

Delivery Methods in Financial Education: A Comparative Analysis of Face-to-Face Classes, Live Streaming, Videos, and Gaming

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Abstract

The paper analyses how different methods to deliver contents in financial education affect the learning output of the curricula. The authors developed a specific financial education curriculum and delivered in four different manners (face-to-face class, live-streaming class, pre-recorded videos, educational game). Using a RCT (Random Control Treatment) methodology, the study tests the effects of different delivery methods on financial literacy and financial confidence (over-confidence included) of the attendees of the financial education initiative. Results show how financial education is able to increase financial literacy with any delivery method. A comparison between these options showed how educational game and live-streaming classes are more effective delivery methods in financial education than the others. No statistically significant effects have been found on people financial confidence *per se*, while financial education is able to reduce the gap between financial confidence and financial knowledge, reducing people overconfidence. The study offers several policy implications, including the chance to choose between different delivery methods of contents in financial education without the risk to affect the effectiveness of the program, and the chance to use innovative teaching methods - as educational game – in planning financial education.

JEL code: G53

Keywords: financial education, financial literacy, overconfidence, edugaming

1. Introduction

The evidence provided by more than 15 years of studies on financial literacy first, and financial education latter, is enough to arrive to several conclusions. First, financial literacy matters. Several studies highlighted how more financially literate individuals take better financial decisions. For instance, they are more likely (1) to participate to the stock markets

(van Rooij et al. 2011; Almenberg and Dreber 2015), (2) to avoid financial troubles (Gathergood, 2012; Lusardi and Tufano, 2015; French and McKillop, 2016), (3) to be ready for retirement (Bucher-Koenen and Lusardi, 2011; Lusardi and Mitchell, 2011; Sekita, 2011; Van Rooij et al. 2012), (4) to be resilient in case of financial shocks (de Bassa Scheresberg, 2013; Anderson et al., 2017). Second, the degree of financial literacy among the general population is on average low and, sometimes, not enough to allow people to achieve a financial wellbeing. Studies promoted by international organization (Atkinson and Messy, 2013; OECD, 2020) stress the need to provide people around the world, and specially young people, with knowledge, skills, and help them to develop the right attitude to be aware of their personal finance needs, to take financial decisions, and to know what to do and where to find the right information and to seek for help when they cannot do all by themselves. Third, to help people developing their financial literacy there is the need of financial education. Several studies have shown how financial education has the potential to increase people's financial literacy (Fernandes et al., 2014; Xiao and O'Neil, 2016; Lusardi, 2019; Kaiser et al. 2022). Such strong evidence convinced many countries to plan national strategies to increase financial literacy, even introducing financial education in school programs. Fourth, financial education can be a useful tool to support people developing their financial literacy. We have studies that assessed the effectiveness of financial education curricula in different scenarios. Some of them assessed financial education in school (Walstad et al., 2010; Kaiser et al., 2020), other studies referred to the case of financial education to adults taking financial decisions (Ambuehl et al., 2014; DeHart et al. 2016). Some other studies tried to achieve more robust conclusions by meta-analysis (Kaiser and Menkhoff, 2020; Kaiser et al. 2022). If the long-term effect of financial education on financial knowledge is still not clear, there is more consensus on the need to develop and provide effective financial education curricula. The aim of this study is to assess how different educational content delivery options affect the learning outcome of a financial education curriculum. Previous studies assessed the effectiveness of single curricula. However, the fact that different curricula could differ in several terms, including the target of recipients (e.g. children, students, adults, workers, etc.), the topics (e.g. basic principles or specific areas of knowledge, as investments, loans and debt, retirement planning, etc.), the length of the curriculum (e.g. a single short seminars, a complete course, etc.), the delivery options of the contents (e.g. face to face meetings, online streaming, videos, etc.), do not give the chance to understand how these different dimensions of a financial education curriculum can affect the effectiveness of the program. Assessing a single curriculum, it is possible to conclude that this specific combination of target, topic,

length, and delivery option works or does not. What is not possible to assess is the contribution of each of these dimensions to the effectiveness of the whole program. This study wants to shed light on this point, trying to assess how different delivery options affect the effectiveness of a financial education curricula. Materials on basic financial contents have been designed and developed to be delivered by (1) face to face classes, (2) live streaming classes, (3) pre-recorded videos, and (4) an educational game. The differences in the learning outcome between groups have been assessed and compared with a control group, according to the RCT (Randomized Controlled Trial) methodology.

The awareness that financial literacy is not only related to financial knowledge, and the effectiveness of a financial education curriculum goes beyond an increase of knowledge, suggested to assess differences between the pre- and post-treatment measures accounting to financial confidence too. A program that helps people being more comfortable about their financial management, or that helps them to reduce the perceived stress in dealing with their finances could be considered as much effective as programs that affects financial knowledge. The knowledge about how delivering the same contents in different ways affects the effectiveness of a financial education curriculum can help to target specific groups¹. At the same time, the fact that different delivery options involve different costs can help to maximize the value of the dollars spent in financial education². Moreover, the chance to use different delivery options (once proved that they are equally efficient/effective) allow to plan, for instance, a large-scale program that otherwise could not be feasible if only not-scalable options are considered³, or to reach targets of recipient with personal constraints that could make the use of a financial education curriculum not feasible or not likely to be used⁴. Hence, results of the study can help professionals of financial education in planning new curricula or delivering the current curricula. At the same time, policymakers can take benefits from the knowledge of how much the effectiveness of financial education changes when it is done using different delivery methods, supporting the most convenient options.

¹ In case a certain delivery options (e.g. YouTube videos) works better than others (e.g. face-to-face class) to address a certain target group (e.g. young people), this option should be preferred planning the curriculum.

² If two delivery options are both able to increase financial literacy, there is the chance to use a cost-saving delivery option, maximizing the utility of the program in a cost-benefit analysis.

³ Without any knowledge about the different effectiveness of live streaming classes (or video) and face-to-face classes, a standard face-to-face class could be preferred. However, using classes, to double the number of recipients there is the need to double the number of classes, while the use of distance learning dramatically reduce the marginal cost of additional attendees.

⁴ For instance, adults are typically hard-to-reach target groups, specially compared to students. The offer of traditional face-to-face courses to adults could be ineffective if the time required to attend the course does not fit with personal preferences about time allocation.

The rest of the paper is organized as follow. A literature review stresses the need to promote more studies on the effectiveness of financial education, supporting the need of the present study. The description of the methodology and the data of the study will explain the analysis and the reliability of the study. The next session is about the results, while the main achievement and the implication of the study will be presented in the conclusions.

2. Literature Review

A considerable number of extensive meta-analyses have already addressed the causal effects of financial education on financial knowledge and downstream financial behaviors, e.g. credit usage, budgeting, saving and investment, insurance, and remittances (Fernandes et al., 2014; Miller et al., 2015; Kaiser & Menkhoff, 2017, 2020; Kaiser et al., 2022). However, these analyses have revealed mixed evidence regarding the effectiveness of financial education programs. The most recent study (Kaiser et al., 2022) elaborated that, in randomized controlled trials (RCTs), financial education has had, on average, positive treatment effects on financial knowledge and downstream financial behaviors. However, the authors stated that the evidence regarding the sustainability of these effects (i.e., the decay of treatment effects over time) is inconclusive. Finally, they documented that estimates of the associated statistical effect sizes are economically significant.

In light of previous evidence, it is also recommended that financial education programs be highly targeted toward specific audiences (e.g., low-income populations or high school students) and areas of financial activity (e.g., homeownership or credit card counseling) (Walstad et al., 2010; Kalmi & Rahko, 2022). Furthermore, it is recommended that this training occur just before a corresponding financial event (e.g., the purchase of a home or use of a credit card). Multi-skill or broad-based programs appear to have certain disadvantages relative to highly targeted programs, in that they are perceived as less relevant, attendants tend to pay less attention and may suffer reduced motivation following these programs (Fernandes et al., 2014).

A recent systematic review and bibliometric analysis by Goyal and Kumar (2020) impressively shows that the impact of financial education on improving financial literacy and

financial behavior is one of the three major themes identified in current research on financial literacy, with digital financial education identified as an emerging theme.

Past research shows that providers of financial education are faced with the challenge of effectively evaluating such programs (Fox, Bartholomae, & Lee, 2005; Lyons, Palmer, Jayaratne, & Scherpf, 2006). In a more recent study, Kalmi and Rahko (2022) studied the emerging theme of digital financial education, i.e. the effects of three game-based financial education approaches and their combinations to a control group that received only traditional teaching. They found robust effects with respect to knowledge gained from game-based approaches.

Apart from the question of digital versus traditional teaching approaches, Goyal and Kumar (2020) also stress the demand from policymakers to implement effective financial education programs. Therefore, they also present future research directions. Among others, they argue in favor of assessing the appropriateness of financial education interventions with the goal to identify the least costly programs, stressing the cost-benefit aspect of financial education.

Another interesting research area is the one related to psychological aspects of personal finance, and in particular to overconfidence. In the literature, overconfidence appears mainly in three different constructs: overprecision, overplacement, and overestimation (Moore and Healy, 2008; Olsson, 2014). According to Moore and Schatz (2017), overprecision is the excessive faith that one knows the truth, overplacement is the exaggerated belief that one is better than others are, and overestimation as thinking that one is better than they are. As a result, overconfidence can be defined as a systematic tendency to overestimate one's own ability to make accurate probability judgements, or an overestimation of one's own performance, knowledge, and abilities compared to their actual performance, or other's knowledge and abilities (Koellinger et al. 2007). The consensual finding of an overconfidence bias in the judgement and decision-making literature, namely that people have a systematic tendency of seeing themselves as having better perceived skills than their actual skills is often described as one of the most robust, most prevalent and, at the same time, most damaging among the observed decisional biases (Stankov and Crawford, 1996; Schaefer et al., 2004; Blake, 2009; Kahneman, 2011). A recent meta-analysis reviewing and summarizing the results of 34 studies in this area is in line with this longstanding notion by finding an overall positive and significant effect of overconfidence on financial decisions related to trading volume, investment, and innovativeness (Grežo, 2021).

