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Can artificial intelligence help improve the financial literacy of primary schools' students?

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Abstract

The paper reports the results of an experiment designed to compare the impact on financial literacy skills of primary school students of a switch from a traditional pedagogical approach supported by textbooks to one relying on AI-supported methods favouring the gamification of the learning process. The study focuses on 152 students aged 8 to 11 distributed across six classes in a Bulgarian public school. The results show an important statistically significant literacy improvement for the treatment group. It also discusses the contextual dimensions accounted for in control variables that may lead to outcome differences according to the families' socio-economic background.

CREFS references: Education, Economie financière, Protocole d'expérimentation

JEL codes : A20, G1, G5, I2, O3, P46

Key words: Artificial Intelligence, Education and Training, Financial Markets, Household Finance

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1. Introduction

Despite growing international recognition of the importance of financial literacy as a key 21st-century life skill, many students still leave primary and high school with limited understanding of "how money works". This paper reports the results of an experiment conducted during the 2024-2025 academic year in a public primary school in Bulgaria to test a new pedagogical approach aiming at improving the effectiveness of financial literacy teaching.[1] The new approach relies on a gamification of learning methods supported by artificial intelligence (AI). The analysis of the effectiveness of the new approach allowing more creative approaches to teaching is based on a comparison of the short term effects of the financial literacy scores achieved by students that followed the traditional and the new teaching approach. The measure of the impact of the alternative approach relies on a Difference-in-Differences estimation, relying also on student-level controls suggested by a review of the literature.

The analysis shows that the experiment delivers important statistically significant improvements in the absolute and relative average level of financial literacy achieved by the students in the treatment group when compared to those achieved by students in the control group. The results also hint at suggestions to ensure that the new approach allows students from less favoured socio-economically families to offset some, although not all, of their comparative financial literacy disadvantage resulting from a lower exposure to traditional and digital financial concepts and tools. Improving their financial literacy is needed to reduce their odds of being caught up in scams and other risks linked to the growing digitalization of financial transactions.

The empirical results reported in the paper add to the growing evidence at the primary school level of a positive effect of financial literacy classes summarized by Frisancho (2020), Kaiser and Menkhoff (2020), Kaiser and Lusardi (2024), Lusardi and Mitchell (2023) or Lukas and Lukas (2024). When there is a willingness of the authorities to invest in financial literacy programs, the traditional pedagogical approaches can already make a difference— although there are some exceptions such as Berry et al. (2018) for instance. But most importantly, this paper adds evidence to the suggestion made by these authors that an AI anchored gamification approach could do even better.

Currently, financial literacy levels are insufficient in many countries. The OECD's Programme for International Student Assessment (PISA) 2022 students' knowledge evaluation in 14 countries showed that an average of 18% struggled with basic financial tasks (OECD, 2024). A possible explanation is that financial topics are still often poorly integrated, treated as abstract, or presented through passive methods that fail to engage many young learners as they are often disconnected from students' everyday experiences. A second explanation is that not all students start with the same initial conditions in their ability to learn financial concepts. For instance, less favoured families often do not have steady access to laptops, tablets, or the internet while these accessories are needed to allow their children to be exposed to the increased digitalisation of finances. This helps understand why the reviews by Kaiser and Menkhoff (2017, 2020), for instance, found a smaller positive impact of financial education for lower-income groups. These conclusions are particularly true for the primary school students, the age group covered here.

These two explanations help make the case for the potential desirability of a change in the way financial literacy is being taught. Here we focus on the potential impact of a stronger role for digital technologies, including a stronger role for AI, in the development of the financial literacy class material. The idea is to increase the opportunities for interactive and playful teaching and learning as suggested by Eutsler et al (2020) and Cordova et al. (2024). It can make a difference across age and income groups. These approaches can also be designed to ease the adaptation and training of teachers and of the learning approaches to culture and socio-economic contexts. Gajic and De Rosa (2022), for instance, shows that countries in South-Eastern Europe that adopted innovative financial education tools—such as mobile apps, storytelling formats, or digital games—experienced more promising results compared to those relying on static curricula.

[1] The experiment is described in full details in Doseva (2025)

The returns across socio-economic groups to the gamification of financial education, including in the context of online applications, has been quantitatively estimated by a few authors in a wide range of case studies since 2020 (Agasisti et al. (2022), Batty et al. (2020), French et al. (2020), Iterbeke et al. (2020), Kalmi and Rahko (2022), Rodriguez-Raga and Martinez-Camelo (2022), Sconti (2022), Signorini (2022) and Cannistra et al. (2024)). One subtle lesson from a review of this evidence is that their effectiveness depends on the extent to which they were properly tailored to match local contexts as discussed by Ross (2020) or Polly et al. (2021).

Particularly in primary schools, these alternative approaches have to internalize the challenges imposed by the need to deal with students of very different background and teachers with very different affinities with new technologies. And this is where a rational use of AI as part of a gamified approach to learning can help. It can do so, at a relatively low cost, for the design of the class material and make the most of the teachers' creativity. AI can be used to help young learners not only to understand financial concepts better but also to become more critical, confident, and resilient in real-life financial situations. The approach teaches general abstract concepts like money, saving, or budgeting through cases from examples anchored in the students' own needs, experiences, and ways of understanding the world. It is also designed to avoid excessive additional preparation time for teachers as compared to the more traditional approaches.

With this context in mind, the analysis of this experiment contributes to the literature on the effectiveness of financial literacy programmes in primary school in three main ways. First, it illustrates in a concrete case how to design and to implement a new creative pedagogical method relying on AI. Second, it provides quantitative evidence on the absolute and relative effectiveness of the suggested new approach. Third, it allows an evidence based discussion of the scope and limits of the margin it has to help reduce the financial literacy gap of the less advantaged socio-economic students.

The remainder of the paper is organized as follows. Section 2 summarizes the research on the potential role of AI in financial literacy programs. Section 3 explains the Bulgarian context. Section 4 describes the experiment. Section 5 discusses the results and possible policy oriented interpretations in the Bulgarian context as well as the limitations of the experiment. Section 6 summarizes the "take-aways" that go beyond the specific Bulgarian case study. Section 7 concludes.

2. The potential role of technology and AI in financial education

Cordova et al. (2024) and many other earlier studies provide evidence that technology-enhanced learning environments increase students' motivation and understanding when financial concepts are presented through interactive tools and simulations. Bukvić (2022), for instance, explains in detail how machine learning and big data enable financial education to shift from general instruction to highly adapted learning experiences. She shows that AI-powered educational environments, by supporting personalized learning, help students better understand key financial concepts through adaptive simulations and scenario-based tasks.

The AI platforms also ease the efforts made by teachers interested in designing realistic financial scenarios to teach complex concepts—such as budgeting, investing, or recognizing fraudulent behaviour—in a personalized and controlled environment. Simulations make abstract concepts more tangible and can be adjusted to different learning paces and preferences. AI tools also have the advantage of tracking students' choices and adapting future tasks at individual level, offering a personalized educational pathway that traditional classroom teaching often cannot provide. Through data-driven algorithms, students can as well receive instant feedback, reinforcement of key concepts, and practice with dynamic simulations.

From a viewpoint more focused on the social role of education, introducing these tools through school initiatives offers a potential way to help reduce disparities in digital financial exposure. But this requires measures to ensure broader access to digital devices and stable internet connections at home. Unless access gaps are addressed, technology-based learning may end up making existing inequalities worse instead of reducing them. As suggested by OECD (2023), policy discussions on

digital equity have to be part of the efforts to combine AI-supported or gamified educational programs. This concern also needs to be internalized in school-based initiatives trials and evaluations such as the one described in this paper.

Harrison, Shaw, and Ansell's (2023), among others, add the importance of involving parents in the implementation of the literacy programs. While digital interventions can function independently, those that engage families tend to produce longer-lasting knowledge gains. The authors recommend companion materials that encourage dialogue between students and caregivers. In some cases, there may even be a need for complementary parent education programs to ensure that caregivers themselves feel equipped to support their children's financial learning.

