3.23%
	(−29.48%; 35.93%)
Information	
Positive reviews * Treatment	2.41%
	(−19.75%; 24.56%)
Negative reviews * Treatment	10.18%
	(−22.47%; 42.82%)
Promotion	
Free gift * Treatment	−9.06%
	(−30.42%; 12.30%)

Note: This table provides information on how the probability of choosing the baseline offer changes when one of the attributes changes. The baseline alternative is defined as: €300, cash payment, no reviews available and no gifts. Confidence Intervals in parenthesis.
$^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

6. Discussion and conclusion

While earlier research on financial education has focused on the impact of a financial education course on financial knowledge or some particular behaviors such as saving, little is known about the impact of financial education on more complex consumer decisions. By combining a randomized controlled trial with a discrete choice experiment we elicit consumer preferences of students and examine whether financial education can affect such choices. We targeted students aged 13 since this is the age at which they make their first independent financial decisions with the pocket money they receive.

Our main conclusions can be summarized as follows. First, we find evidence that the financial education course is successful in increasing students' financial literacy levels with 0.46 standard deviations. Second, our results suggest that the financial education course does not significantly alter students' consumer decisions. From a policy perspective, this does not imply that financial education would not be relevant for better consumer choices. In order to design effective programs, our results however show that programs should account for the fact that traditional classroom financial education does not automatically result in changes in consumer choices. Hence, there is a growing need to complement traditional classroom approaches with more interactive settings like online learning tools targeted towards behavioral change or interactive games that immerse students in different everyday consumer situations in which they have to take financial decisions.

Future research could examine the role of financial literacy in other consumer settings than the one analyzed in the current paper. Moreover, more targeted financial education interventions designed to improve specific (detrimental) consumer behaviors like, for instance, impulsive or compulsive buying behavior would be welcome. In addition, financial education interventions that consider other real-life tasks or that try to simulate real-life conditions even closer would be welcome. For instance, we measure consumer decisions of students by means of a discrete choice experiment, which may be seen as a second-best option, as students take decisions in the absence of a real monetary incentive. Hence, experiments with real monetary incentives could advance our understanding of real-life choice behavior. A final avenue for future research could be to examine how financial literacy and financial education matters in avoiding investment mistakes.

Our results also stimulate critical reflections on consumer decisions taken at a young age. As we know from previous literature (e.g. Grohmann et al., 2015), financial attitudes are rooted in childhood and are often difficult to change at an older age. Hence, further research on fostering positive consumer decisions at a young age is welcome. Moreover, it would be interesting to consider the long run effects of financial education interventions because behavioral changes often take time.

Declaration of Competing Interest

None

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Appendix A: financial literacy questionnaire

1. Suppose you receive €80 pocket money every month. You pay €5 per week for your sports club and €20 per month for your phone subscription. If every month has four weeks, how much money do you have left at the end of the month?
   a. €40
   b. €55
   c. €20
   d. €60
   e. I don't know

2. In five years, I can buy with a bank note of €100:
   a. More than today
   b. Less than today
   c. As much as today
   d. I don't know

3. Suppose you open a savings account and deposit €100. The yearly interest rate on the savings account is 1%. The inflation rate amounts to 2% per year. After one year, you can buy with the amount on your savings account:
   a. More than today
   b. Less than today
   c. As much as today
   d. I don't know

4. Suppose you open a savings account and deposit €100. The yearly interest rate on the savings account is 2%. How much money will be on your savings account in five years, if you do not withdraw or deposit money:
   a. Less than €110
   b. Exactly €110
   c. More than €110
   d. I don't know

5. Suppose your parents give you €100 for your birthday. You can deposit the money on a checking account. Which option will give you the highest return?
   a. Savings account
   b. Checking account
   c. Both options will give the same rate
   d. I don't know

6. Which of the following forms of saving and investment will give you the highest return, but also bears the highest risks of losing your whole investment?
   a. A stock
   b. A savings account at a bank

    c. A government bond
    d. A cash receipt
    e. I don't know

7. What does 'being careful with your bank card' involve?
    a. Entering your credit card details on a secured website of a known and reliable dealer.
    b. Writing your PIN on the back of your debit card
    c. Putting your bank card together with your PIN next to the card reader
    d. I don't know