Past research has applied these findings of overconfidence to the field of financial literacy, defined according to the Organisation for Economic Co-operation and Development (OECD) International Network on Financial Education (OECD/INFE) as “a combination of awareness, knowledge, skill, attitude and behavior to make sound financial decisions and ultimately achieve individual financial well-being” (Atkinson and Messy, 2012). Therefore, a main concern about the miscalibration of one’s perceived and objective financial literacy in the form of financial literacy overconfidence is whether it correlates with negative financial behaviors, risky or even dangerous financial decision-making that may lead to poor financial outcomes, and eventually lower financial well-being. In a surge of studies, concerns about the disconnect between actual and perceived financial literacy have gained attention. High perceived financial literacy coupled with low objective financial literacy—financial literacy overconfidence — has been linked to higher rates of mortgage delinquency (Kim et al., 2020), poor management of credit card debt and investment decisions (Allgood and Walstad, 2016), increased trading activity, higher risk-taking, and less portfolio diversification (Merkle, 2017; Barber and Odean, 2001; Glaser and Weber, 2007), as well as extensive utilization of high-cost alternative financial services (Robb et al., 2015). Furthermore, overconfident individuals more often invest by themselves, hold only stocks in their portfolio (Chu et al. 2017) and show higher stock market participation, a potentially risky behavior (Xia et al. 2014). This is especially concerning as overconfident individuals are less likely to seek professional financial advice and accept professional help (Kramer, 2016; Porto and Xiao, 2016; Anderson et al., 2017).

In the light of the empirical evidence on the negative financial consequences of financial literacy overconfidence, past research has also provided implications for policymakers, practitioners, and researchers. Robb et al. (2015) point out that, in the past, financial education aimed at increasing actual financial knowledge has been the dominant strategy. However, it is more recently suggested that additional gains might be achieved by promoting more realistic assessments of individual’s financial literacy level (Robb et al. 2015; Kim et al. 2020). Furthermore, the underutilization of financial advice can also widen the literacy gap (Lusardi and Mitchell 2007). Therefore, Porto and Xiao (2016) conclude that mandated financial education or advice can be a channel to reduce an existing overconfidence bias.

This study wants to contribute to the existing literature addressing both the effects of financial education on financial literacy, and financial confidence (including financial overconfidence). In particular, the study wants to shed light on the role of the methods used to delivery contents in financial education in the overall effectiveness of financial education. Four different options – face-to-face classes, live-streaming classes, pre-recorded videos, and educational games – are tested to check if the use of one or another option affect the success of a financial education curriculum, and to test the differences due to the use of different delivery methods.

3. Data and Methodology

To assess how delivery methods of contents in financial education affect the effectiveness of a financial education curriculum, it was necessary to design and plan a specific curriculum and to test its effectiveness delivering contents by different methods. The options accounted in the study were (1) face-to-face meetings (standard educational classes), (2) live-streaming classes, (3) pre-recorded videos, and (4) educational games. The target of recipients was freshmen of a faculty of Economics. The initiative was part of the “Financial Literacy Month” promoted by a national authority as part of the national strategy to promote financial literacy and financial education. Participation was free and no monetary incentives were paid to participants. Those who fully participated by doing all the activities of the program were rewarded with credits for “extra-activities” included in their bachelor program. Data was collected by pencil and paper questionnaires, and all the activities were done in October 2022.

Several reasons suggested to work with freshmen students of a faculty of economics. The research interest was on young adults, and the average age of freshmen should fit with this target. Being just-enrolled freshmen, the students of the sample were not already exposed to any class on economics or finance, not being biased by these educational experiences. The students’ decision to enroll in a faculty of economics should guarantee the interest to learn about economics and finance, avoiding the risk that the effectiveness of the financial education could be negatively affected by a lack of attention or motivation of the participants. Data from homogeneous groups – as freshmen of a specific faculty in a single university are

– can limit the external validity of the results⁵, but a very specific sample can be an additional element that helps to achieve a *ceteris paribus* scenario, which is pivotal to guarantee the robustness of the results. Moreover, the core of the study is not to assess the effectiveness of financial education, but to assess the differences due to the delivery of financial education contents by different methods. So, even if the participants of the study could be more motivated and more interested to learn about finance than other groups, this potential shift in motivation should be equally distributed between all the participants, not affecting the differences between intra-groups of the sample⁶, and not jeopardizing the reliability of the results.

The topic of the financial education curriculum was “Money and its use”. The decision to address a very basic topic is motivated by the will to avoid the potential risk that, in case of advanced topics, differences in the baseline financial literacy of the participants could affect the reliability of the study⁷. Moreover, the analysis of cash and other payment tools, should be familiar to students, and this would be an additional source of confidence and motivation to pay attention for them⁸. To minimize selection biases, even the length of the program was designed to be short⁹: the participation to the whole study required a single day of attendance. The methodology of the study is a standard RCT (randomized controlled trials), where participants are randomly assigned to two groups. One group will be exposed to a “treatment”, while the other will work as a control group. A measurement of a certain variable for each group before and after the treatment will be used to test how the treatment is able to change the value of the variable. The difference between groups is based on the difference between the distance between groups – based on the variable of interest – before and after the treatment. So, the RCT is based on a “difference-in-difference” (or diff-in-diff) approach.

⁵ Freshmen are not representative of the entire population.

⁶ The financial education curriculum proposed in this study could be more effective in this target of recipients (freshmen) than others (e.g. adults, elderly, etc.), but the differences in the learning outcomes between students exposed to different delivery methods (e.g. face-to-face class, pre-recorded videos, etc.) can be a reliable measure of the role played by the delivery method.

⁷ In case of sophisticated topics, computational skills, family backgrounds, and – generally speaking – previous financial experiences, could be causes of differences between students and potential source of noise in the data.

⁸ The analysis of topics with not an immediate perceived relevance for students (even if useful), like pension planning or investing, could affect the attention of students.

⁹ Longer is the time needed to attend a course, lower is the chance that not high motivated attendees will decide to enroll and to complete the program.

After the welcome of the students and a brief introduction, all the participants were invited to fill a questionnaire that included 10 multiple choice questions about money (e.g. banknotes and coins, exchanging currencies, withdrawing cash from ATMs, etc.). Then, each participant was invited to download and play the education game (“edugame”) of the program. Three games were required. After each answer to the quizzes, the player had to declare how much confident was about the chance that the answer was correct, according to a standard one-to-five Likert scale. Then students were randomly assigned to five groups¹⁰. Four groups were invited, respectively, (1) to attend a face-to-face class about money and its use, (2) to move to another class attending the same class in live-streaming by their own devices (e.g. laptops, tablets, etc.), (3) to move to another class and watch a web-series of videos (available on Youtube)¹¹, (4) to download and play an educational game based on a quiz, which questions addressed the topics of the course¹².

The quiz is based on a sequence of multiple-choice questions. Each question has four options (one is right, the other three are false), plus the option “Do not know”. A correct answer allows to pass to the next level of the game, with another question. The difficulty of questions increases from one level to the next. Failing a question makes the game to be over and it requires to (re)start from the beginning. The game ends proving a correct answer to the level 15 of the game. The questions of each level were randomly selected from a set of more than 50 questions. Playing the game multiple times should help to learn from previous mistakes, developing financial knowledge and skills. The structure of the game is very easy and inspired to popular TV shows, so it should not require time to learn how to play and let players to focus on the contents of the questions.

The fifth group had the function of a control group. It was invited to leave the room and come back at the end of the day. In the meantime, participants of this group were denied any access to the other activities (attending class, watching videos, playing the game). The learning activities (face-to-face class, live-streaming class, videos, and edugame) were done at the same time (as parallel sessions) and had an average total length of three hours. A break of around 90 minutes was placed in between the end of the activities and the final meeting¹³,

¹⁰ Each student was invited to pick up a playing card from a deck. Each card had a symbol referred to a specific group (face-to-face class, YouTube videos, etc.).

¹¹ The videos were prepared and recorded by the same teacher that taught in class, using the same structure and planning of face-to-face class.

¹² Questions were prepared by the same teacher of the other delivery options, always referring to the same syllabus.




¹³ A break was included to minimize the chance that correct answers to the second questionnaire were just related to the short-time memory of the students (e.g. topics just discussed in the last minutes of the class, or question just answered to the last play of the game).

where all the five groups were invited to fill a second questionnaire with the same questions of the morning time¹⁴. Finally, all the participants were invited to play the edugame for a last time.

The first questionnaire (administrated in the morning time) included (1) socio-demographic variables of the participants – including age, gender, parental education, and high-school diploma final grade – (2) 10 multiple choice questions on financial literacy about money and its use, and (3) three standard financial literacy questions on compound interest, inflation, and risk diversification (the so called “Lusardi-Mitchell questions”). The second (final) questionnaire included only the 10 multiple choice questions and the identification code of the respondent.