While quite generally enthusiastic about the potential learning impact the new technologies can have, the literature is also quite aware of the challenges to changes. Lukas and Lukas (2024), for instance, argue that digital immersion can lead to impulsive online behaviour—including overspending or mis-spending—especially in the absence of proper financial education. AI-based activities can be used to tackle these types of risks, with, for instance, interactive lessons on scams, targeted marketing, and informed spending. This concern is addressed partially in the experiment.

3. The Bulgarian Context

Bulgaria presents clear regional disparities in terms of educational and economic development. Sofia, the capital, benefits from greater investments in infrastructure, access to digital technologies, and better teacher availability. In contrast, rural and smaller urban areas face persistent challenges including underfunded schools, limited exposure to digital payment systems, and reduced parental familiarity with banking practices. These differences result in unequal access to financial learning opportunities, especially for students in lower-income households (European Commission, 2020; OECD, 2023).

These differences are often correlated with those observed in maths skills evaluations. Indeed, in Bugaria, in particular, financial concepts are taught as an application of maths skills as part of the subject "*Technologies and Entrepreneurship*" since 2013. The content related to money is limited to basic calculations, such as adding or subtracting coins, and perceived as quite disconnected from everyday life. The fact that only 5% of students from the bottom socioeconomic quartile reached high achievement levels in mathematics, compared to 20% of students in the top quartile (OECD (2023)) suggests that the poor performance in both math and financial literacy is more than a simple coincidence. And the main risk associated with an inability to address the differences in learning these topics across socio-economic groups may contribute to the students' disengagement in a primary school (Foy (2018) or Skagerlund et al. (2018)).

Part of the difficulty may be that the classes are taught mostly through textbooks from Grades 1 to 4 (age to 7 to 11 years old) with a fairly conceptual content not designed to target these differences across students. In Grade 2 (around age 8-9), all students are introduced to the concepts of needs and wants, family expenses, and community job roles. In Grade 3 (around age 9-10), lessons cover smart spending, advertising, retail environments, and different professions. In Grade 4 (around age 10-11), the curriculum expands to cover topics such as taxes, the role of banks, the use of bank cards, digital payment tools, and money circulation. In all three grades, getting all children to learn as well from a standardized textbook approach may be a challenge when their backgrounds are very heterogeneous. And this may be all the more challenging when teachers are not trained or expected to adjust a material that may be perceived to be complex by some. The importance of the role and the perspective of teachers is not formally tracked in the Bulgarian system. However, interviews of six teachers described in Doseva (2025) suggest that the subject *Technologies and Entrepreneurship* is often treated as low-priority, particularly because it is not evaluated and has no formal examinations.

To complement these descriptions of the system available from official and informal sources, Doseva (2025) relied on additional informal pre-experience interviews with students. The idea was to identify other possible sources of the poor PISA performance on financial literacy tests. The

small-scale exploratory phase was conducted with a group of 15 Bulgarian students aged 8 to 11 from various schools—mostly from Sofia, but also from smaller towns and villages to account for the diversity socioeconomic backgrounds. While the sample was small and lacked statistical robustness, it helped inform the new design on how students of this age group perceive financial topics, what prior knowledge they had, how they prefer to learn, and how their interests could inform the design of AI-based and creativity-driven educational tools. It also validated the teachers' interviews since the majority of the students confirmed that financial literacy had received little attention in class. Many could not recall any structured lessons about money, banks, or budgeting. And several disliked money-related questions because they reminded them of maths problems.

A few common biases and misunderstandings are worth mentioning to highlight some of the challenges that any pedagogical tool is likely to have to face and that the test questionnaire would have to internalize. The main ones are that: (i) many students believed that adults have unlimited money; (ii) some thought that banks simply "give you money for free"; (iii) credit cards were often described as "magic cards,"; (iv) there was no understanding of interest, debt or taxes; (v) some have never seen an ATM or digital payment in use, as their parents primarily used cash; (vi) some knew "bad people" exist online although they could not clearly identify scams or financial dangers, (vii) girls and boys did not have the same concerns linked to finance, and (viii) several of them occasionally discussed money with grandparents who often have an important role in their life.

These informal interviews also helped get a sense of existing preferences among the students with respect to tools that could be used in any effort to redesign financial literacy classes. Most were familiar with advanced uses of phones and tablets. And most were influenced on various dimensions by their favourite fictional characters, YouTubers, and games. This suggested that references to these figures could be used to increase engagement and retention.

Additional suggestions of possible drivers of the gaps and of solution paths used in the design of the experiment were provided by the Financial Competence Framework for Children and Youth in the European Union (EU/OECD, 2023). Considered jointly, the various sources of information directly informed the design approach behind the AI-enhanced and creativity-driven activities used in the classroom experiment analysed here.

4. The experiment [2]

This section starts with a general description of the experiment. It then reviews the process that guided the preparation of the new teaching material used in the experiment. It continues with a discussion of the pre-and post-class questionnaires and related material. [3] It ends with an initial basic statistical discussion of the data generated by the questionnaires.

4.1 General idea

The paper relies on a quasi-experimental intervention in a school selected for its representative profile. It is located in peripheral neighbourhood of Sofia and draws students from both lower-income households (including from nearby villages) and middle-income families (more urban). This socioeconomic diversity made it an ideal setting for testing financial education tools designed to be inclusive and adaptable. Overall, 152 students aged between 8 and 11 distributed across six classes covering Grades 2, 3, and 4 were part of the experiment. About 49% were boys and 51% girls.

Randomization occurred at the class level. Within each grade level, one class was randomly assigned to the treatment group, while the other was assigned to the control group. The class distribution is reported in Table 1. The school director and teachers confirmed that this distribution reflects a typical classroom size and demographic profile in Bulgaria.

The control group followed the standard curriculum while the treatment group covered the same topics through AI-enhanced and specially designed creative activities using simulations, games and storytelling. The treatment included drawing personalized currency, role-playing with bank cards,

[2] This section is largely a summary of the detailed description provided by Doseva (2025)

[3] The detailed questionnaires are available in Appendix.1

participating in budgeting simulations, and using AI-generated ads and Chabot scenarios to explore online financial risks. Overall, the approach allows an assessment for each topic of interest of what is taught or how it is taught, especially in contexts in which traditional delivery fails to maintain student interest or produce lasting knowledge.

Table 1: Sample description

Class	Size	Group	Boys	Girls
2A	26	Treatment	11	15
2B	24	Control	10	14
3A	25	Treatment	11	14
3B	28	Control	16	12
4A	23	Treatment	12	11
4B	26	Control	14	12
TOTAL	152		74	78

All activities were delivered within a one-month period, with efforts made to ensure consistency across all classes. The treatment group received four financial literacy sessions delivered by the researcher. The control group, in contrast, was taught their regular classroom teachers using the official curriculum and textbook materials—covering the same financial literacy themes, but without the AI or the related creative elements. In both groups, the financial literacy content was condensed to focus intensively on the same core topics, ensuring comparability in content coverage while isolating the difference in instructional approach.

Both groups of students completed a pre- and a post-class questionnaire. The questionnaires collect detailed information on family background, basic familiarity with financial concepts before taking the class and access to modern technologies. They show that the students of this sample had varying levels of prior exposure to financial topics, technology, and family financial practices. The answers to the conceptual questions before and after the classes served as the main source of data for comparing their financial knowledge before and after the activities while the answers to the background questions were used to construct control variables in the econometric work.

To prepare and personalize the learning experience and boost engagement, information about each child's interests was also collected. The students were asked to write and draw their favourite games, foods, shows, characters, and career goals. With these responses, an AI model was used to identify the most common preferences in each class (OpenAI, 2024). This approach allowed the preparation of a questionnaire more engaging and accessible for students—especially younger ones who may still struggle with reading or interpreting written questions. In practice, this means that each question was accompanied by a visual illustration—a picture or a drawing. The images were generated or selected to match the question content closely, helping students better understand the meaning and reduce the risk of confusion or misinterpretation. Most images were created using Adobe Firefly (Adobe, 2025), while additional visuals were adapted from educational resources by Shusterman (2018) and Business Standard (2020).

