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Do heuristics matter for financial literacy? The impact of better heuristics awareness to financial literacy[☆]

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ABSTRACT

Policymakers are increasingly focused on improving citizens' financial well-being through better financial literacy. Traditional strategies emphasize financial education to boost financial knowledge, while recently behavioural-based education focus on issues like behavioural biases and emotional influences. This paper suggests a randomized controlled-study to assess if financial education including lessons on heuristics (availability and gambler's fallacy) enhances financial literacy. Results showed that traditional financial education significantly improved financial literacy, while adding heuristics had effect close to zero. This suggests expanding curricula to address rules-of-thumb may not necessarily improve financial literacy, challenging the notion that more complex financial education is always beneficial.

1. Introduction

Insufficient financial literacy renders individuals susceptible to make poor financial choices, resulting in adverse consequences, including an accumulation of excessive debt, bankruptcy, and financial instability, perpetuating the cycle of poverty by the absence of knowledge and aptitude required to effectively manage personal finances (Mitchell and Lusardi, 2015). In the absence of financial literacy, individuals may become susceptible to exploitative lending practices, high-interest loans, and fraud, thereby trapping them in a recurring pattern of indebtedness and restraining their financial autonomy (Khan et al., 2022). By lacking the proper financial knowledge in a realm of complex and in-numerous financial instruments, consumers rely on heuristics or rules of thumb, which are mental shortcuts that help them make fast financial decisions, but can also result in errors (Bernheim, 1995; Lusardi and Mitchell, 2014). However, given the increasing complexity of financial products and the amplified attention to provide costumers all relevant information, it becomes fundamental to find effective methods to improve financial literacy and to examine whether pointing individuals to heuristics changes their financial literacy (Lusardi, 2019; Shefrin and Nicols, 2014).

Financial education has emerged as the most effective approach thus far in enhancing financial literacy. Extensive research indicates its positive impact on financial knowledge, and to a lesser extent, on financial behaviour, facilitating financial inclusion (Kaiser et al., 2022; Atkinson and Messy, 2013). However, the long-term effects of financial education on financial outcomes and overall well-being remain uncertain. Existing findings are inconclusive and lack sufficient evidence to establish causal relationships (Kaiser et al., 2022; Willis, 2011), except for recent evidence from Germany and Brazil (Sutter et al., 2023; Bruhn et al., 2022). While alternative interventions like financial advisory services have been proposed, their effectiveness is mixed, and empirical evidence is

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scarce (Chalmers and Reuter, 2020). A major policy concern is related on which content should be included in financial education curricula to improve the financial competences of the youth, especially considering complex themes such as sustainable finance and investments (Commission European Union/OECD, 2023).

Recent advancements in the literature highlight the significant role of behavioural and cognitive factors in shaping financial literacy and decision-making processes (Compen et al., 2022; Jonsson et al., 2017; Pitthan and De Witte, 2021). Building upon this understanding, behavioural-based financial education programs, *i.e.* when financial education also teaches *how* to make good financial decision and about *which factors* could be in the way to make good decisions, show that learning about biases can improve financial literacy (Pitthan and De Witte, 2023). Although often centred in behavioural or cognitive biases, it is important to acknowledge that other factors, such as heuristics, can also lead to suboptimal outcomes. Heuristics serve as simplifications of reality that facilitate decision-making in complex scenarios (Tversky and Kahneman, 1973). However, there is ambivalence regarding the usefulness of heuristics in decision-making processes. Although heuristics can streamline decision-making, they may lead to inconsistent behaviour when evaluated under von Neumann–Morgenstern utility functions (Tversky, 1996; Gigerenzer and Gaissmaier, 2011). While fast and frugal heuristics can be beneficial in complex situations with time constraints (Forbes et al., 2015; OECD/INFE, 2019; Drexler et al., 2014), they can prove considerably detrimental in financial decisions with long-term consequences, such as purchasing a house or choosing a pension plan (Dhami et al., 2019; Qudus and Banerjee, 2021).