The descriptive statistics of the sample are reported in Table 1

Table 1 – Socio-demographic characteristics of the sample

|  Gender (Male=1) | | | |  Topgrade(Yes=1) (at high school) | | |  Parentsgrad (Yes=1) (at least one) | | |
|---|-------|--------|-----|--|----------|-----|---|-------------------|-----|
| | Male | Female | Obs | | Topgrade | Obs | | Parents Graduated | Obs |
| Class | 59.1% | 40.9% | 22 | Class | 22.7% | 22 | Class | 31.8% | 22 |
| Streaming | 55.2% | 44.8% | 29 | Streaming | 34.5% | 29 | Streaming | 44.8% | 29 |
| Video | 48.3% | 51.7% | 29 | Video | 34.5% | 29 | Video | 51.7% | 29 |
| Quiz | 50.0% | 50.0% | 32 | Quiz | 18.8% | 32 | Quiz | 71.0% | 32 |
| (Control) | 54.8% | 45.2% | 31 | (Control) | 19.4% | 31 | (Control) | 48.4% | 31 |
| ALL | 52.6% | 47.4% | 156 | ALL | 25.9% | 143 | ALL | 51.0% | 156 |

The overall sample is balanced between male (52.6%) and female (47.4%), and even the gender distribution within groups does not show great differences. Around one on four (25.9%) of the participants completed high school with a top grade, while the ratio between participants coming from a family where at least one of the parents are graduated and those that are first generation of college attendees is almost one to one. No variable about job is included (all participants are college students) and no data about age is considered, due to the very low variation (98% of the participants was born between 2002 and 2004).

The 10 multiple choice questions on financial literacy were analysed to build a single scale. Five questions were dropped from the analysis due to the very high correct response rates that made them unable to differentiate between individuals (see Table 2). The remaining five

¹⁴ The questions were the same of the first questionnaire with a difference order.

questions were used to build a financial literacy score equal to the number of correct answers to these questions.

Table 2 – Financial literacy questions: 1 to 5

| | | |
|--|---|---|
| <p>1) Which background colour is the 20€ bill?</p> <p><input type="radio"/> Grey</p> <p><input type="radio"/> Pink/Red</p> <p><input type="radio"/> Blue</p> <p><input type="radio"/> Orange</p> <p><input type="radio"/> (Do not know)</p> | <p>2) Who is the issuer of Euros (banknotes and coins)?</p> <p><input type="radio"/> Minister of Economics and Finance</p> <p><input type="radio"/> European Central Bank (ECB)</p> <p><input type="radio"/> Parliament</p> <p><input type="radio"/> Government</p> <p><input type="radio"/> (Do not know)</p> | <p>3) When did it happen the switch from the Italian Lira and the Euro?</p> <p><input type="radio"/> Around 5 years ago</p> <p><input type="radio"/> Around 10 years ago</p> <p><input type="radio"/> More than 15 years ago</p> <p><input type="radio"/> Less than 5 years ago</p> <p><input type="radio"/> (Do not know)</p> |
| <p>Correct answer (%) Pre-test: 97.4% Post-test 100%</p> | <p>Correct answer (%) Pre-test: 90.8% Post-test 88.0%</p> | <p>Correct answer (%) Pre-test: 96.7% Post-test 99.3%</p> |
| <p>4) Which of the following Countries do NOT use Euro as local currency?</p> <p><input type="radio"/> France</p> <p><input type="radio"/> Germany</p> <p><input type="radio"/> Spain</p> <p><input type="radio"/> USA</p> <p><input type="radio"/> (Do not know)</p> | <p>5) If the Euro-Dollar exchange rate is 1.20, how much dollar you take exchanging 100€?</p> <p><input type="radio"/> \$80</p> <p><input type="radio"/> \$120</p> <p><input type="radio"/> \$83.33</p> <p><input type="radio"/> \$1,200</p> <p><input type="radio"/> (Do not know)</p> | |
| <p>Correct answer (%) Pre-test: 98.7% Post-test 99.3%</p> | <p>Correct answer (%) Pre-test: 73.7% Post-test 78.2%</p> | |

Table 3 – Financial literacy questions: 6 to 10

| | | |
|---|--|---|
| <p>6) Which is the maximum amount (by law) of cash you can withdraw from an ATM in a month?</p> <p><input type="radio"/> 10,000 Euro</p> <p><input type="radio"/> 5,000 Euro</p> <p><input type="radio"/> 2,500 Euro</p> <p><input type="radio"/> There is no limit by the law</p> <p><input type="radio"/> (Do not know)</p> | <p>7) You are coming back from the US. Shopping around in the airport you decide to buy an item that you can pay either by Euro or US Dollars. Suppose you still have dollar and you can exchange them at Bid=1.10 and Ask 1.40 in a currency kiosk. Is it more convenient to pay in store with 100€ or US\$ 120?</p> <p><input type="radio"/> It is better to pay in Euro</p> <p><input type="radio"/> It is better to pay in US Dollar</p> <p><input type="radio"/> Because the average between Bid and Ask is 1.20, to pay in store in Euro or Dollar is the same</p> <p><input type="radio"/> There is not enough information to answer for sure</p> <p><input type="radio"/> (Do not know)</p> | <p>8) You have found banknotes that are “trunked” by the 60% (60% of the banknote is missing). If you go to Bank of Italy (central bank) ...</p> <p><input type="radio"/> ... you can still replace these banknotes with a new one</p> <p><input type="radio"/> ... you will receive new banknotes equal to the 40% of the original full value</p> <p><input type="radio"/> ... you receive nothing, because the trunkation is beyond the 50% and you receive your banknotes back</p> <p><input type="radio"/> ... your banknotes will be retained by the central bank and you receive nothing back</p> <p><input type="radio"/> (Do not know)</p> |
| <p>Correct answer (%) Pre-test: 17.1% Post-test 62.0%</p> | <p>Correct answer (%) Pre-test: 17.1% Post-test 62.0%</p> | <p>Correct answer (%) Pre-test: 17.1% Post-test 62.0%</p> |
| <p>9) If you find a suitcase full of Italian Lira and you go to the Bank of Italy (issuer)...</p> <p><input type="radio"/> ... you realize these banknotes cannot be exchanged for Euro anymore</p> <p><input type="radio"/> ... banknotes will be exchanged for Euro at the 2001 official exchange rate (1,936.27 Lira for 1 Euro)</p> <p><input type="radio"/> ... you can exchange Lira for Euro only proving the legal provenance of the banknotes</p> <p><input type="radio"/> ... banknotes will be retained and destroyed (without anything in exchange)</p> <p><input type="radio"/> (Do not know)</p> | <p>10) Which the limit by the law for cash payment by coins in Italy?</p> <p><input type="radio"/> There is no limit, because coins are Euro as banknotes</p> <p><input type="radio"/> 50 coins (regardless their value)</p> <p><input type="radio"/> 500 coins (regardless their value)</p> <p><input type="radio"/> Coins which total value exceeded 500€</p> <p><input type="radio"/> (Do not know)</p> | |
| <p>Correct answer (%) Pre-test: 27.6% Post-test 70.4%</p> | <p>Correct answer (%) Pre-test: 25.7% Post-test 72.5%</p> | |

The correlation between items, both in the pre-test and the post-test (Table 4), does not show a strong overlap between them. Hence, a correct answer to one item does not predict a correct answer to another.

Table 4 – Correlation analysis of the financial literacy items

| Correlation in the Pre-test | | | | | | | | | | | Correlation in the Post-test | | | | | | | | | | | |
|-----------------------------|------|-------|-------|-------|-------|-------|-------|------|-------|-------|------------------------------|-------|------|-------|-------|-------|------|------|------|------|-------|---|
| | fl1a | fl2a | fl3a | fl4a | fl5a | fl6a | fl7a | fl8a | fl9a | fl10a | | fl1z | fl2z | fl3z | fl4z | fl5z | fl6z | fl7z | fl8z | fl9z | fl10z | |
| fl1a | 1 | | | | | | | | | | | fl1z | . | | | | | | | | | |
| fl2a | 0.09 | 1 | | | | | | | | | | fl2z | . | 1 | | | | | | | | |
| fl3a | 0.20 | 0.32 | 1 | | | | | | | | | fl3z | . | -0.03 | 1 | | | | | | | |
| fl4a | 0.34 | 0.16 | 0.30 | 1 | | | | | | | | fl4z | . | -0.03 | -0.01 | 1 | | | | | | |
| fl5a | 0.09 | 0.07 | 0.14 | 0.19 | 1 | | | | | | | fl5z | . | 0.02 | -0.04 | 0.16 | 1 | | | | | |
| fl6a | 0.07 | -0.10 | -0.11 | -0.10 | -0.05 | 1 | | | | | | fl6z | . | 0.11 | -0.07 | -0.07 | 0.22 | 1 | | | | |
| fl7a | 0.10 | -0.11 | -0.13 | 0.07 | 0.14 | 0.03 | 1 | | | | | fl7z | . | -0.05 | -0.05 | -0.05 | 0.03 | 0.29 | 1 | | | |
| fl8a | 0.00 | -0.07 | -0.15 | 0.07 | -0.09 | -0.07 | -0.03 | 1 | | | | fl8z | . | 0.11 | -0.05 | -0.05 | 0.02 | 0.20 | 0.22 | 1 | | |
| fl9a | 0.04 | -0.01 | -0.06 | 0.03 | 0.04 | -0.09 | 0.11 | 0.14 | 1 | | | fl9z | . | -0.06 | -0.03 | -0.03 | 0.08 | 0.13 | 0.16 | 0.18 | 1 | |
| fl10a | 0.07 | -0.05 | -0.32 | 0.05 | -0.19 | -0.01 | -0.03 | 0.20 | -0.01 | 1 | | fl10z | . | 0.11 | -0.05 | -0.05 | 0.02 | 0.30 | 0.15 | 0.19 | 0.28 | 1 |

The range of financial literacy score, equal to the sum of the correct answers to five questions (from the sixth to the tenth), goes from zero to five, but the average of the sample was equal to 1.49 in the pre-test and 3.66 in the post-test (Table 5).