Minor adjustments were made to the AI suggested outputs to ensure the proper matching with the Bulgarian context or to simplify some of the narrative to match the age groups as effectively as possible. But globally, the AI suggestions directly guided the visual content, examples, and characters used in both creative and AI-driven activities. The tailoring to each age group allowed students to interact through familiar themes and figures they admire. The activities were aligned with the needs identified in the literature—especially the need to reach disadvantaged students, who may lack digital exposure or prior financial experience.

The experiment was structured to reflect the realities of classroom implementation. All students participated in the intervention during school hours, and any child who was absent for a session was individually supported to ensure there was no missing data in the outcome measurements. There were no major external factors disrupting the delivery of the program.

The results were complemented by direct feedback from participants. Teachers noted that students in the treatment group engaged more deeply and retained content better, while parents and grandparents described how the activities encouraged real conversations at home. The students referred to images, characters, and AI-generated stories when explaining what they had learned, showing the role of personalization in memory and motivation.

4.2 Details on the preparation of the experiment

The experiment included three different core activities: (i) creative classroom-based activities, (ii) AI-enhanced simulations, and (iii) a final take-home family task. While the creative elements allowed students to learn through drawing, acting, and playing, the AI-based components were designed to strengthen critical thinking and digital literacy. Each activity targeted the same curriculum objectives as the control group, but was taught through methods designed to better fit the learning style and environment of today's digitally engaged children.

The first activity focused on Do-it-yourself money (DIY money), smart shopping & banking simulation. It was spread across three sessions: (i) creating currency and introducing core concepts; (ii) bank cards, digital payments, and understanding institution, and (iii) simulated scenarios and budgeting practice. They were designed to provide the students with a practical, immersive learning experience where they could explore core financial topics in a playful and creative way. The financial concepts covered were those taught as part of the standard Bulgarian curriculum but were delivered through alternative methods following a more engaging format.

In the session on creating a currency and learning core concepts, the students were invited to create their own currency—banknotes, coins, or digital tokens—using paper, colour pencils, and stickers. This allowed a discussion of essential financial themes such as the existence of different currencies around the world, the role of money in households, and how people earn money through different types of jobs. It also allowed a discussion of the difference between *needs* and *wants,* using examples the students could relate to (e.g. food vs. toys).

In the session on bank cards, digital payments and institutions, students learned the differences between cash and card payments and the role of banks. This was done through visuals featuring their favourite characters. Students created their own *banking cards* using cardboard and drawings, and personalized their card with colours and names. The session also allowed a link between the role of banks, ATM and cards. The interactions were used to discuss, in an age-appropriate way, the concepts of needs and wants. They also helped increase the awareness of the sensitivity of some information, the need to understand the growing risks of scams and, more generally, the risks of having to deal with "bad people online".

The session on simulations introduced real-life situations. Each child was given a fictional profile: some acted as parents receiving salaries, others as retirees receiving pensions, while others yet had freelance-type jobs. They were told to go to an "ATM station" in the classroom to withdraw money and then make purchasing decisions for a weekly budget. The simulation included real-world categories: food, clothing, household bills, and leisure items. Students had to prioritize what to buy first when to save, and when it might be appropriate to borrow. Some role-play examples included: "You are a parent with two children—how much do you spend on food before buying a toy?" or "You received your salary; what bills must be paid before going to the cinema?" These simulations made the abstract concepts of budgeting and prioritizing much more tangible and relatable.

Throughout these three sets of interactions, students learned the usual material taught in the financial literacy classes taught with a textbook in the control group—jobs, income, needs vs. wants, payment types, taxes, and budgeting. But while the students in the control group were longer passive recipients of information, the approach adopted here allows those in the treatment group to become actors in the learning and in the use of concepts, within realistic financial environments.

The second main activity, building on the previous sessions, explored how advertising, online scams, and misinformation are becoming central issues in modern financial behaviour. It also

served as a practical introduction to AI and a reflection on how technology and emotional intelligence must go hand in hand. The session began with an interactive presentation created using AI (OpenAI, 2024). The content, adapted to each class's interests (based on the "All About Me" worksheets), featured popular YouTubers, singers, or fictional characters the students recognized and trusted. These characters "spoke" to the students through personalized slides to explain what advertising is, how marketers use emotional triggers, and how some scammers copy advertising strategies to trick people. The activity focused on how to recognize suspicious phrases such as "only today," "win instantly," or "enter your card to receive a free gift".

To allow a more concrete sense of risks and to allow discussion of red flags —such as fake logos or unrealistic prices—, the class relied on AI-generated fake advertisements, customized to their interests—such as "limited edition Harry Potter wand for just €1". To make the experience even more immersive, an AI chatbot walked students through different scenarios and asked them to explain their reasoning (OpenAI, 2024): *Why does this ad seem fake? What would happen if someone believed it?*

At the end of this module, the class was invited to create their own advertisement with a clear and honest message that would not mislead the consumer. These interactions were complemented by an activity called "*Fact or Fake?*". Students were asked to read or listen to very short stories—one real and one fake—and to explain which one they believed and why. It was a practical way to show them how AI tools can both help and deceive—and that being critical and thoughtful matters. It also allowed the teacher to discuss the need to see that they must develop the human skills that machines cannot replicate (e.g. empathy or emotional intelligence).

One final activity was assigned as a take-home task. Studies have shown that children are more likely to develop long lasting financial skills and habits when families actively discuss money-related topics at home (Batty et al. (2015) and OECD, 2023)). Each child received a personalized financial scenario**,** generated by AI using the responses from the "All About Me" worksheet (Canva, 2024). These scenarios included familiar references—favourite foods, games, or characters—and presented a problem that had to be solved in collaboration with a parent or caregiver. For example, a student who enjoyed *Harry Potter* might be asked to choose between saving for a themed experience or helping his/her family with a larger household expense. Students were encouraged to discuss the options, negotiate, and explain their reasoning together with an adult. They were not evaluated on the "correctness" of their answers but on whether they could reason, justify their choices, and engage with real-life financial logic in a supportive environment.

4.3 **Details on the questionnaires and their preparation**

A key component of the experiment was to document, based on the earlier review of the literature, key background variables that could influence financial understanding and the choice of pedagogical tools. The literature points to the following individual characteristics of each student: (i) gender, (ii) age (to account for developmental differences in cognitive capacity and exposure to financial concepts), (iii) the frequency of discussions of money at home (to measure pre-existing family engagement with financial topics), (iv) the people they usually talk to about money (to account for the possibility that it is not only their parents since in Bulgaria, grandparents often play a significant role in children's financial awareness), (v) who usually gives them money (pocket vs gifts vs small jobs), (vi) whether and where they save money, (vii) how often they use phone, tablets or computers (to measure digital exposure), (viii) whether their parents or family members use digital payments in front of them (in Bulgaria, especially in lower-income or rural areas, children have limited exposure to banking tools like cards or digital payments due to family preferences for cash), and (ix) about how they would prefer to learn about money (book, teacher, game, video, etc.).

Each one of these dimensions were covered by the questions on the individual characteristics of each student in the first part of the questionnaire. And each one was turned into a control variable in the econometric treatment of the data, allowing us also to test the extent to which these

dimensions were as relevant for this experiment as they had been in other countries and class contexts.

The second part of each questionnaire focused on assessing the students' financial knowledge through multiple-choice questions. These questions were adapted to the age group and aligned with both the EU/OECD framework and the content of the classroom activities.

The rest of this section provides the main details on the pre and post-class questionnaires.