8. Rank the following sources from most to least neutral (i.e., non-commercial)
    A. *website of the government*
    B. *website of a bank*
    C. *website of private consumer organization or price comparison website*
      a. A B C
      b. A C B
      c. B A C
      d. B C A
      e. C B A
      f. I don't know

9. Suppose you own some money and you expect to need it in the near future. Which option is the most reasonable?
    a. For the time being, you keep the money in your wallet
    b. You deposit the money on your checking account. You use your debit card when you need the money
    c. You put the money safely in your piggy bank
    d. You deposit the money on your savings account
    e. I don't know

10. Christine would like to buy a new bike. As she has no savings and her parents cannot lend her any money, she wants to start saving. However, she does not know how to proceed. What is the best advice you can give her?
    a. Put all your money in a piggy bank
    b. Set up a budget with all your incomes and expenses, calculate how much you can save every month and put the amount on a savings account.
    c. Forget the bike! With your high expenses for clothing you cannot save.
    d. Deposit the money you have left at the end of each month on a savings account.
    e. I don't know

Appendix B: attrition

Table B1
Selective attrition.

Dependent variable	Attrition	
Treatment	−0.0499	−0.1329
	(0.1328)	(0.1624)
Controls	No	Yes
Observations	1139	1139
R^2	0.003	0.043

Note: The estimates in this table are the result of an OLS regression of an attrition indicator (dummy indicating whether there are missing observations between the pre- and the post-test) on a treatment indicator and controls (private school, eight grade, track, gender, age, native Dutch speaker, Dutch score, math score and SES score). Standard errors clustered at school level are reported in parentheses.
    *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table B2
Comparison of compliers and non-compliers.

	Control					Treatment				
	Compliers		Non-compliers		p-value	Compliers		Non-compliers		p-value
Number of students	329		266			358		222		
Private education	0.75		0.73		0.617	0.98		0.94		0.008
Fraction of 8th grade students	0.55		0.73		0.246	0.59		0.49		0.634
Share by track										
Academic	310	94.22	239	89.85		189	52.79	92	41.44	
Technical	19	5.78	8	3.01	0.123	125	34.92	62	27.93	0.114
Vocational	0	0.00	19	7.14		44	12.29	68	30.63	
Student characteristics										
Gender (female)	0.53		0.46		0.294	0.44		0.36		0.099
Age (year)	13.34	(0.04)	13.40	(0.05)	0.728	13.66	(0.04)	13.99	(0.07)	0.163
Language (Dutch)	0.91		0.82		0.332	0.85		0.75		0.019
Dutch grade (5)	3.92	(0.05)	3.98	(0.05)	0.306	3.69	(0.05)	3.53	(0.07)	0.226
Math grade (5)	3.74	(0.06)	3.68	(0.07)	0.735	3.33	(0.06)	3.16	(0.08)	0.538
Socio-economic status (4)	3.04	(0.05)	2.91	(0.06)	0.558	2.78	(0.06)	2.63	(0.08)	0.216
Financial literacy										
Pre-test financial literacy (10)	3.36	(0.08)	3.41	(0.10)	0.193	3.08	(0.08)	3.18	(0.12)	0.705