Table 5 – Financial literacy of the participants before (pre-test) and after (post-test) the financial education

| | Pre-test (Average) | Post-test (Average) | diff. (Post-Pre) | T-test post-pre>0 (p-value) |
|------------------|-----------------------|------------------------|---------------------|--------------------------------|
| Class | 1.773 | 4.045 | 2.273 | 0.000*** |
| Streaming | 1.207 | 4.138 | 2.931 | 0.000*** |
| Video | 1.586 | 4.034 | 2.448 | 0.000*** |
| Quiz | 1.586 | 4.355 | 3.065 | 0.000*** |
| (Control) | 1.484 | 1.903 | 0.419 | 0.000*** |
| ALL | 1.493 | 3.662 | 2.211 | 0.000*** |

The “Big 3” Lusardi-Mitchell questions – on compound interest, inflation, and diversification – plus questions on mortgages and bond pricing were used to compare the degree of financial literacy of the sample with samples from other studies. The average number of correct answers to these five questions is 3.16 (see Table 6), showing an initial degree of financial literacy a bit higher than samples from other studies¹⁵.

Table 6 – Financial literacy according to the Lusardi-Mitchell questions

¹⁵ A study of Klapper et al. (2015) based on the S&P Financial literacy survey, that includes respondents from more than 100 countries around the world, report average rates of correct answers to the three Lusardi-Mitchell question on Inflation (50%), Compound interest (42%), and Risk diversification (31%), that are lower than those of the respondents of the present study. However, the differences are smaller relying on results from European countries.

| | Correct answer (%) |
|-------------------|--------------------|
| Compound Interest | 70.4% |
| Inflation | 79.6% |
| Bond | 21.1% |
| Mortgage | 64.8% |
| Diversification | 73.5% |

Average number of correct answers **3.16**

(All observations)

Financial Literacy and Financial Education

A first step of the analysis, to assess the effectiveness of the financial education in increasing financial literacy, used the above mentioned RCT methodology. The difference-in-difference analysis tested if the difference between the financial literacy of a group exposed to a financial education experience and the financial literacy of a group that did not (the “control group”) show a statistically significant difference before and after financial education. This approach should be able to isolate the marginal effect of financial education on financial literacy, discounting for other external influences that can affect any group (exposed or control group). Each of the four financial education initiatives, delivered in different manner (face to face class, live streaming class, pre-recorded videos, and edugame), are compared with the control group to test the “difference in the difference” of financial literacy.

An additional analysis worked as robustness test, and used a regression model to test how much the difference in financial literacy between the pre-test and the post-test is affected by the delivery methods (using the group not exposed to any financial education as the control group) and other control variables (gender, to be a top-grade high school student, to have at least one parent graduated).

This step of the analysis was used to address the first research question of the study about the effectiveness of financial education in increasing financial literacy: the chance that only some of the delivery methods in financial education allow to find significant results about the effectiveness of financial education has to be taken into account. If some delivery options would be ineffective, developers of financial education curricula should be discouraged from using such options.

In a second step, the analysis compared groups exposed to financial education between each other, to test if some statistically significant differences between delivery methods of financial education exist or not. The analysis uses the same RCT (“diff-in-diff”) methodology

described above, relating each difference in financial literacy achieved with a certain delivery method (face to face class, live streaming class, etc.) with other delivery methods (e.g. face to face class Vs live streaming class; face to face class Vs pre-recorded videos, etc.). This analysis can help to figure out if some delivery methods is more efficient than others, or if the delivery methods of financial education is not a relevant issue. This point can be pivotal in planning financial education curricula, especially when only some delivery options are available.

Financial Confidence and Financial Education

The next step of the analysis repeated all the comparisons (education Vs control group; education X Vs education Y) replacing the difference in financial literacy with the difference in financial confidence. This analysis assumes that the effect of financial education could not be limited to increase financial literacy: even a change in financial confidence can be a relevant and valuable output of financial education. People could be financially literate, but a low level of financial confidence could refrain them from taking action in their financial lives. Or people could overestimate their abilities and, thanks to financial education, they could correct an over-confidence bias, preventing them to do financial mistakes. The effect of financial education on financial confidence and the differences due to different delivery options of the contents represent an additional research question of the study.

The measure of financial confidence used in this study is the average of the answers to the question “how much confident are you that your answer is the correct one?” proposed after each question of the edugame. The average of the answer coming from the game played before financial education and the average assessed in the answers after financial education were used to test how much financial education can change financial confidence of individuals. Each participant had the chance to answer to the financial confidence question choosing between five options: “I am sure”, “I am very confident”, “I am confident”, “I am not very confident”, “I guess”. Each option was related to a number from one (“I guess”) to five (“I am sure”), making the average of these answers floating between one and five. The values of the confidence index, before (pre-test) and after (post-test) financial education, are listed in Table 7.

Table 7 – Financial confidence score

| 1 | 2 | 3 | 4 | 5 |
|---------|--------------------|-----------|----------------|------|
| I guess | Not very confident | Confident | Very confident | Sure |

Financial Confidence score [1 - 5]

| | Pre-test (Average) | Post-test (Average) | diff. (Post-Pre) | T-test post-pre>0 (p-value) |
|------------------|-----------------------|------------------------|---------------------|--------------------------------|
| Class | 4.263 | 4.837 | 0.574 | 0.007** |
| Streaming | 4.245 | 4.567 | 0.322 | 0.011** |
| Video | 4.097 | 4.661 | 0.564 | 0.000*** |
| Quiz | 4.429 | 4.640 | 0.211 | 0.026** |
| (Control) | 4.047 | 4.481 | 0.435 | 0.017** |
| ALL | 4.230 | 4.670 | 0.440 | 0.000*** |

(137 ← Total Obs. → 89)

Financial Over-confidence

The final step of the analysis addressed simultaneously the change in financial confidence related to the change in financial literacy, both caused by financial education. After rescaling the financial confidence index from one-to-five to zero-to-five, to make it match with the range of the financial literacy index, the ratio between the financial confidence index and the financial literacy index provided a measure of how much people confidence is aligned or not with their financial literacy. A value of the ratio equal to one will show a coherence between people's confidence and knowledge. Values bigger than one will be related to over-confidence (people are too much confident compared to their knowledge). Values smaller than one show under-confidence (people are too few confident compared to their knowledge). This analysis should help to test if the effect of financial education can be expressed in relative terms ("how much financial literacy changes compared on how much financial confidence changes) rather than in absolute terms ("how much financial literacy change" or "how much financial confidence changes").

As in the previous steps of the analysis, a regression model to test the effect on the change in the ratio confidence/literacy before and after financial education (dependent variable) by the delivery methods of financial education (compared to the control group) and socio-demographic variables (gender, to be a top-grade high school student, to have at least one parent graduated) was used as robustness test.

As an exploratory study, there are not expected results, except the fact that, on average, financial education has the potential to increase financial literacy. The chances to find or not differences in the effectiveness of financial education, when different delivery options of the contents are used, are both taken into account. A similar approach regards the analysis of financial education on financial confidence.

4. Results

This section present the results for the different analysis of the study. The first part relates to the effect of financial education on financial literacy. The second part concerns the effects of financial education on financial confidence (including overconfidence).

Financial Literacy and Financial Education

The first set of RCT analysis compared the financial literacy of groups exposed to financial education treatments to the financial literacy of the control group. It follows that there are four set of results, that are listed in Table 8.

Table 8 – RCT results on the effectiveness of financial education (delivered by different options) on financial literacy.