The financial literacy component of the pre-test questionnaire consisted of 16 multiple-choice questions, again, each aligned with the specific learning EU/OECD (2023) objectives. These questions were designed to match both the Bulgarian curriculum for Technologies and Entrepreneurship and the new pedagogical approach being tested. They can be grouped into four thematic categories:

i. Understanding money and financial systems – including the recognition of money in its various forms, the concept of earning, and different types of income. For example, one question asks which of the listed options qualify as forms of money (coins, banknotes, vouchers),
ii. Managing a budget, limited resources, and making informed decisions – including concepts such as scarcity, prioritization, comparing prices, and making value-based choices. For instance, one question asks the child to prioritize essential needs based on available funds (such as food vs. toys).
iii. Identifying financial institutions and operations – covering foundational knowledge about how banks work, saving, lending, and pensions. For instance, a question asks what a bank is and another what happens when money is saved in one.
iv. Developing financial safety, critical thinking, and digital awareness – focused on detecting scams, evaluating online risks, understanding digital payments, and encouraging safe behaviour in financial and digital environments. For instance, one question evaluates understanding of payment security by simulating a scenario involving a PIN code at the cashier.

To evaluate the effect of the intervention, the post-questionnaire followed the same general structure and content logic as the pre-test. However, it introduced a few small changes to better capture conceptual understanding and activity-specific learning outcomes and to evaluate knowledge gains, reduce response bias, and improve the overall reliability of the assessment.

First, it slightly adjusted the surface structure of the questions—changing names, numerical values, and contextual settings—while keeping the difficulty level consistent. This approach ensured that the questions assessed conceptual understanding rather than notes memorization, a strategy aligned with common educational measurement practices (Batty et al. (2015)).

Second, three new knowledge questions were added at the end of the post-class test. They were specifically designed to match the content and structure of the creative and AI-based classroom activities implemented during the intervention phase. Their purpose was to explore general financial comprehension and the ability of students to transfer learning from experiential settings into abstract reasoning and decision-making. They also allowed for an exploratory comparison between knowledge gained through traditional exposure (as reflected in shared questions across both questionnaires) and through more targeted, activity-specific interventions.

A final characteristic of the experiment is that the post-class test included a feedback section consisting of three Likert-style questions, each scored on a scale from 0 to 5. These questions assessed how fun and engaging the activities were perceived to be, how confident students felt in making smart money decisions after the program and how helpful the AI-based activities were in supporting their financial learning. These feedback items provided qualitative insights into student perception of the activities. We will not discuss it further here, but the answers suggest that nearly all students in the treatment group rated the activities as extremely enjoyable and helpful, with average scores close to the top of the scale.

4.4 A first look at the answers to the questionnaires

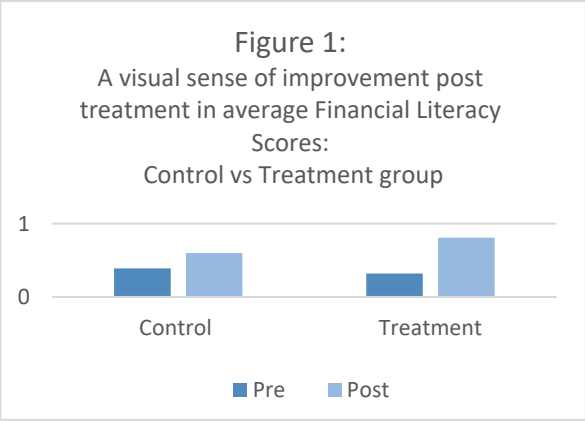
The questionnaire generated a dataset constructed from the test scores collected from the students. To ensure fair and consistent comparison across students, each individual's score was calculated by dividing the number of correct answers by the total number of financial literacy questions on their test version.

All questions were given equal weight in the final score, since they were intentionally designed to be of similar difficulty. For example, if a student answered 12 out of the 16 questions correctly on the pre-test, their score was calculated as 0.75, or 75%. This proportional scoring approach made it possible to compare results across students and groups, and to interpret changes in financial understanding over time in a straightforward way. It also ensured that all topics were valued equally in the analysis, without favouring any single area.

Table 2 reports the detailed descriptive statistics for students' test scores for the normalized financial literacy scores in the control and treatment groups before and after the intervention. Figure 1 provides a visual illustration of the differences in the average pre- and post-treatment scores for both the control and the treatment group. It shows quite clearly that the randomization process resulted in classes in the control group with a somewhat better score pre-class but that the intervention led to a significantly better performance in the post-class score for the classes in the treatment group. In the control group, the average score increased from 0.39 (pre-test) to 0.60 (post-test), with the median rising from 0.31 to 0.63.

Table 2. Comparison of financial literacy scores across groups

	Control group		Treatment group		Difference between the 2 groups (Treatment-Control)	
	Pre-class	Post-class	Pre-class	Post-class	Pre-class	Post-class
Average	0.39	0.60	0.32	0.81	-0.07	0.21
Median	0.31	0.63	0.25	0.84	-0.06	0.21
Minimum	0.06	0.16	0.00	0.16	-0.06	0
Maximum	0.81	0.89	0.81	1.00	0	0.11
Std dev.	0.22	0.19	0.21	0.14	-0.01	-0.05
Quartile 1	0.19	0.43	0.19	0.74	0	0.31
Quartile 3	0.56	0.74	0.38	0.89	-0.18	0.15



The additional statistical data offers a few more details on the impact of the experiment. The standard deviation dropped slightly from 0.22 to 0.19, indicating that there were fewer outliers in the post-test scores. The interquartile range also shifted upward, with Q1 moving from 0.19 to 0.43 and Q3 from 0.56 to 0.74. This reflects a general improvement across students even if there is some remaining spread.

The results for the treatment group show a particularly strong improvement. The average score jumped from 0.32 (pre-test) to 0.81 (post-test), and the median from 0.25 to 0.84. This striking increase suggests that the majority of students in the treated group benefited substantially. The minimum score also rose from 0.00 to 0.16, while the maximum reached 1.00. The standard deviation fell from 0.21 to 0.14, and the interquartile range moved sharply upward (Q1 from 0.19 to 0.74 and Q3 from 0.38 to 0.89), indicating both higher and more consistent scores. These are significant improvements when compared to those observed for the control group. This upward shift in both central tendency and distribution is more precisely tested in the econometric treatment of the data discussed next.

Note that the post-test questions targeting scam recognition and digital behaviour also revealed a clear difference in the ability to identify the risks in favour of the approaches relying on AI. Students in the treatment group scored significantly higher on all three scenario-based items related to fake offers, online fraud, and the use of payment tools. This performance cannot be explained by general financial knowledge alone, as these items were not covered in the control group's curriculum. Students who had completed the AI-generated scam lessons were able to identify suspicious phrasing, question misleading visuals, and explain why a website or message seemed untrustworthy.

5. The quantitative treatment of the data

The dataset collected through the experiment was used to conduct a Difference-in-Differences (DiD) estimation of the impact of the alternative pedagogical approach on the tests scores. It accounts for the personal and contextual characteristics of each student that the literature has identified in other experiment. A final relevant detail is that the score value used in the econometric treatment is the normalized financial literacy score (ranging from 0 to 1) to ease the interpretation of the results. The discussion ends with some remarks on possible limitations to be considered when trying to extrapolate to other schools.

5.1 The model specification and the variables designs

The diff-in-diffs equation estimated to measure the impact of the intervention follows the following usual specification:

$$\text{Student test score} = \beta 0 + \beta 1 * [\text{treatmentdummy}] + \beta 2 * [\text{interventiondummy}]$$

$$+ \beta 3 * [\text{intervention.treatmentdummy}] + \beta 4 * [\text{Covariates}] + \varepsilon$$

The first dummy indicates whether the student belonged to the treatment group (treatmentdummy = 1) or control group (treatmentdummy = 0). The second indicates whether the observation corresponds to the pre- or post-intervention period (interventiondummy=0 for pre-test, 1 for post-test). The interaction term (interventiondummy.treatmentdummy) captures the DiD effect, isolating of the treatment effect.