Note: Standard errors are reported in parentheses with the exception of the track where relative values of the total share are given. Private education represents the share of students in our sample of private (mainly catholic) schools. In grade 8, students have to choose a preparatory track which we assign to one of the three tracks. Gender represents the relative share of girls in our sample. Age represents the average age of the participating students. Dutch is a dummy which indicates whether a student speaks Dutch at home or not. Dutch and math grade refer to the results of the previous year. These are self-reported and measured as a five-point Likert scale in five categories: $< 50\%$, 50–60%, 60–70%, 70–80%, $>80\%$. We proxy socio-economic status by the number of travels abroad in the past year: (0, 1, 2, >2). The financial literacy score is based on a set of 10 questions (see Appendix A for more details). The value for financial literacy in this table is a raw score ranging between 0 and 10. The p-value report to differences between compliers and non-compliers within treatment groups from an OLS regression with standard errors clustered at school level.
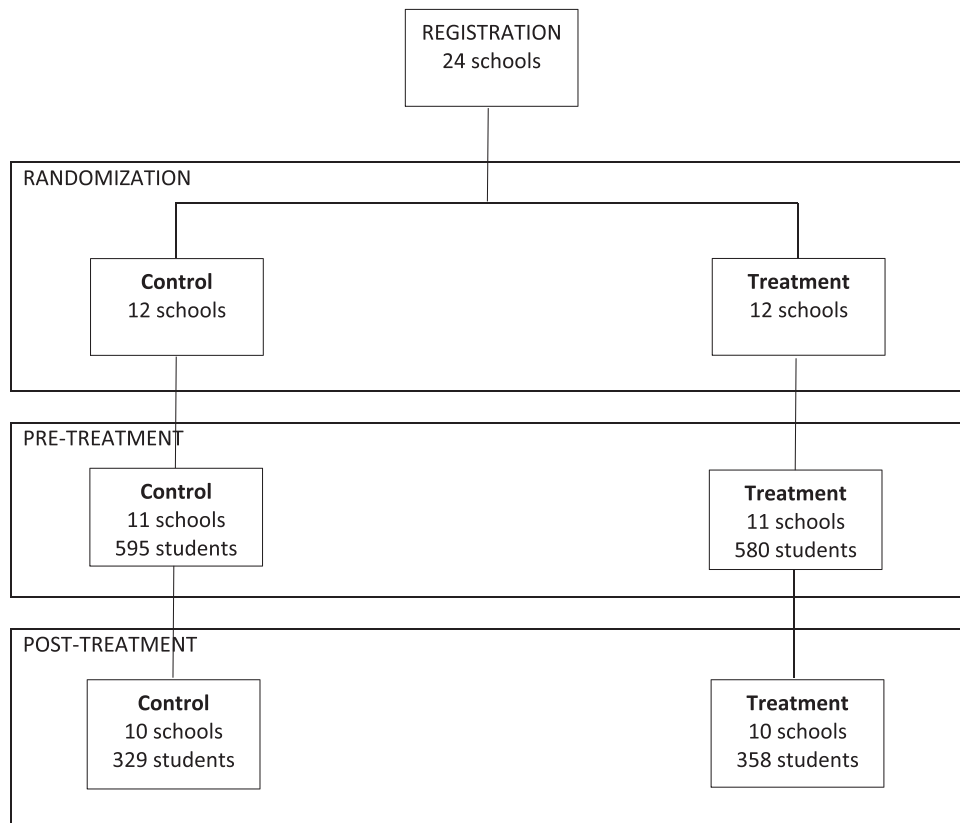*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Fig. B1. *Note:* The control group refers to the subgroup that did not receive any financial education within the period of the experiment. The treatment group refers to the subgroup that was exposed to financial education during the experiment. The numbers of the post-test comprise the students who have completed both pre- and post- test. Students were randomized at school level.

Appendix C: using an alternative financial literacy score

As a robustness check we re-estimate specification (1) but exclude questions 2, 8 and 9 from our financial literacy score. The results are shown in Table C1.

Table C1
Intent-to-treat analysis.

	Financial literacy	
Treatment	0.257**	0.323**
	(0.122)	(0.149)
Pre-test financial literacy	0.360***	0.299*** (0.032)
	(0.032)	
Controls	No	Yes
Observations	20,640	20,640
R^2	0.138	0.177

Note: Financial literacy score is standardized with mean 0 and standard deviation of 1. Estimates are the result of an intent-to-treat (ITT) OLS regression of specification (1). Standard errors clustered at school level are reported in parentheses. Controls: type of school, grade, track, gender, age, home language, Dutch grade, math grade, socio-economic status (SES).
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

These new findings show the robustness of the original findings. In line with the original results, we find that the financial education course is effective. Controlling for all observed heterogeneity in terms of school and student characteristics, the financial education course increases students' financial literacy scores by 0.32 standard deviations, on average. This is somewhat lower than the 0.46 standard deviations found in our original analysis, but in line with evidence in the existing literature.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jebo.2021.06.022.

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