| Face-to-face class Vs control group | | Live-Streaming class Vs control group | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---------|--|--------|----------|--|----------|----|----|----|----------|----|----|----|--|----|----|--|--------------|---------|---------|---|------|---------------|--|--|--|--|---------|-------|--|--|--|---------|-------|--|--|--|------------|-------|-------|------|-------|--------------|--|--|--|--|---------|-------|--|--|--|---------|-------|--|--|--|------------|-------|-------|------|----------|--------------|-------|-------|------|----------|---|--|--|--------|-------|--|----------|----|----|----|----------|----|----|----|--|----|----|--|--------------|---------|---------|---|------|---------------|--|--|--|--|---------|-------|--|--|--|---------|-------|--|--|--|------------|--------|-------|-------|-------|--------------|--|--|--|--|---------|-------|--|--|--|---------|-------|--|--|--|------------|-------|-------|------|----------|--------------|-------|-------|------|----------|
| <p>DIFFERENCE-IN-DIFFERENCES ESTIMATION RESULTS Number of observations in the DIFF-IN-DIFF: 106</p> <table border="1"> <thead> <tr> <th></th> <th>Before</th> <th>After</th> <th></th> </tr> </thead> <tbody> <tr> <td>Control:</td> <td>31</td> <td>31</td> <td>62</td> </tr> <tr> <td>Treated:</td> <td>22</td> <td>22</td> <td>44</td> </tr> <tr> <td></td> <td>53</td> <td>53</td> <td></td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Outcome var.</th> <th>FL5sc-a</th> <th>S. Err.</th> <th> t </th> <th>P> t </th> </tr> </thead> <tbody> <tr> <td colspan="5">Before</td> </tr> <tr> <td>Control</td> <td>1.484</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Treated</td> <td>1.773</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Diff (T-C)</td> <td>0.289</td> <td>0.239</td> <td>1.21</td> <td>0.231</td> </tr> <tr> <td colspan="5">After</td> </tr> <tr> <td>Control</td> <td>1.903</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Treated</td> <td>4.045</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Diff (T-C)</td> <td>2.142</td> <td>0.239</td> <td>8.95</td> <td>0.000***</td> </tr> <tr> <td>Diff-in-Diff</td> <td>1.853</td> <td>0.339</td> <td>5.47</td> <td>0.000***</td> </tr> </tbody> </table> <p>R-square: 0.56 * Means and Standard Errors are estimated by linear regression **Inference: *** p<0.01; ** p<0.05; * p<0.1</p> | | | Before | After | | Control: | 31 | 31 | 62 | Treated: | 22 | 22 | 44 | | 53 | 53 | | Outcome var. | FL5sc-a | S. Err. | t | P> t | Before | | | | | Control | 1.484 | | | | Treated | 1.773 | | | | Diff (T-C) | 0.289 | 0.239 | 1.21 | 0.231 | After | | | | | Control | 1.903 | | | | Treated | 4.045 | | | | Diff (T-C) | 2.142 | 0.239 | 8.95 | 0.000*** | Diff-in-Diff | 1.853 | 0.339 | 5.47 | 0.000*** | <p>DIFFERENCE-IN-DIFFERENCES ESTIMATION RESULTS Number of observations in the DIFF-IN-DIFF: 120</p> <table border="1"> <thead> <tr> <th></th> <th>Before</th> <th>After</th> <th></th> </tr> </thead> <tbody> <tr> <td>Control:</td> <td>31</td> <td>31</td> <td>62</td> </tr> <tr> <td>Treated:</td> <td>29</td> <td>29</td> <td>58</td> </tr> <tr> <td></td> <td>60</td> <td>60</td> <td></td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Outcome var.</th> <th>FL5sc-a</th> <th>S. Err.</th> <th> t </th> <th>P> t </th> </tr> </thead> <tbody> <tr> <td colspan="5">Before</td> </tr> <tr> <td>Control</td> <td>1.484</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Treated</td> <td>1.207</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Diff (T-C)</td> <td>-0.277</td> <td>0.226</td> <td>-1.23</td> <td>0.223</td> </tr> <tr> <td colspan="5">After</td> </tr> <tr> <td>Control</td> <td>1.903</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Treated</td> <td>4.138</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Diff (T-C)</td> <td>2.235</td> <td>0.226</td> <td>9.89</td> <td>0.000***</td> </tr> <tr> <td>Diff-in-Diff</td> <td>2.512</td> <td>0.319</td> <td>7.86</td> <td>0.000***</td> </tr> </tbody> </table> <p>R-square: 0.64 * Means and Standard Errors are estimated by linear regression **Inference: *** p<0.01; ** p<0.05; * p<0.1</p> | | | Before | After | | Control: | 31 | 31 | 62 | Treated: | 29 | 29 | 58 | | 60 | 60 | | Outcome var. | FL5sc-a | S. Err. | t | P> t | Before | | | | | Control | 1.484 | | | | Treated | 1.207 | | | | Diff (T-C) | -0.277 | 0.226 | -1.23 | 0.223 | After | | | | | Control | 1.903 | | | | Treated | 4.138 | | | | Diff (T-C) | 2.235 | 0.226 | 9.89 | 0.000*** | Diff-in-Diff | 2.512 | 0.319 | 7.86 | 0.000*** |
| | Before | After | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Control: | 31 | 31 | 62 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Treated: | 22 | 22 | 44 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 53 | 53 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Outcome var. | FL5sc-a | S. Err. | t | P> t | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Before | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Control | 1.484 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Treated | 1.773 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Diff (T-C) | 0.289 | 0.239 | 1.21 | 0.231 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| After | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Control | 1.903 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Treated | 4.045 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Diff (T-C) | 2.142 | 0.239 | 8.95 | 0.000*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Diff-in-Diff | 1.853 | 0.339 | 5.47 | 0.000*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Before | After | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Control: | 31 | 31 | 62 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Treated: | 29 | 29 | 58 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 60 | 60 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Outcome var. | FL5sc-a | S. Err. | t | P> t | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Before | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Control | 1.484 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Treated | 1.207 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Diff (T-C) | -0.277 | 0.226 | -1.23 | 0.223 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| After | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Control | 1.903 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Treated | 4.138 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Diff (T-C) | 2.235 | 0.226 | 9.89 | 0.000*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Diff-in-Diff | 2.512 | 0.319 | 7.86 | 0.000*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>Pre-recorded videos Vs control group</p> <p>DIFFERENCE-IN-DIFFERENCES ESTIMATION RESULTS Number of observations in the DIFF-IN-DIFF: 120</p> <table border="1"> <thead> <tr> <th></th> <th>Before</th> <th>After</th> <th></th> </tr> </thead> <tbody> <tr> <td>Control:</td> <td>31</td> <td>31</td> <td>62</td> </tr> <tr> <td>Treated:</td> <td>29</td> <td>29</td> <td>58</td> </tr> <tr> <td></td> <td>60</td> <td>60</td> <td></td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Outcome var.</th> <th>FL5sc-a</th> <th>S. Err.</th> <th> t </th> <th>P> t </th> </tr> </thead> <tbody> <tr> <td colspan="5">Before</td> </tr> <tr> <td>Control</td> <td>1.484</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Treated</td> <td>1.586</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Diff (T-C)</td> <td>0.102</td> <td>0.218</td> <td>0.47</td> <td>0.639</td> </tr> <tr> <td colspan="5">After</td> </tr> <tr> <td>Control</td> <td>1.903</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Treated</td> <td>4.034</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Diff (T-C)</td> <td>2.131</td> <td>0.218</td> <td>9.79</td> <td>0.000***</td> </tr> <tr> <td>Diff-in-Diff</td> <td>2.029</td> <td>0.308</td> <td>6.59</td> <td>0.000***</td> </tr> </tbody> </table> <p>R-square: 0.61 * Means and Standard Errors are estimated by linear regression **Inference: *** p<0.01; ** p<0.05; * p<0.1</p> | | | Before | After | | Control: | 31 | 31 | 62 | Treated: | 29 | 29 | 58 | | 60 | 60 | | Outcome var. | FL5sc-a | S. Err. | t | P> t | Before | | | | | Control | 1.484 | | | | Treated | 1.586 | | | | Diff (T-C) | 0.102 | 0.218 | 0.47 | 0.639 | After | | | | | Control | 1.903 | | | | Treated | 4.034 | | | | Diff (T-C) | 2.131 | 0.218 | 9.79 | 0.000*** | Diff-in-Diff | 2.029 | 0.308 | 6.59 | 0.000*** | <p>Edugame Vs control group</p> <p>DIFFERENCE-IN-DIFFERENCES ESTIMATION RESULTS Number of observations in the DIFF-IN-DIFF: 125</p> <table border="1"> <thead> <tr> <th></th> <th>Before</th> <th>After</th> <th></th> </tr> </thead> <tbody> <tr> <td>Control:</td> <td>31</td> <td>31</td> <td>62</td> </tr> <tr> <td>Treated:</td> <td>32</td> <td>31</td> <td>63</td> </tr> <tr> <td></td> <td>63</td> <td>62</td> <td></td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Outcome var.</th> <th>FL5sc-a</th> <th>S. Err.</th> <th> t </th> <th>P> t </th> </tr> </thead> <tbody> <tr> <td colspan="5">Before</td> </tr> <tr> <td>Control</td> <td>1.484</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Treated</td> <td>1.250</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Diff (T-C)</td> <td>-0.234</td> <td>0.244</td> <td>-0.96</td> <td>0.340</td> </tr> <tr> <td colspan="5">After</td> </tr> <tr> <td>Control</td> <td>1.903</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Treated</td> <td>4.355</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Diff (T-C)</td> <td>2.452</td> <td>0.246</td> <td>9.96</td> <td>0.000***</td> </tr> <tr> <td>Diff-in-Diff</td> <td>2.685</td> <td>0.347</td> <td>7.75</td> <td>0.000***</td> </tr> </tbody> </table> <p>R-square: 0.63 * Means and Standard Errors are estimated by linear regression **Inference: *** p<0.01; ** p<0.05; * p<0.1</p> | | | Before | After | | Control: | 31 | 31 | 62 | Treated: | 32 | 31 | 63 | | 63 | 62 | | Outcome var. | FL5sc-a | S. Err. | t | P> t | Before | | | | | Control | 1.484 | | | | Treated | 1.250 | | | | Diff (T-C) | -0.234 | 0.244 | -0.96 | 0.340 | After | | | | | Control | 1.903 | | | | Treated | 4.355 | | | | Diff (T-C) | 2.452 | 0.246 | 9.96 | 0.000*** | Diff-in-Diff | 2.685 | 0.347 | 7.75 | 0.000*** |
| | Before | After | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Control: | 31 | 31 | 62 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Treated: | 29 | 29 | 58 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 60 | 60 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Outcome var. | FL5sc-a | S. Err. | t | P> t | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Before | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Control | 1.484 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Treated | 1.586 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Diff (T-C) | 0.102 | 0.218 | 0.47 | 0.639 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| After | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Control | 1.903 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Treated | 4.034 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Diff (T-C) | 2.131 | 0.218 | 9.79 | 0.000*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Diff-in-Diff | 2.029 | 0.308 | 6.59 | 0.000*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Before | After | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Control: | 31 | 31 | 62 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Treated: | 32 | 31 | 63 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 63 | 62 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Outcome var. | FL5sc-a | S. Err. | t | P> t | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Before | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Control | 1.484 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Treated | 1.250 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Diff (T-C) | -0.234 | 0.244 | -0.96 | 0.340 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| After | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Control | 1.903 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Treated | 4.355 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Diff (T-C) | 2.452 | 0.246 | 9.96 | 0.000*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Diff-in-Diff | 2.685 | 0.347 | 7.75 | 0.000*** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Results show how financial education is always able to (positively) affect financial literacy, regardless the delivery methods used for its contents. The differences between the degree of financial literacy of the two groups (treated and control group) before and after the financial education “treatment” is positive and statistically significant for all the four delivery options. The delivery method that shows the biggest increase in financial literacy – related to the control group – is the edugame. On average the financial literacy of those who played the educational game (quiz) increased 2.685 points more than those that did not receive any financial education. Results for those attending a class in live-streaming are pretty similar, with an average increase of 2.512 points on a scale from zero to five. However, results are positive and statistically significant even for groups that attended a face-to-face class (2.142 points more than the control group) and those who watched pre-recorded videos (2.029 points). Hence, as expected, financial education confirms to be an effective tool to increase financial literacy. This result confirms several previous studies (Fernandes et al., 2014; Xiao and O’Neil, 2016; Lusardi, 2019; Kaiser et al. 2022).