The control variables allow a formal test for this sample of some of the dimensions identified in the literature as potentially relevant to explain differences in learning outcomes. Their statistical significance thus provides an indication of their relevance for this specific sample of students. Their inclusion has the added benefit of also reducing the risks of biases in the estimation of the effects of the experiment, although this proved a bit more challenging than expected as some of them showed some correlation limiting the ability to use them all jointly.

The following is the list of these controls. The simplest one are gender (female = 1), age (numerical, ranging from 8 to 11) and whether the child owned a piggy bank (binary: 1 = yes, 0 = no). These are the variables for which measurement errors were unlikely. The remaining variables are more subject to biases and to different valuation by different students. They include: (i) a measure of the frequency of discussions about money at home, (ii) a measure of who talks to them about money, (iii) a measure of the way in which in which they receive money, (iv) a measure of the frequency with which they use a phone, a tablet or a computer and (v) a measure of the frequency with which their parents use digital forms of payments. They require more detailed explanations.

The variable on the frequency of talks about money at home was constructed to account for four possible answers: never, sometimes, monthly or daily. The reference category is thus "never". The variable on the people students talk to the most about money at home distinguished five possible answers: nobody, parents, grandparents, siblings or multiple family members. The variable focusing on how they usually receive money distinguishes between the following five possibilities: they don't receive money, money as a gift from family, money earned by doing small jobs or chores, pocket money given by parents regularly or multiple sources. The variable covering the frequency of use of a phone, tablet, or computer at home distinguishes between four possible answers: hardly ever, sometimes, a few times a week and every day. And finally, the variable on the use by parents or family members of digital payments (like bank cards or phone) in front of the student had the following five possible answers: I don't know, never, rarely, sometimes or often. The distribution of the students' answers across the different options is available in Appendix 2.

A detailed review of the data generated by these answers to this second group of questions argues for caution in the interpretation of some of the results for four main reasons. The first is that the answers to some of the questions could be sensitive to the ability of students to have a good comprehension of all dimensions they cover. This seems to be a reasonable concern for the age groups covered by the experiment. The second is that some of the students may be biasing their replies for predictable reasons. For instance, they may not want to reveal how often they use their phone or who they talk to about money if it is not the parents. A third source of concern is the relevance of the complexity of the family organization and of the distribution of tasks. In Bulgaria, grand-parents can be quite present in the education of children, including as caretakers after school. This makes it difficult to deal with questions asking for a clear identification of their main counterpart in interactions linked to money for instance. A final concern is the correlation between some these variables, even it is almost lower than 0.4 for all answers' combinations.

5.2 The results

The estimations were all conducted through ordinary least squares and the "robust" instruction in Stata to address the concerns for heteroscedasticity. Table 3 summarizes the results of the impact of the experiment according to seven specifications of the model. Column (1) reports its estimation accounting for all control variables jointly, including both those based on objective answers (age, gender, access to a piggybank) and those constructed from the answers to the questions allowing some margin for subjectivity or biases in the replies (the how often, how or who). The following columns focus on one control at the time. Column (2) focuses on the potential relevance of exposure to piggybanks for the financial literacy scores, the third objective control. Columns (3) to (7) report the estimation considering in turn each one of the five "subjective" control variables, one at the time. This allows a formal individual test of each one of the drivers of the effectiveness of financial literacy in schools discussed in the literature. All specifications lead to an R^2 over 0.72.

5.1.2. Focusing on the treatment results

The main conclusion of the analysis is that the treatment is effective and its effect comparable for all the specifications tested. Exposing students to the AI based gamified version of the classes significantly improves their post-class financial literacy skills when compared to the improvements achieved from the traditional pedagogical approach. The coefficient of the interventiondummy.treatmentdummy suggests statistically significant improvements ranging from 26% to 32% depending on the model specification. The most conservative DiD estimation (0.258) is the one considering all controls (i.e. column (1)). A 26 percentage points difference clearly argues in favour of the consideration of the alternative approach to teach this material in class.

The other two variables linked directly to the experiment (i.e. the first two dummies in the table) add useful information. The first (the treatment dummy) is not statistically significant for most specification, except for specification (5) which isolates the impact of having access to a computer, phone or tablet. This weak significance trend confirms that the difference in tests scores between the control and the treatment group was not statistically significant before the new approach was tested. The base line was thus roughly comparable as seen in the basic statistical analysis.

The intervention dummy, the second variable directly related to the experiment, indicates that both groups did actually better after taking a financial literacy class, with an improvement in tests scores around 21-22%. On average then, independently of the pedagogical method chosen, financial literacy classes are useful as the children gain financial literacy skills. But adopting the new approach can help achieve even stronger skills improvements.

Table 3: Measure of the effectiveness of the treatment							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Coef. (t stat.)	Coef. (t stat.)	Coef. (t stat.)	Coef. (t stat.)	Coef. (t stat.)	Coef. (t stat.)	Coef. (t stat.)
Treatment dummy	-0.034 (-1.21)	**-0.052 (-1.86)**	-0.051 (-1.89)	-0.029 (-1.03)	**-0.059 (-2.09)**	-0.043 (-1.71)	-0.046 (-1..71)
Intervention dummy	**0.209 (8.23)**	**0.218 (9.15)**	**0.209 (9.10)**	**0.217 (8.90)**	**0.213 (8.91)**	**0.224 (9.44)**	**0.200 (8.14)**
Interventiondummy.Treatmentdummy	**0.255 (6.61)**	**0.307 (9.11)**	**0.291 (8.41)**	**0.271 (7.43)**	**0.321 (9.58)**	**0.276 (7.95)**	**0.305 (9.15)**
Age	**0.122 (12.56)**	**0.133 (14.75)**	**0.132 (14.73)**	**0.132 (14.50)**	**0.133 (15.32)**	**0.124 (13.55)**	**0.134 (15.62)**
Gender	**0.041 (2.46)**	**0.049 (2.88)**	**0.045 (2.75)**	**0.044 (2.73)**	**0.050 (3.00)**	**0.038 (2.27)**	**0.047 (2.83)**
Has a piggybank	-0.022 (-1.11)	0.011 (0.59)					
Frequency of talks with family (Default=never)							
Sometimes	0.045 (0.92)		**0.097 (2.14)**				
Monthly	0.045 (0.92)		**0.094 (2.13)**				
Daily	0.071 (1.37)		**0.142 (3.04)**				
Who do you talk to about money (Default=no-one)							
Parents	0.037 (0.43)			**0.147 (2.44à**			
Grand-parents	0.023 (0.27)			**0.120 (2.08)**			
Siblings	-0.062 (-0.65)			0.045 (0.69)			
Multiple family members	0.037 (0.42)			**0.161 (2.77)**			
Frequency of use of phone, tablet or computer (Default=hardly ever)							
Sometimes	**0.169 (2.00)**				**0.226 (2.62)**		
A few times a week	**0.145 (1.82)**				**0.202 (2.46)**		
Every day	0.127 (1.61)				**0.207 (2.55)**		
How do you receive money (Default=I don't)							
As a gift from family	-0.054 (-1.08)					0.037 (0.89)	
Earned by doing small jobs or chores	-0.030 (-0.65)					0.070 (1.83)	
Pocket money given by parents regularly	0.004 (0.08)					**0.110 (2.66)**	
Multiple sources	0.015 (0.30)					**0.131 (3.20)**	
Frequency of use of digital payments by family (Default=Never)							
I don'know	-0.047 (-0.62)						-0.106 (1.70)
Rarely	0.037 (0.98)						0.051 (1.41)
Sometimes	**0.071 (1.95)**						**0.072 (2.07)**
Often	0.060 (1.370						0.062 (1.53)
Constant	**-1.083 (-8.00)**	**-0.972 (10.95)**	**-1.045 (-10.65)**	**-1.104 (-10.08)**	**-1.173 (-9.96)**	**-0.962 (-10.27)**	**-1.027 (-11.44)**
Number of data	296	299	304	301	304	304	304
R^2	0.758	0.716	0.727	0.732	0.722	0.732	0.729

5.1.2. Focusing on the controls results

The results concerning the control variables mostly serve to identify dimensions that could complement or offset those obtained from the experiment. The following shows that, potentially, most of the international experience on factors that make a difference to outcomes is also relevant to the Bulgarian case, although with an exception. It also shows that not all factors are equally important for this sample since the spread in coefficient values is quite large. These differences may have an impact on the ability of the new pedagogical approach to address the impact of socio-economic differences among students.