Given the increasing financial complexity, this paper examines the impact of financial education courses supplemented with heuristic materials on improving financial literacy. Moreover, it explores if education can counteract the negative influence of heuristics. To test this, we conducted a randomized controlled trial (RCT) with Belgian secondary school students. We compared traditional financial education materials to modified versions including content on the availability heuristic and the gambler's fallacy (Kahneman et al., 1971; Tversky and Kahneman, 1973). We assess whether the effect of behavioural-based financial education on financial literacy can be mediated by increased awareness of heuristic behaviour. Contrary to assumptions, only traditional financial education courses improved financial literacy, while behavioural courses with heuristic content did not. We did not observe a similar indirect effect to financial literacy mediated by heuristics, as seen with the myopic bias (Pitthan and De Witte, 2023). These findings can be attributed to the dual nature of heuristics, which can both simplify reality and undermine decision-making in complex scenarios. Consequently, teaching about heuristics may not be the optimal delivery method, as it can potentially confuse students by emphasizing both the usefulness and the detrimental effects of heuristics on decision-making skills. This makes decisions more complex, since the simplifications from heuristics now are no longer unconscious, which worsens financial literacy outcomes.

2. Theory and methods

The literature presents causal frameworks that propose connections among financial education, financial literacy, and financial outcomes (Carpena and Zia, 2020; Pitthan and De Witte, 2023). Since heuristics can play a role on financial decisions (Strough et al., 2011), we hypothesize that such causal frameworks could be augmented in order to also consider the role of heuristics in financial literacy and financial decisions. We propose the following mechanism: behavioural-based financial education courses that teach about heuristics would make individuals more aware of such rules of thumb. In turn, this could make them more conscious of their financial decisions, improving their financial literacy and financial outcomes.

Our hypothesized framework is shown in the Direct Acyclic Graph (DAG) of 1.

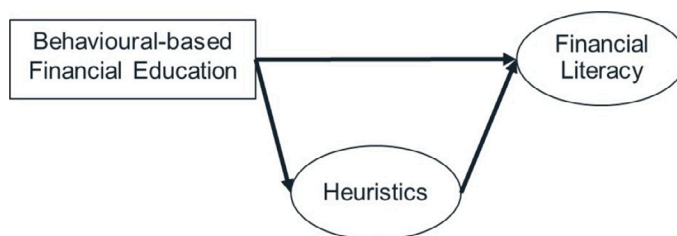


Fig. 1. Direct acyclic graphs with estimated causal links of behavioural-based financial education mechanisms. .

The experiment is centred in financial education courses offered to secondary schools in the Dutch-speaking part of Belgium, with students aged between 14 and 19 years.¹ Although our target group has a restrictive sample of individuals, teenagers and young-adults are a perfect target group for financial education interventions, since they are already making daily financial-decisions and consuming financial products starting from a young age (OECD/PISA, 2020). Earlier research from Flanders shows indeed that findings in the studied age group of 14–19 years old provides reliable conclusions (De Beckker et al., 2021; Iterbeke et al., 2021, 2020). Moreover, starting financial education at an early age is fundamental to cultivate healthy financial habits that can otherwise be uncorrectable as adults (Whitebread and Bingham, 2013), having potential to bring improvements to the whole financial life of such individuals (Compen et al., 2021). Finally, given the similarity in the findings from the OECD PISA studies, which measures financial literacy at age 15, and the OECD INFE studies, which measures financial literacy among adults, the experimental findings from the study at hand are likely to be externally valid towards older age populations.

¹ The experiment was conducted between September 2021 and January 2022.

Table 1
Schematic representation of the experimental conditions.