Evidence from a regression analysis with dependent variable the difference between the pre-test and the post-test of each participant, confirms the robustness of the results (see Table 9).

Table 9 – Regression model (OLS) of the pre- post-financial literacy difference of the sample.

| FL_delta | Coeff. | Std.Err. | P-value | Coeff. | Std.Err. | P-value |
|------------------|------------------------|----------|-----------------|------------------------|----------|-----------------|
| Class | 1.626 | 0.285 | 0.000*** | 1.576 | 0.284 | 0.000*** |
| Streaming | 2.097 | 0.264 | 0.000*** | 2.110 | 0.264 | 0.000*** |
| Video | 1.753 | 0.264 | 0.000*** | 1.798 | 0.264 | 0.000*** |
| Quiz | 2.322 | 0.260 | 0.000*** | 2.389 | 0.260 | 0.000*** |
| control | <i>(control group)</i> | | | <i>(control group)</i> | | |
| Gender | | | | 0.183 | 0.177 | 0.303 |
| Topgrade | | | | -0.157 | -0.203 | 0.438 |
| Parentsgrads | | | | -0.287 | 0.175 | 0.105 |
| constant | 0.419 | | 0.024** | 0.488 | 0.233 | 0.038** |
| Obs. | 142 | | | 142 | | |
| R-squared (Adj.) | 0.4173 | | | 0.4104 | | |

The RCT based on the comparison of (a) the increase of financial literacy before and after the case of a certain delivery method (e.g. face to face class) with (b) the increase in financial literacy related to another delivery method (e.g. live streaming class) allowed to test if some delivery options are more effective than others on a statistical term. With four delivery methods available (face-to-face class, live-streaming class, pre-recorded videos, edugame) there are six possible comparisons. Results are reported in Table 10.

Table 10 – RCT results on the comparison of different delivery methods in financial education: the effect on financial literacy

| | | |
|--|---|---|
| <p style="text-align: center;">Face-to-face class Vs Live-Streaming class</p> <pre> DIFFERENCE-IN-DIFFERENCES ESTIMATION RESULTS Number of observations in the DIFF-IN-DIFF: 102 Before After Control: 29 29 58 Treated: 22 22 44 51 ----- Outcome var. flsco-5 S. Err. t P> t ----- Before Control 1.207 Treated 1.773 DIFF (T-C) 0.566 0.260 2.17 0.032** After Control 4.138 Treated 4.045 DIFF (T-C) -0.092 0.260 0.36 0.723 DIFF-in-Diff -0.658 0.368 1.79 0.077* R-square: 0.69 Means and Standard Errors are estimated by linear regression Inference: *** p<0.01; ** p<0.05; * p<0.1 </pre> | | |
| <p style="text-align: center;">Face-to-face class Vs Pre-recorded videos</p> <pre> DIFFERENCE-IN-DIFFERENCES ESTIMATION RESULTS Number of observations in the DIFF-IN-DIFF: 102 Before After Control: 29 29 58 Treated: 22 22 44 51 ----- Outcome var. flsco-5 S. Err. t P> t ----- Before Control 1.586 Treated 0.773 DIFF (T-C) 0.187 0.250 0.75 0.458 After Control 4.034 Treated 4.045 DIFF (T-C) 0.011 0.250 0.04 0.965 DIFF-in-Diff -0.176 0.354 0.50 0.621 R-square: 0.65 Means and Standard Errors are estimated by linear regression Inference: *** p<0.01; ** p<0.05; * p<0.1 </pre> | <p style="text-align: center;">Live-Streaming class Vs Pre-recorded videos</p> <pre> DIFFERENCE-IN-DIFFERENCES ESTIMATION RESULTS Number of observations in the DIFF-IN-DIFF: 116 Before After Control: 29 29 58 Treated: 29 29 58 58 ----- Outcome var. flsco-5 S. Err. t P> t ----- Before Control 1.586 Treated 1.207 DIFF (T-C) -0.379 0.236 -1.61 0.110 After Control 4.034 Treated 4.138 DIFF (T-C) 0.103 0.236 0.44 0.662 DIFF-in-Diff 0.483 0.333 1.45 0.150 R-square: 0.70 Means and Standard Errors are estimated by linear regression Inference: *** p<0.01; ** p<0.05; * p<0.1 </pre> | |
| <p style="text-align: center;">Face-to-face class Vs Edugame</p> <pre> DIFFERENCE-IN-DIFFERENCES ESTIMATION RESULTS Number of observations in the DIFF-IN-DIFF: 107 Before After Control: 32 31 63 Treated: 22 22 44 54 ----- Outcome var. flsco-5 S. Err. t P> t ----- Before Control 1.250 Treated 0.523 DIFF (T-C) 0.727 0.283 2.57 0.011** After Control 4.355 Treated 4.045 DIFF (T-C) 0.310 0.285 1.08 0.281 DIFF-in-Diff -0.832 0.402 2.07 0.041** R-square: 0.66 Means and Standard Errors are estimated by linear regression Inference: *** p<0.01; ** p<0.05; * p<0.1 </pre> | <p style="text-align: center;">Live-Streaming class Vs Edugame</p> <pre> DIFFERENCE-IN-DIFFERENCES ESTIMATION RESULTS Number of observations in the DIFF-IN-DIFF: 121 Before After Control: 32 31 63 Treated: 29 29 58 61 ----- Outcome var. flsco-5 S. Err. t P> t ----- Before Control 1.250 Treated 1.207 DIFF (T-C) -0.043 0.261 -0.17 0.869 After Control 4.355 Treated 4.138 DIFF (T-C) -0.217 0.263 -0.82 0.411 DIFF-in-Diff -0.174 0.371 -0.47 0.640 R-square: 0.70 Means and Standard Errors are estimated by linear regression Inference: *** p<0.01; ** p<0.05; * p<0.1 </pre> | <p style="text-align: center;">Pre-recorded videos Vs Edugame</p> <pre> DIFFERENCE-IN-DIFFERENCES ESTIMATION RESULTS Number of observations in the DIFF-IN-DIFF: 121 Before After Control: 32 31 63 Treated: 29 29 58 61 ----- Outcome var. flsco-5 S. Err. t P> t ----- Before Control 1.250 Treated 1.586 DIFF (T-C) 0.336 0.254 1.32 0.189 After Control 4.355 Treated 4.034 DIFF (T-C) -0.320 0.256 -1.25 0.214 DIFF-in-Diff -0.657 0.361 -1.82 0.072* R-square: 0.67 Means and Standard Errors are estimated by linear regression Inference: *** p<0.01; ** p<0.05; * p<0.1 </pre> |

Results from the one-to-one comparisons of different delivery methods in financial education are interesting. In three (out of six) cases there is a statistically significant difference in the increase of financial literacy. Edugame seems to be more effective than pre-recorded videos. Compared to the latter, participants at the edugame increase their financial literacy on average 0.657 points more than participants that watched videos. At the same time financial education by the edugame increases financial literacy 0.832 points more than attending a course based on face-to-face class. Even a live-streaming class seems to be more effective than a face-to-face class, with a difference of 0.658 points of (additional) increase in financial literacy in favour of the live-streaming option. In the meanwhile, no statistically significant

differences in the increase of financial literacy have been found comparing face-to-face classes and pre-recorded videos; live-streaming classes and pre-recorded videos; and live-streaming classes and edugame. So, the big picture shows that (1) a standard face-to-face class is not the only option to do financial education (and sometime not the most effective), (2) alternative delivery methods of contents can be considered as reliable alternatives (or complements) designing financial education curricula, and (3) no big differences exist adopting different methods in delivering financial education.

Financial Confidence and Financial Education

Result of the RCT methodology based on the difference in financial confidence (not financial literacy) are reported in Table 11.