The rest of this section starts with a discussion of the relevance of all the controls considered jointly. It is followed by a variable specific discussion. It provides some thoughts on their absolute and relative relevance and on some of potential policy implications revealed by these controls that could be considered in the Bulgarian case.

Column (1) shows that when they are all included in the specification, the correlations between the dimensions covered by the controls discussed earlier are such that very few of the controls show any statistical significance. These correlations often reflect the influence of shared underlying factor within the family of the child observed in the raw data. How much children talk about money, who they talk to about money, whether they receive money and in which way, are all linked, and probably, in particular, to the income level of the family somehow. But this is a variable we don't have access to. The punchline is that these correlations (or non-linear relationships suggested by the Ramsey test) increase standard errors and this may lead to unreliable rejections of some controls that may be relevant in practice.

This is why we then tested all controls individually. If there is a risk of underestimating the possible joint significance of some of them with this approach, the one by one approach reported in columns (2) to (7) has the advantage of providing a simple test of the extent to which each individual contextual characteristic of the students may indeed have an influence. The cost of this approach is that there is now a possibility that the coefficient estimated may be biased upward (since all of them are significantly positive). But this should not impact the assessment of their relative relevance based on the size of the coefficient estimated. This is discussed in detail for each variable next.

Starting with the objective control variables, the results are quite coherent with earlier experiences on academic performances in that age group for two of them: age and gender. This explains why these two controls are present in all specifications. The older the students are, the more they benefit from financial literacy classes. Also, female students do better in the tests than male students in that age group, although not much more so. The impact of age is however almost three time stronger than the gender impact.

For the third objective variable (having a piggybank), the international experience does not translate to this sample of students: it makes no difference to their score as seen in column (2). This is why this objective control is not present in the specifications reported in columns (3) to (7) while the other two are. Giving piggybanks to all students of this sample would thus not make a difference to their tests scores, considering that almost two thirds of the children in this sample had a piggy bank and it did not help them do better on average than those without a piggybank.

The discussion of the relevance of the subjective control variables is more challenging. All of them are statistically significant when considered in isolation. Their relative importance and their policy relevance are however worth of some additional comments.

The control with the strongest impact on the score achieved by students is the one linked to their frequency of use of computers, phones or tablets. The impact on scores is roughly comparable for the three levels of frequency and all do better than the "hardly ever" default option. These are not surprising results. The more children are exposed to modern technologies, the more likely they are to understand how these technologies matter to financial transactions as documented in Money and Pension Services (2023). The fact that the impact on scores of this control is comparable to the

impact of the treatment could be used by the authorities to consider targeting support to access to these technologies for those from the least favour socio-economic background.

The statistically significant positive signs on the "family related" variables (Frequency of discussions at home of money related issues and who do they talk to about it) confirm earlier studies such as Batty et al. (2015, LeBaron et al. (2020, 2021), Moreno-Herrero et al. (2018) or Maldonado et al. (2022)). The results argue for finding a way of teaching that manages to involve the family somehow. There is an implicit social dimension of these results for this sample since those who live in families talking the least about financial concepts are those benefiting the least from the financial literacy classes. These tend to be those from the lowest income groups. One way of addressing this distortion is to ensure that the third group of activities described in section 3 that gets students to take home tasks to be done with parents or grand-parents is not omitted from the efforts to improve the pedagogical approach to teaching financial literacy to primary school children in Bulgaria.

The other two controls provide results somewhat more challenging to interpret. First, while the way students get money makes a difference to the score achieved for this sample of students, it does so in a somewhat unexpected way for this sample. Receiving pocket money regularly from parents or from multiple sources does seem to have an impact on the scores achieved by students. In contrast, earning money from small jobs or getting it as occasional gifts does not have an Impact for this age group. Second, the frequency of the use of digital payments does not seem to make a difference either, except for the 55% of students answering that their parents do use them sometimes. Here also, there is an underlying social dimension implicit in this control since the children less likely to benefit from an exposure, even indirect, to the use these technologies are likely to be those from the less favoured socio-economic backgrounds. This rare exposure to the use of digital payments by their parents concerns 23% of the students of the sample.

5.3. Limitations of the experiment

The results help to make the case for a more active use of new technologies and the more engaging pedagogical approaches to teaching financial literacy. But the enthusiasm that the success of the experiment may induce should not lead to an underestimation of the limitations and possible sources of biases linked to the specificities of the experiment.

First, the DiD model relies on the idea that the treatment and control groups were comparable before the intervention and would have followed similar learning paths if the intervention had not taken place. Since students were grouped based on their existing classes rather than assigned randomly as individuals, the analysis assumes that both groups were comparable at the start and would have shown similar progress without the intervention. As discussed above, on average, the control classes were a bit better in scoring in the financial literacy tests on average. But this was not known ex-ante. The need to rely on randomization at the class level for logistical and administrative constraints rather than at the individual level is thus a possible weakness in the design of the experiment. While it is impossible to test directly whether all students would have followed similar learning trajectories in the absence of the intervention, we believe that the pre- and post-tests, class-level balancing, and control variables helped mitigate potential bias.

A second possible concern is that relying on only one school to conduct the experiment may affect the scope to draw general conclusions. However, this choice is consistent with a sandbox approach to testing new rules in regulation for instance and these types of approaches are widely seen as able to deliver useful tests of potential innovations.[4] Moreover, the school was selected precisely because it reflects a broad cross-section of the Bulgarian population. Located on the border area of Sofia, it includes students from urban, suburban, and rural backgrounds. Students came from a wide range of socioeconomic situations, with families who used both traditional cash-based habits and digital banking methods. This makes the sample more representative than a school located in

[4] See Attrey et al. (2020) for instance for an overview of sandboxes as they are used in sector regulation.

a purely urban or rural setting, although future studies would benefit from replication in multiple schools and regions.

A third limitation relates to the relatively short duration of the intervention. While the four-week period allowed for an intensive delivery of activities, it remains a relatively brief window to observe long-term behavioural change or retention of knowledge. This timeframe was chosen to match the one typically scheduled for the financial literacy programs in the school.

It seems thus useful to consider the findings of the experiment within the context of these limitations. However, since every effort was made to ensure the validity and reliability of the research design and in particular, the use of pre- and post-tests, structured lesson plans, matched curriculum content, and carefully aligned questionnaires, we believe that the biases linked to these limitations were minimized and that accuracy of the observed treatment effects reasonably solid enough to guide further pedagogical choices in Bulgaria but also elsewhere.

6. Some "take-aways" that go beyond the Bulgarian context

The conclusions from this experiment are not only useful to the Bulgarian school system. They are also help fuel global policy discussions about the scope to adopt a new pedagogical approach to improve the financial literacy performance gaps. They can do so along four main dimensions.

The first is a confirmation of other studies showing that AI can allow the development or refinement of pedagogical tools available to teach financial literacy. As a complement to other tools, it can ease the learning and the teaching process while making the classes more enjoyable for all stakeholders, in particular when dealing with concepts otherwise considered to be too complex.

The second is that an AI assisted approach makes it possible to cover more material during the time allocation usually available to those following the traditional approach. In this particular experiment, it allowed the coverage of topics otherwise largely ignored such as scam detection, digital awareness, and applied financial reasoning. Moreover, this is achieved with tools developed at a relatively low cost since most of the softwares used are on open access on the web.