	Control	Treat. Tradit. Fin. Educ.	Treat. Heurist. Fin. Educ.
Traditional financial education course about insurance, pensions and investments	No	Yes	Yes
Heuristics-based materials about Availability and Gambler's Fallacy	No	No	Yes

The courses are in the format of computer-assisted games (*i.e.* based on an online interactive platform), covering the main financial literacy objectives from the Flemish curriculum. Students make financial decisions in close to real life examples, receiving feedback on their mistakes. Using a mix of text, interactive elements, games, and videos, students explore key financial concepts like investment and insurance. The curriculum brings them face-to-face with the kind of financial choices they will encounter in real life, emphasizing the importance of budgeting, long-term planning, and coping with the risk and reward trade-off. The experiment has three different experimental arms, which were randomized at the school level to avoid contamination and peer effects. (i) A control group that does not receive any course until the end of the experiment. (ii) A treatment group that receives traditional financial education (TFE), *i.e.* a version of the game focusing only on financial knowledge concepts. (iii) A treatment group that receives heuristics financial education (HFE), *i.e.* a modified version of the game, including behavioural-based material about the heuristics of availability and gambler's fallacy, in addition to the core financial knowledge content of the previous treatment arm. The only absence of the material in the HFE course (when compared to the TFE course) were a couple of examples about financial products specific to the Belgian context (*e.g.* mandatory third-party risk insurance), which have no direct relationship to the general questions used to estimate the financial literacy score about financial knowledge, attitude and behaviour. An overview of the treatment arms and corresponding course material interventions is seen in [Table 1](#). Students in one experimental arm only follow the course from their respective treatment (if any).

All participants fill out both pre and post-tests, which include socioeconomic questions; financial literacy tests with questions inspired on [OECD/INFE \(2011\)](#); and heuristics tests, partially based on [Camerer and Kunreuther \(1989\)](#). An overview of a few examples seen in the course is given in Appendix A. The timeline of the experiment was divided as follows: (i) the course was built between May and August 2021; (ii) an open-call to interested schools was made in August 2021, with registration made until September 2021; (iii) schools completed pre-tests from September to mid October 2021; (iv) stratified randomization was made with eligible schools that completed pre-tests; (v) schools completed the course between October and December 2021; (vi) post-tests were filled after the completion of the course between November 2021 and January 2022. For ethical reasons, schools in the control condition were eligible to receive the course after the end of the examination and post-test period, so that no school was left behind.

We estimate the average treatment effects (ATE) and average direct effect (ADE) of our treatment variables (*i.e.* receiving either the TFE or HFE courses) to our main outcome variable (*i.e.* financial literacy) and to our mediating variable (*i.e.* better heuristics awareness) using OLS estimates, clustering standard errors by school. The treatments are constructed as two dummy variables, with a value of 1 assigned to indicate if participated in a certain treatment, while utilizing the control group as the baseline when both dummy variables are set to 0. The causal mediation analysis follows the approach of [Imai et al. \(2010\)](#), in order to estimate average causal mediated effects (ACME).² The ATE and ADE are identified by the statistical independence of the treatment status with both the mediation and outcome variables, which is given by the random attribution of treatments from our RCT design. The statistical independence of the mediation and outcome variables (that identifies the ACME) is indirectly tested by sensitivity analysis and proxy tests for endogeneity.

3. Results

[Table 2](#) shows the ATEs for the main variables of our study, financial literacy and heuristics scores. Although the treatment achieved full compliance following exogenous allocation, we still observe sample imbalance due to attrition in the post-tests. To address this issue, we use both Mahalanobis distance matching (MDM) and [Lee \(2009\)](#)'s bounds techniques, in addition to controlling for any balancing differences.³ The set of controlling variables is seen in Appendix B, in which, among others, relevant family-related factors and background characteristics are included, such as language spoken at home, socioeconomic status questions, family composition, and family education. In Panel A, we observe that all ATEs to financial literacy are positive, although only the traditional financial education has a significant effect of 0.36 standard deviations (sd).

One possibility is that the inclusion of heuristics education may make decision-making more complex, provoking heuristics to become conscious and acting as a distraction for students in relation to the main financial literacy outcomes. Alternatively, it is plausible that the explanation of heuristics could cause confusion among students as they become suddenly aware of the complexity involved in making decisions. Besides, we note in Appendix B that the financial literacy pre-test score of students that participated in the heuristics education treatment is significantly higher in comparison to the other treatment arms. Although we control for this difference in the analysis, we do not exclude the hypothesis that this could undermine the total effect of the course.

² For similar causal mediation applications in the financial education literature, see [Carpene and Zia \(2020\)](#) and [Pitthan and De Witte \(2023\)](#).