Table 11 – RCT results on the effectiveness of financial education (delivered by different options) on financial confidence.

| Face-to-face class Vs control group | | | | | Live-Streaming class Vs control group | | | | |
|---|-------|---------|------|-------|---|--------|---------|------|----------|
| DIFFERENCE-IN-DIFFERENCES ESTIMATION RESULTS Number of observations in the DIFF-IN-DIFF: 59 Before After Control: 27 7 34 Treated: 19 6 25 46 13 | | | | | DIFFERENCE-IN-DIFFERENCES ESTIMATION RESULTS Number of observations in the DIFF-IN-DIFF: 86 Before After Control: 27 7 34 Treated: 28 24 52 55 31 | | | | |
| Outcome var. | q8a | S. Err. | t | P> t | Outcome var. | q8a | S. Err. | t | P> t |
| Before | | | | | Before | | | | |
| Control | 4.047 | | | | Control | 4.047 | | | |
| Treated | 4.263 | | | | Treated | 4.245 | | | |
| Diff (T-C) | 0.216 | 0.148 | 1.46 | 0.151 | Diff (T-C) | 0.198 | 0.126 | 1.58 | 0.119 |
| After | | | | | After | | | | |
| Control | 4.481 | | | | Control | 4.481 | | | |
| Treated | 4.837 | | | | Treated | 4.567 | | | |
| Diff (T-C) | 0.355 | 0.275 | 1.29 | 0.202 | Diff (T-C) | 0.086 | 0.200 | 0.43 | 0.668 |
| Diff-in-Diff | 0.139 | 0.313 | 0.45 | 0.658 | Diff-in-Diff | -0.112 | 0.236 | 0.47 | 0.637 |
| R-square: 0.21 | | | | | R-square: 0.17 | | | | |
| * Means and Standard Errors are estimated by linear regression | | | | | * Means and Standard Errors are estimated by linear regression | | | | |
| **Inference: *** p<0.01; ** p<0.05; * p<0.1 | | | | | **Inference: *** p<0.01; ** p<0.05; * p<0.1 | | | | |
| Pre-recorded videos Vs control group | | | | | Edugame Vs control group | | | | |
| DIFFERENCE-IN-DIFFERENCES ESTIMATION RESULTS Number of observations in the DIFF-IN-DIFF: 80 Before After Control: 27 7 34 Treated: 25 21 46 52 28 | | | | | DIFFERENCE-IN-DIFFERENCES ESTIMATION RESULTS Number of observations in the DIFF-IN-DIFF: 93 Before After Control: 27 7 34 Treated: 30 29 59 57 36 | | | | |
| Outcome var. | q8a | S. Err. | t | P> t | Outcome var. | q8a | S. Err. | t | P> t |
| Before | | | | | Before | | | | |
| Control | 4.047 | | | | Control | 4.047 | | | |
| Treated | 4.097 | | | | Treated | 4.429 | | | |
| Diff (T-C) | 0.051 | 0.129 | 0.39 | 0.696 | Diff (T-C) | 0.382 | 0.125 | 3.05 | 0.003*** |
| After | | | | | After | | | | |
| Control | 4.481 | | | | Control | 4.481 | | | |
| Treated | 4.661 | | | | Treated | 4.640 | | | |
| Diff (T-C) | 0.180 | 0.202 | 0.89 | 0.376 | Diff (T-C) | 0.159 | 0.199 | 0.80 | 0.426 |
| Diff-in-Diff | 0.129 | 0.240 | 0.54 | 0.591 | Diff-in-Diff | -0.223 | 0.235 | 0.95 | 0.345 |
| R-square: 0.26 | | | | | R-square: 0.20 | | | | |
| * Means and Standard Errors are estimated by linear regression | | | | | * Means and Standard Errors are estimated by linear regression | | | | |
| **Inference: *** p<0.01; ** p<0.05; * p<0.1 | | | | | **Inference: *** p<0.01; ** p<0.05; * p<0.1 | | | | |

Results on the effectiveness of financial education to affect people’s financial confidence are pretty clear. In all the cases, financial education does not provide a change in financial

confidence that is statistically different from those who did not receive any financial education (control group). However, it has to be noted that the very high confidence of individuals since the beginning of the study – with average values beyond four in a zero-to-five scale – makes the chance to increase financial confidence challenging.

What is more interesting is the analysis of results of the relationship between the change in financial confidence related to the change in financial literacy of individuals. If the ratio of the two (financial confidence divided by financial literacy) makes a value beyond one to be related to over-confidence and a value below one to be related to under-confidence, results on the effect of financial education on the over- under-confidence of the individuals show how people tend to be overconfident, but financial education is able to reduce this misperception reducing the distance between the two values (Table 12).

Table 12 – RCT results on the effectiveness of financial education (delivered by different options) on over-confidence/under-confidence of individuals.

| Face-to-face class Vs control group | Live-Streaming class Vs control group |
|--|--|
| <p>Face-to-face class Vs control group</p> <pre> DIFFERENCE-IN-DIFFERENCES ESTIMATION RESULTS Number of observations in the DIFF-IN-DIFF: 59 Before After Control: 27 7 34 Treated: 19 6 25 46 13 Outcome var. overc~5 S. Err. t P> t Before Control 2.290 Treated 2.341 Diff (T-C) 0.052 0.345 0.15 0.882 After Control 2.352 Treated 0.796 Diff (T-C) -1.556 0.641 2.43 0.019** Diff-in-Diff -1.608 0.728 2.21 0.032** R-square: 0.15 Means and Standard Errors are estimated by linear regression *Inference: *** p<0.01; ** p<0.05; * p<0.1 </pre> | <p>Live-Streaming class Vs control group</p> <pre> DIFFERENCE-IN-DIFFERENCES ESTIMATION RESULTS Number of observations in the DIFF-IN-DIFF: 86 Before After Control: 27 7 34 Treated: 19 24 52 46 31 Outcome var. overc~5 S. Err. t P> t Before Control 2.290 Treated 2.842 Diff (T-C) 0.552 0.272 2.03 0.046** After Control 2.352 Treated 0.418 Diff (T-C) -1.934 0.434 4.46 0.000*** Diff-in-Diff -2.486 0.512 4.85 0.000*** R-square: 0.50 Means and Standard Errors are estimated by linear regression *Inference: *** p<0.01; ** p<0.05; * p<0.1 </pre> |
| <p>Pre-recorded videos Vs control group</p> <pre> DIFFERENCE-IN-DIFFERENCES ESTIMATION RESULTS Number of observations in the DIFF-IN-DIFF: 80 Before After Control: 27 7 34 Treated: 25 21 46 52 28 Outcome var. overc~5 S. Err. t P> t Before Control 2.290 Treated 2.352 Diff (T-C) 0.062 0.267 0.23 0.818 After Control 2.352 Treated 0.672 Diff (T-C) -1.680 0.419 4.00 0.000*** Diff-in-Diff -1.741 0.497 3.50 0.001*** R-square: 0.38 Means and Standard Errors are estimated by linear regression *Inference: *** p<0.01; ** p<0.05; * p<0.1 </pre> | <p>Edugame Vs control group</p> <pre> *Treatment is quiz=g4 (_control control=g0) diff overconf5, t(g4) p(posttest) DIFFERENCE-IN-DIFFERENCES ESTIMATION RESULTS Number of observations in the DIFF-IN-DIFF: 92 Before After Control: 27 7 34 Treated: 30 28 58 57 35 Outcome var. overc~5 S. Err. t P> t Before Control 2.290 Treated 3.020 Diff (T-C) 0.730 0.249 2.93 0.004*** After Control 2.352 Treated -0.037 Diff (T-C) -2.389 0.397 6.02 0.000*** Diff-in-Diff -3.119 0.469 6.66 0.000*** R-square: 0.66 Means and Standard Errors are estimated by linear regression *Inference: *** p<0.01; ** p<0.05; * p<0.1 </pre> |

Financial education reduces the over-confidence (compared to the control group) in all the cases, with strong statistically significant evidence. The biggest effects have been found in

the case of the edugame (-3.119) and live-streaming classes (-2.486), but not negligible effects have been found for face-to-face classes (-1.608) and pre-recorded videos (-1.741) too.

The final step of the analysis addressed the effect on over-confidence by a direct comparison between delivery methods (see Table 13).

Table 13 - RCT results on the comparison of different delivery methods in financial education: the effect on over-confidence.

| | | |
|---|--|---|
| <p style="text-align: center;">Face-to-face class Vs Live-Streaming class</p> <pre> DIFFERENCE-IN-DIFFERENCES ESTIMATION RESULTS number of observations in the DIFF-IN-DIFF: 77 before after Control: 28 24 52 Treated: 19 6 25 47 30 Outcome var. overc-5 S. Err. t P> t before Control 2.842 Treated 2.341 Diff (T-C) -0.500 0.343 -1.46 0.149 after Control 0.418 Treated 0.796 Diff (T-C) 0.378 0.527 0.72 0.475 Diff-in-Diff 0.878 0.629 1.40 0.167 R-square: 0.47 Means and Standard Errors are estimated by linear regression *Inference: *** p<0.01; ** p<0.05; * p<0.1 </pre> | | |
| <p style="text-align: center;">Face-to-face class Vs Pre-recorded videos</p> <pre> DIFFERENCE-IN-DIFFERENCES ESTIMATION RESULTS number of observations in the DIFF-IN-DIFF: 71 before after Control: 25 21 46 Treated: 19 6 25 44 27 Outcome var. overc-5 S. Err. t P> t before Control 2.352 Treated 2.341 Diff (T-C) -0.010 0.341 -0.03 0.977 after Control 0.672 Treated 0.796 Diff (T-C) 0.124 0.518 0.24 0.812 Diff-in-Diff 0.134 0.620 0.22 0.830 R-square: 0.35 Means and Standard Errors are estimated by linear regression *Inference: *** p<0.01; ** p<0.05; * p<0.1 </pre> | <p style="text-align: center;">Live-Streaming class Vs Pre-recorded videos</p> <pre> DIFFERENCE-IN-DIFFERENCES ESTIMATION RESULTS number of observations in the DIFF-IN-DIFF: 83 before after Control: 30 28 58 Treated: 19 6 25 49 34 Outcome var. overc-5 S. Err. t P> t before Control 3.020 Treated 2.341 Diff (T-C) -0.678 0.315 -2.15 0.035** after Control -0.037 Treated 0.796 Diff (T-C) 0.833 0.484 1.72 0.089* Diff-in-Diff 1.511 0.578 2.62 0.011** R-square: 0.62 Means and Standard Errors are estimated by linear regression *Inference: *** p<0.01; ** p<0.05; * p<0.1 </pre> | |
| <p style="text-align: center;">Face-to-face class Vs Edugame</p> <pre> DIFFERENCE-IN-DIFFERENCES ESTIMATION RESULTS number of observations in the DIFF-IN-DIFF: 98 before after Control: 25 21 46 Treated: 28 24 52 53 45 Outcome var. overc-5 S. Err. t P> t before Control 2.352 Treated 2.842 Diff (T-C) 0.490 0.276 1.78 0.079* after Control 0.672 Treated 0.418 Diff (T-C) -0.254 0.300 0.85 0.398 Diff-in-Diff -0.744 0.407 1.83 0.071* R-square: 0.53 Means and Standard Errors are estimated by linear regression *Inference: *** p<0.01; ** p<0.05; * p<0.1 </pre> | <p style="text-align: center;">Live-Streaming class Vs Edugame</p> <pre> DIFFERENCE-IN-DIFFERENCES ESTIMATION RESULTS number of observations in the DIFF-IN-DIFF: 110 before after Control: 30 28 58 Treated: 28 24 52 58 52 Outcome var. overc-5 S. Err. t P> t before Control 3.020 Treated 2.842 Diff (T-C) -0.178 0.258 -0.69 0.491 after Control -0.037 Treated 0.418 Diff (T-C) 0.455 0.273 1.67 0.098* Diff-in-Diff 0.633 0.375 1.69 0.095* R-square: 0.68 Means and Standard Errors are estimated by linear regression *Inference: *** p<0.01; ** p<0.05; * p<0.1 </pre> | <p style="text-align: center;">Pre-recorded videos Vs Edugame</p> <pre> DIFFERENCE-IN-DIFFERENCES ESTIMATION RESULTS number of observations in the DIFF-IN-DIFF: 104 before after Control: 30 28 58 Treated: 25 21 46 55 49 Outcome var. overc-5 S. Err. t P> t before Control 3.020 Treated 2.352 Diff (T-C) -0.668 0.255 -2.62 0.010** after Control -0.037 Treated 0.672 Diff (T-C) 0.709 0.272 2.61 0.010** Diff-in-Diff 1.377 0.372 3.70 0.000*** R-square: 0.65 Means and Standard Errors are estimated by linear regression *Inference: *** p<0.01; ** p<0.05; * p<0.1 </pre> |