Third, the new approach may be more attractive to teachers than the somewhat excessively abstract traditional approach. If properly trained and informed about the potential of the AI based approaches, they add to the menu of pedagogical options they have to rely on their creativity. The experience shows that AI should not be seen as a substitute to teachers in primary schools for the financial literacy programs since the teachers did well in the control group accounting for the limitation of the pedagogical tools there were able to rely on. Relying on AI based technologies simply gives them an additional new tool allowing them to make the most of their creativity. In this experiment, this was recognized by the teachers who watched its preparation and implementation. However, they also noted that preparation time and unfamiliarity with AI tools could be significant challenges in some contexts.

Fourth, from a stricter social perspective, the experiment suggests that there may be a case to improve the ex-ante assessments of how much the choice of the pedagogical approach can help close the knowledge and learning gaps observed across socio-economic backgrounds. In this experiment, the gap reduction was the result of, both, better motivation in class for all groups and a change in the desire to interact with the family on money related matters. The impact is likely to be different across countries and across cultures, but this deserves some broader testing. The main lesson may actually be that a change in the business as usual approach can deliver both efficiency and fairness/equity gains in financial literacy programs but that this may require complementary interventions such as ensuring that all children have a comparable access to computers or tablets. Without an effort to improve the learning process, the equitable access to modern technologies and the relevance of an involvement of families in this effort, social and financial exclusion will continue to be "two Sides of the same coin" as detailed by Fernández-Olit et al. (2018) in their study of the Spanish experience.

7. Concluding comments

By way of conclusion, the most useful may be to briefly discuss the role of teachers in the improvements in students' scores and about the expectations of students. AI-based pedagogical approaches will help as seen in this paper, but they will not deliver on their potential if the teachers are not on board.

A new approach works if teachers can use it to make the most of their creativity and of their commitment to get the students to learn, to question, to challenge and to interact with others in the process. Teachers are not just content providers, they are mentors, facilitators, and role models, particularly in primary schools.

While some teachers may need some training in the use of new technologies, their role will become even more important—not less—when AI enters the classroom. And this is why it is essential for changes in the financial literacy programs (and other academic programs) are developed jointly with the current teachers across age groups. The skills that will set future generations apart are the ones that are hardest to automate: collaboration, adaptability, curiosity, and emotional intelligence. These will continue to require human teachers. The Bulgarian experiment largely worked because the teachers were part of the design change.

For teachers to be effective in preparing the next generations of students for the technology driven world they will inherit, it is also essential to keep in mind the funding their training and of the equipment needed. Ignoring or underfunding the preparation and the delivery of the change is setting them up for failure. And this failure has social implications.

The growing social risks linked to the adoption of new technologies in financial management stems from an underestimation of the growing likelihood that the people without the skills and tools needed to use these new technologies will face exclusion from access to a growing number of public and private services, simply because their providers increasingly only rely on digital technologies. Unless accounted for in the design and financing of financial literacy classes for all age groups, this is likely to broaden social gaps and social tensions already associated with the current levels of financial exclusions.

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Appendix 1: The pre- and post-class questionnaires

(original version in Bulgarian)

Pre-class questionnaire

Background information

1. What is your gender?
◯ Woman
◯ Man

2. How old are you?
◯ 8 years old
◯ 9 years old
◯ 10 years old
◯ 11 years old

3. Which class are you in?
◯ 2 a
◯ 2 b
◯ 3 a
◯ 3 b
◯ 4 a
◯ 4 b

4. Do you ever talk about money at home, like how to save or what things cost?
◯ Daily
◯ Weekly
◯ Monthly
◯ Never

5. Who do you usually talk to about money at home? (choose everything that applies)
◯ Parents
◯ Grandparents
◯ Siblings
◯ I don’t talk about money at home

6. How do you usually receive money? (choose everything that applies)
◯ I get pocket money from my parents regularly
◯ I sometimes get money as a gift from my family
◯ I earn money by doing small jobs or chores
◯ I don’t receive money

7. Do you have a place where you save money, like a piggy bank or bank account?
◯ Yes
◯ No

8. How often do you use a phone, tablet, or computer at home?
◯ Every day
◯ A few times a week
◯ Sometimes
◯ Hardly ever

9. Do your parents or family members use digital payments (like bank cards or phone) in front of you?
◯ Yes, often
◯ Yes, sometimes
◯ Rarely
◯ Never
◯ I don't know

10. If you could choose, how would you prefer to learn about money? (choose everything that applies)
◯ Having a teacher explain it with examples
◯ Learning from a book or worksheet
◯ Watching videos about money skills
◯ Playing a game on a computer or tablet

Financial literacy

11. Money can come in different forms. Which of these are forms of money? (10 points)
◯ Coins
◯ Banknotes
◯ Vouchers
◯ All of the above
◯ I don't know

12. Lily's mom wants to buy her a new bike for her birthday! Where can she get money to buy it? (10 points)
◯ From an ATM (machine in a bank)
◯ From the bike shop
◯ From school
◯ From the supermarket
◯ I don't know.

13. Jake has saved up some of his pocket money, but he doesn't have enough for everything he wants. What does that mean? (10 points)
◯ Money is endless, so he'll always have enough
◯ People have a limited amount of money they can use
◯ He should ask for more money and spend it all
◯ I don't know.

14. Emma wants to buy a toy, but she doesn't have enough money, so she asks her friend Mia to lend her some. What does "lending" mean? (10 points)
◯ Giving money and expecting it back
◯ Giving money as a gift
◯ Sharing money
◯ I don't know.

15. Different families have different incomes. What could cause this? (10 points)
◯ Different jobs
◯ Family size
◯ Different skills
◯ All of the above
◯ I don't know.

16. Maria wants to buy a bottle of water. Where do you think it would cost the most? (10 points)
◯ At the grocery store
◯ At the airport
◯ In the park
◯ At the toy store
◯ I don't know.

17. What might help you choose between two pens with different prices? (10 points)
◯ Just pick the first one you see
◯ Compare the prices and pick the one that costs less if they are similar
◯ Choose the one that costs more
◯ I don't know.

18. You see an ad that says, "This watch will make you the coolest kid in school!" What should you do? (10 points)
◯ Buy it immediately without thinking
◯ Think carefully and decide if you really need it
◯ Believe everything the ad says
◯ I don't know.

19. Alex buys a snack at the store, and the cashier gives him change. What should Alex do? (10 points)
◯ Count the change carefully.
◯ Put the money in his pocket quickly because there are people waiting in line.
◯ Leave the change behind and walk away.
◯ Hand the change to the next person in line.
◯ I don't know.

20. If you have a little bit of money for the whole day, which would be the best thing to buy first? (10 points)
◯ A toy you want
◯ Candy
◯ Food you need
◯ Snacks (not enough to feed you)
◯ I don't know.
21. Is it a good idea to save a little money from your allowance every week? – 2 correct answers (10 points)
◯ No, it is easier to lose track of money.
◯ Yes, it allows me to have money for emergencies or future needs.
◯ No, it is better to spend it immediately.
◯ Yes, it can help me buy something nice later.
◯ I don't know.

22. What is a bank? (10 points)
◯ A store where you buy things with your money.
◯ A machine that makes new money for everyone.
◯ A place where people trade toys and games.
◯ A place where people keep their money safe and can borrow or save money.
◯ I don't know.

23. What can happen if you put your money in the bank and leave it there for a long time? (10 points)
◯ The bank will take it all.
◯ It might grow with extra money called interest.
◯ It will stay exactly the same forever.
◯ I don't know.

24. What do people receive after working for many years and retiring? (10 points)
◯ Nothing at all.
◯ A free vacation.
◯ A pension, which is money every month.
◯ I don't know.

25. Dani's mom sent him to buy bread at the store and told him to pay with her debit card. The cashier asked Dani for the PIN code. What should he do? (10 points)
◯ Tell the PIN code out loud for everyone to hear.
◯ Hand the card to the cashier and walk away.
◯ Say, "Debit cards don’t have a PIN code."
◯ Enter the PIN code on the machine carefully, making sure no one else sees it.
◯ I don’t know.