³ A post-hoc power analysis found a minimum detectable effect-size of 0.31, considering a power of 80%, sample of 427, significance level of 5%, 42 clusters and the estimated intraclass correlation of clusters of 0.01. An overview about the data and sample is seen in Appendix B.

Table 2
Estimated ATEs and Lee bounds of main variables.

Specification	Mahalanobis matching	Lower bound	Upper bound	Trimming proportion
Panel A: Financial literacy post-test score as outcome				
Treat. Trad. Fin. Educ.	0.359** (0.138)	-0.311 [-0.580, -0.042]	0.697 [0.414, 0.980]	22.3%
Treat. Heuristics Educ.	0.127 (0.151)	-0.329 [-0.592, -0.070]	0.220 [-0.059, 0.499]	11.6%
N	427			
R ²	0.364			
F	76.37			
Panel B: Heuristics post-test score as outcome				
Treat. Trad. Fin. Educ.	0.931** (0.297)	-0.406 [-0.785, -0.028]	0.963 [0.537, 1.388]	22.3%
Treat. Heuristics Educ.	0.363 (0.224)	-0.778 [-1.221, -0.334]	0.313 [-0.071, 0.696]	11.6%
N	427			
R ²	0.168			
F	147.1			

Note: Lower and upper bounds coefficients are the Lee (2009)'s bounds estimations for the required trimming rate in comparison with control conditions. Treatments are constructed as dummy variables, indicating 1 if followed a certain treatment, and 0 otherwise. Numbers in brackets are the 95% confidence intervals. The Mahalanobis Distance Matching estimated coefficients are in terms of standard deviations of the outcome variable. Clustered standard errors in parentheses. * $p \leq .05$ ** $p \leq .01$ *** $p \leq .001$. Estimation controls for all pre-test observed characteristics presented at Appendix B.

Table 3
Mediation analysis for financial literacy post-test as outcome with effect mediated by heuristics.

	Treatment Trad. Fin. Educ.	Treatment Heuristics Educ.
Average Causal Mediated Effect (ACME)	-0.009 (0.020)	0.008 (0.013)
Average Direct Effect (ADE)	0.476*** (0.150)	0.132 (0.116)
Average Treatment Effect (ATE)	0.466*** (0.136)	140 (0.116)
% of ATE Mediated	-2.00%	3.92%
N	249	283
R ²	0.356	0.300
F	166.21	21.86

Note: The results show direct and indirect effects estimated by mediation analysis using the algorithm proposed by Imai et al. (2010). Standard errors obtained by quasi-Bayesian Monte Carlo simulations. * $p \leq .05$ ** $p \leq .01$ *** $p \leq .001$. Estimation controls for all pre-test observed characteristics presented at Table 2.

From Panel B, we observe that students in the traditional financial education treatment experienced a significant increase in their heuristics behaviour by 0.93 sd when compared to the control group.⁴ The observed effect size is notably substantial and may be associated with the hypothesis that improving financial literacy in the absence of exposure to heuristics could lead students to develop increased confidence in their decision-making, thereby exhibiting a greater inclination towards relying on heuristics. In the case of heuristics education as the treatment, the ATE remains positive, although it is not statistically significant.

In Table 3, we directly examine the hypothesis presented in 1, which explores whether education that enhances awareness of heuristics can lead to an indirect improvement in financial literacy. Our findings indicate that we have evidence to reject this hypothesis. Neither of the two treatments exhibited a significant average causal mediation effect (ACME) in enhancing financial literacy scores, although the ACME is positive for the heuristics education treatment. Notably, the ACME for the traditional financial education case is even negative, although it is not statistically significant. This observation may be associated with the notable rise in heuristics-based behaviour observed in Table 2. Furthermore, both the average direct effect (ADE) and the average treatment effect (ATE) are only statistically significant for the traditional financial education case, aligning with the findings presented in Table 2. To provide further support, Appendix C replicates the results of both tables for each of the two individual heuristics (availability and gambler's fallacy). Additionally, Appendix D discusses the sensitivity analysis and endogeneity tests conducted to assess the robustness of our mediation analysis.