The edugame is the learning option that reduces overconfidence more than others. Participants exposed to the edugame treatment reduces their overconfidence more than a face-to-face class (-1.511), live-streaming class (-0.633), and pre-recorded videos (-1.377). The fact that playing a game and answering questions there is an immediate feedback about

own financial knowledge (answers can be right or wrong), while other delivery methods of contents separate learning from assessment of knowledge, can be a possible explanation of the big down shift in overconfidence in the case of the edugame. From the other comparisons, the live-streaming class seems to be more effective than pre-recorded videos in decreasing the over-confidence (-0.744), while no statistically significant differences exist between face-to-face classes and live-streaming, and face-to-face classes and pre-recorded videos. Results from a regression analysis with the change in overconfidence (before and after financial education) as dependent variable, and the delivery methods of contents as explanatory variables, with sociodemographic variable as additional control variables, confirm the effectiveness of edugame (quiz) and live-streaming class in reducing overconfidence (Table 14).

Table 14 - Regression model (OLS) of the pre- post-financial confidence difference of the sample.

| Overconfidence_delta | Coeff. | Std.Err. | P-value | Coeff. | Std.Err. | P-value |
|----------------------|------------------------|----------|-----------------|------------------------|----------|-----------------|
| Class | -2.290 | 0.665 | 0.001*** | -2.181 | 0.691 | 0.002** |
| Streaming | -2.577 | 0.514 | 0.000*** | -2.558 | 0.527 | 0.000*** |
| Video | -1.627 | 0.529 | 0.003** | -1.637 | 0.543 | 0.004** |
| Quiz | -3.003 | 0.507 | 0.000*** | -3.019 | 0.514 | 0.000*** |
| control | <i>(control group)</i> | | | <i>(control group)</i> | | |
| Gender | | | | -0.82 | 0.280 | 0.769 |
| Topgrade | | | | 0.226 | 0.317 | 0.479 |
| Parentsgrads | | | | 0.284 | 0.281 | 0.315 |
| constant | 0.030 | 0.452 | 0.947 | -0.146 | 0.546 | 0.790 |
| Obs. | 83 | | | 83 | | |
| R-squared (Adj.) | 0.3188 | | | 0.3114 | | |

5. Conclusions

This study aimed to assess how different educational content delivery options affect the learning outcome of a financial education curriculum. The analysis paid attention to the effect of delivery options on financial literacy, on financial confidence, and on the relationship between the two, analysing over-confidence. A first step of the analysis confirmed how financial education is able to increase financial literacy, regardless the delivery method used in the financial education curricula. A second step made one-to-one comparisons between

delivery options. Results show how the use of educational games (“edugame”) is not only a valid alternative (or complement) to standard face-to-face classes, but it can be more effective than other delivery methods, including face-to-face classes and pre-recorded videos. Live-streaming classes seems to be a reliable delivery option too, especially compared to a face-to-face class.

The second part of the study addressed the effect that financial education can have on financial confidence (instead of financial literacy). Results did not provide any evidence about a potential increase of financial confidence thanks to financial education. The fact that individuals of the sample had a very high confidence level since the beginning of the study can be a possible explanation of this result. The combination of the change in financial literacy with the change in financial confidence allowed to address another critical point of financial education: the over-confidence of individuals. The ration between people’s financial confidence and people financial literacy allows to test if people are over-confident (ratio bigger than one), underconfident (ration smaller than one), or if people are aware about their financial knowledge and abilities. Results have shown how attending a financial education curriculum reduce the over-confidence of individuals in any case, regardless the delivery method of contents used in the study (face-to-face class, live-streaming class, etc.). The one-to-one comparison between delivery methods has shown how the edugame was the options that reduced overconfidence more than others. In all the comparison (face-to-face class, live-streaming class, pre-recorded videos) it has been found that the users of the edugame had a statistically significant bigger reduction in overconfidence compared to their peers.

The results of the study are not only interesting from an academic point of view, but they involve several **policy implications** for both financial educators and policy makers. First, financial educators should not worry using a delivery method that is not an in-person class. Based on the findings of the study, alternative options may work even better than a class in improving the level of financial literacy and decreasing financial overconfidence. All delivery methods used to impart financial knowledge worked in decreasing financial overconfidence, as individual’s may have learnt that they need to learn, or, at least, gaining financial knowledge has helped them to realistically assess their prior knowledge so that they no longer think that they are automatically a financial genius just by attending a class or a course. Therefore, there is no risk of boosting financial overconfidence by financial education. Second, regarding the role of interaction and engagement in learning, we provide additional evidence that individuals may learn more when they are more engaged or more focuses. A

quiz allows one to set their own pace and thus the pace of their own learning progress, whereas in a classroom there may be more distractions than in a quiz.

Third, familiarity with the respective medium or delivery method seems to play a role. At least since the pandemic and the need to homeschool and study remotely, students are much more likely to be online when they learn than they were just a few years ago. They may even feel more comfortable in an online learning environment than in a classroom. Online learning often allows students to learn at their own pace. Nowadays, not only learning is more individualized but also many other areas of daily life (e.g., streaming services, media libraries and podcasts, but also online banking and delivery services). If content is not well understood, it is possible to stop, go back to the relevant point, and repeat it as often as needed. In a face-to-face course with a teacher, a break or a repetition is not possible. However, the evidence that different delivery options for financial education contents exist (and work well), does not mean that they represent only “alternative options”. The results of the present study can be used to support the development of financial education curricula that use multiple deliver options, using – for instance – classes for contents that require or take benefit from the interaction between participants, and let people to develop their own skills and attitude by individual work (e.g. educational games, simulation, etc.).

Fourth, the need for including and promoting alternative delivery methods for building a financial education curriculum is evident. Since we can provide evidence that a quiz is effective in improving financial knowledge, ideas and initiatives for financial education apps should also be supported, where people can spend even just a few minutes per day, but learn something in smaller learning units (e.g., playing an app on the metro, playing the app on a couch). Spending just a few minutes a day on a complex subject may be more promising and likely than spending a whole day taking a finance course. From an educational perspective, to provide a financial education curriculum, being aware that people can learn just a bit, but being aware that is very likely that people will complete the curriculum, is better than to provide a full and comprehensive financial education curriculum with the risk to attract only a small number of attendees. Perhaps smaller, but daily learning sessions of financial literacy can be even better integrated into many people's daily lives.

Finally, the aspect of identifying least costly programs and the cost-benefit aspect of financial education programs mentioned by Goyal and Kumar (2020) should be addressed. In developing countries, this topic of is still in its infancy. Much needs to be performed on the subject matter to enhance policy initiatives on financial education in developing countries. Our evidence that the variety of methods achieve similar knowledge gains, and that some of

them are much cheaper and can reach a much larger number of people than others, makes a strong case for relying on digital learning environments, particularly in low-income countries and remote areas.

Despite the findings and contributions, there are **limitations** to the study. First, the scope of the study is limited, as it only focuses on freshmen students from a department of Economics who study a bachelor's degree entirely taught in English in a country where English is not the local language. The external validity of the study can be very limited if referred to the general population. An extension of the result to young adults can be more reliable. Second, the sample size used in this study is relatively small, meaning that the results may not be generalizable to a larger population. However, from a statistical point of view, the small number of observations usually is a source of concern, because a relationship between variable can exist, but not evident from the application of statistical models. The fact that, even with a small sample, results are statistically significant and robust is an encouraging result. Furthermore, the study may have a country bias. In other countries, the success or failure of the delivery methods used may have different outcomes. Finally, the data utilized in this study are cross-sectional, so an argument could be made that the results are contextually bound to the time in which the data were collected. A longitudinal analysis would have provided a more complete picture of the delivery methods' effectiveness over time and the decay of treatment effects over time that was described in other studies. Future research would benefit from reexamining this study's findings using a broader set of financial topics and measuring the level of financial literacy at several points in time after the intervention.

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