26. You find a website that claims it can help you earn money online. What should you do? – 2 correct answers (10 points)
◯ Keep visiting the site because it says you can win money.
◯ Enter your personal contact information to receive more ways to earn money.
◯ Check if the website is trustworthy before doing anything.
◯ Ask a parent for advice before sharing any personal information or visiting unknown sites.
◯ I don't know.

Post-class questionnaire

Background information

1. What is your gender?
◯ Woman
◯ Man

2. How old are you?
◯ 8 years old
◯ 9 years old
◯ 10 years old
◯ 11 years old

3. Which class are you in?
◯ 2 a
◯ 2 b
◯ 3 a
◯ 3 b
◯ 4 a
◯ 4 b

4. Do you ever talk about money at home, like how to save or what things cost?
◯ Daily
◯ Weekly
◯ Monthly
◯ Never

5. Who do you usually talk to about money at home? (choose everything that applies)
◯ Parents
◯ Grandparents
◯ Siblings
◯ I don’t talk about money at home

6. How do you usually receive money? (choose everything that applies)
◯ I get pocket money from my parents regularly
◯ I sometimes get money as a gift from my family
◯ I earn money by doing small jobs or chores
◯ I don’t receive money

7. Do you have a place where you save money, like a piggy bank or bank account?
◯ Yes
◯ No

8. How often do you use a phone, tablet, or computer at home?
◯ Every day
◯ A few times a week
◯ Sometimes
◯ Hardly ever

9. Do your parents or family members use digital payments (like bank cards or phone) in front of you?
◯ Yes, often
◯ Yes, sometimes
◯ Rarely
◯ Never
◯ I don't know

10. If you could choose, how would you prefer to learn about money? (choose everything that applies)
◯ Having a teacher explain it with examples
◯ Learning from a book or worksheet
◯ Watching videos about money skills
◯ Playing a game on a computer or tablet

Financial literacy

11. Money can come in different forms. Which of these are forms of money? (10 points)
◯ Coins
◯ Banknotes
◯ Gift cards
◯ All of the above
◯ I don't know

12. Emma’s mom wants to buy her a new bike for her birthday! Where can she get money to buy it? (10 points)
◯ From an ATM
◯ From the bike shop
◯ From school
◯ From the supermarket
◯ I don't know.

13. Peter has saved up some of his pocket money, but he doesn't have enough for everything he wants. What does that mean? (10 points)
◯ Money is endless, so he'll always have enough.
◯ People have a limited amount of money they can use.
◯ He should borrow from a friend and not worry about paying it back.
◯ I don't know.

14. Sophie wants to buy a toy, but she doesn't have enough money, so she asks her friend Mia to lend her some. What does "lending" mean? (10 points)
◯ Giving money and expecting it back
◯ Giving money as a gift
◯ Sharing money
◯ I don't know.

15. Different families have different incomes. What could cause this? (10 points)
◯ Different careers
◯ Level of education and skills
◯ How many hours a person works
◯ All of the above
◯ I don't know.

16. Lora wants to buy a bottle of water. Where do you think she would find it at the lowest price? (10 points)
◯ At the grocery store
◯ At the airport
◯ At a stadium
◯ At the toy store
◯ I don't know.

17. What might help you choose between two pens with different prices? (10 points)
◯ Just pick the first one you see
◯ Compare the prices and pick the one that costs less if they are similar
◯ Choose the one that costs more
◯ I don't know.

18. You see an ad that says, "This watch will make you the coolest kid in school!" What should you do? (10 points)
◯ Buy it immediately without thinking
◯ Think carefully and decide if you really need it
◯ Believe the ad and tell everyone about it
◯ I don't know.

19. Alex buys a snack at the store, and the cashier gives him change. What should Alex do? (10 points)
◯ Count the change carefully.
◯ Put the money in his pocket quickly because there are people waiting in line.
◯ Leave the change behind and walk away.
◯ Hand the change to the next person in line.
◯ I don't know.

20. If you have a little bit of money for the whole day, which would be the best thing to buy first? (10 points)
◯ A toy you like
◯ A soft drink
◯ A healthy meal
◯ A small snack that won't keep you full
◯ I don't know.

21. Is it a good idea to save a little money from your allowance every week? – 2 correct answers (10 points)
◯ No, it is easier to lose track of money.
◯ Yes, it will allow me to have money for emergencies or future needs.
◯ No, it is better to spend it immediately.
◯ Yes, it can help me buy something nice later.
◯ I don't know.

22. What is a bank? (10 points)
◯ A store where you buy things with your money.
◯ A machine that makes new money for everyone.
◯ A website where people can buy and sell items
◯ A place where people keep their money safe and can borrow or save money.
◯ I don't know.

23. What can happen if you put your money in the bank and leave it there for a long time? (10 points)
◯ The bank will take it all.
◯ It might grow with extra money called interest.
◯ It will stay exactly the same forever.
◯ I don't know.

24. What do people get when they stop working after many years? (10 points)
◯ They get nothing at all.
◯ A free vacation.
◯ A pension, which is money every month.
◯ I don't know.

25. Oliver's mom sent him to buy bread at the store and told him to pay with her debit card. The cashier asked Oliver for the PIN code. What should he do? (10 points)
◯ Tell the PIN code out loud for everyone to hear.
◯ Hand the card to the cashier and walk away.
◯ Say, "Debit cards don’t have a PIN code."
◯ Enter the PIN code on the machine carefully, making sure no one else sees it.
◯ I don’t know.

26. You find a website that claims it can help you earn money online. What should you do? – 2 correct answers (10 points)
◯ Keep visiting the site because it says you can win money.
◯ Enter your personal contact information to receive more ways to earn money.
◯ Check if the website is trustworthy before doing anything.
◯ Ask a parent for advice before sharing any personal information or visiting unknown sites.
◯ I don't know.

Additional questions

27. You find an online store selling your favourite sneakers for 10 leva, even though they usually cost 100 leva. What should you do? (10 points)
◯ Buy them quickly before the deal disappears.
◯ Check the website’s reviews and payment security before purchasing.
◯ Give your personal details to claim the special discount.
◯ Send the link to your friends so they can also buy the sneakers.
◯ I don't know.

28. You receive a message from someone online offering you a free gift if you share your bank details. What should you do? (10 points)
◯ Share your details quickly to claim the prize
◯ Ask your parents or a trusted adult before making a decision.
◯ Ignore the message and report it as a potential scam.
◯ Click the link but only give your email address.
◯ I don't know.

29. Which of the following allows a bank to let you use its money for a set period of time? (10 points)
◯ A credit or a loan
◯ A piggy bank
◯ A shopping card
◯ All answers are correct
◯ I don't know

Appendix 2: Distribution of the panel across answers for each control variable

	Frequency	Percentage
Age		
8	27	8.88
9	74	24.34
10	105	34.54
11	98	32.24
Total	304	100
Gender		
Female	148	58.68
Male	156	51.32
	304	100
Has a piggybank		
No	112	37.46
Yes	187	62.54
Total	299	100
Frequency of talks with family		
Never	21	6.91
Sometimes	92	30.26
Monthly	122	40.13
Daily	69	22.70
Total	304	100
Who do you talk to about money		
No-one	11	3.65
Parents	39	12.96
Grand-parents	55	18.27
Siblings	17	5.65
Multiple family members	179	59.47
Total	301	100
Frequency of use of phone, tablet or computer		
Hardly ever	2	0.66
Sometimes	20	6.62
A few times a week	74	24.50
Every day	206	68.21
Total	302	100
How do you receive money		
I don't	12	3.95
As a gift from family	57	18.75
Earned by doing small jobs or chores	59	19.41
Pocket money given by parents regularly	77	25.33
Multiple sources	99	32.57
Total	304	100
Frequency of use of digital payments by family		
I don't know	9	2.97
Never	26	8.58
Rarely	71	23.43
Sometimes	167	55.12
Often	30	9.90
Total	303	100