4. Discussion

In this paper, we examined the potential role of heuristics in enhancing financial literacy. To investigate this, we conducted a randomized controlled trial in Belgium involving 427 secondary school students. The results revealed that students who participated

⁴ From Appendix C, this seems to be driven mostly by the availability heuristics type of behaviour.

in traditional financial education courses experienced a significant improvement in their financial literacy scores. However, this improvement was not observed among students who received instruction on heuristics. Additionally, our mediation analysis indicated that increased awareness of heuristics does not serve as a significant mediator in improving financial literacy.

The findings presented in Panel A of Table 2 demonstrate that the incorporation of heuristics content rendered financial education ineffective in improving financial literacy. This provides evidence of the dual nature of heuristics' influence on financial decision-making. On the one hand, heuristics can be beneficial by simplifying complex situations. On the other hand, they can be detrimental by making individuals more prone to making mistakes. In essence, teaching about heuristics can be too complicated for students, leaving them uncertain about the benefits and drawbacks, while potentially diverting their attention away from the main course content, causing information loading when too much information is present (Huang et al., 2012). The results presented in Panel B of Table 2 indicate that traditional financial education may contribute to an increase in heuristics-based behaviour among students. This may be attributed to the confidence gained from the course. However, despite this shift in behaviour, it does not appear to have a negative impact on students' financial literacy, as evidenced by the absence of any mediation effect of heuristics, as shown in Table 3.

One lingering question remains: why does the improved awareness of heuristics not have a statistically significant indirect effect on enhancing financial literacy, unlike the positive impact observed with the learning of behavioural biases such as myopia (Pitthan and De Witte, 2023)? First, heuristics should not be viewed solely as a negative influence on financial decisions. This is especially evident when individuals are faced with time constraints, as heuristics can offer a practical solution. Second, some behavioural biases like myopia can have a more direct link to low financial literacy (e.g. short-term preference), which is not always seen in the case of heuristics. Finally, the realization of exactly when heuristics are useful or dangerous might be more beneficial to individuals, instead of better awareness to different types of heuristic behaviour.

In terms of policy implications, our findings suggest that the inclusion of heuristics in financial education programs may not be advisable, as it appears to diminish the effectiveness of such courses, making decisions more complex than they should be. Although recent national strategies (Department of US Treasury, 2020) are built given a very complex financial system, the answer to effective education programs is not to make decisions more difficult than they should be. Furthermore, considering the dual nature of heuristics, policies aimed at mitigating their negative effects should prioritize interactive approaches, such as "learning by doing", rather than traditional teaching methods. By engaging in practical exercises and experiencing firsthand both the advantages and disadvantages of heuristics, individuals can develop a more comprehensive understanding of their implications.

Our analysis has some limitations. First, the limited sample size resulted in a power that was small. Second, although we tested our hypothesis with both the availability and gambler's fallacy heuristics, many other heuristics were not analysed (e.g. framing effect, affection, representativeness), which might have a similar or different effect, depending on how closely linked with financial literacy they are. Third, the analysis was realized in a time span of 4 months, which does not allow to draw conclusions about long lasting outcomes of financial education courses. Finally, the hypothesis of causal mediation analysis are not directly testable, although they were still indirectly tested here with proxy measures and sensitivity analysis. Future research should focus on these aspects by conducting experiments across various locations, employing diverse heuristics and biases, and extending the observational period to assess long-term financial outcomes and well-being. Additionally, it is valuable to analyse the implications of our findings on behavioural and heuristics-based financial education in other contexts, such as mindful household energy decisions and the heterogeneity in households' risk sensitivity, as these factors may lead to different results (Korkmaz et al., 2021; Ye and Yue, 2023).

CRediT authorship contribution statement

Francisco Pitthan: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Kristof De Witte:** Writing – review & editing, Supervision, Project administration, Funding acquisition, Conceptualization.

Data availability

Data will be made available on request.

Appendix A. Supplementary data

Supplementary material related to this article can be found online at <https://doi.org/10.1016/j.frl.2024.105854>.

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