

RET: Games and Real-Life Investments to Enhance Personal Financial Literacy Understanding for Middle School Students

Ms. Elif Polat, Texas A&M University

More than a decade in Education Loves to travel

Dr. Sheng-Jen Hsieh, Texas A&M University

Dr. Sheng-Jen ("Tony") Hsieh is a Professor in the Department of Engineering Technology and Industrial Distribution and a member of the Graduate Faculty at Texas A&M University, College Station, TX. His research interests include automation, robotics, cyber-manufacturing and Industry 4.0; optical/infrared imaging and instrumentation; micro/nano manufacturing; and design of technology for engineering education. He is also the Director of the Rockwell Automation Laboratory at Texas A&M University, a state-of-the-art facility for education and research in the areas of automation, robotics, and Industry 4.0 systems. He was named Honorary International Chair Professor for National Taipei University of Technology in Taipei, Taiwan, for 2015-21. Dr. Hsieh received his Ph.D. in Industrial Engineering from Texas Tech University, Lubbock, TX.

RET: Games and Real-Life Investments to Enhance Personal Financial Literacy Understanding for Middle School Students

Introduction and Motivation

Personal financial literacy serves as an introduction for students to real-life investment. Applying mathematical process standards to develop an economic way of thinking and problem solving useful in one's life as a knowledgeable consumer and investor. Although some studies suggest that inadequate teacher preparation might contribute to students' underperformance in these areas, research on applying interdisciplinary approaches using technology is almost nonexistent.

Students frequently encounter difficulties with personal financial literacy. They also struggle to connect their learning to practical, everyday situations. Implementing a discovery-based activity that incorporates visualization through games, simulations, followed by real-life investments, can help bridge these learning gaps and enhance their conceptual understating and retention.

Concepts like saving for retirement or long-term investments are very abstract for 7th graders whose primary focus is often immediate wants. Terms like 'interest rate', 'credit scores', 'inflation' can be confusing and boring if not explained in relatable ways. Lack of real-world experience, and most of the middle schoolers do not have their own income (beyond allowance or occasional gifts). Lack of readily available, age-appropriate and engaging curriculum materials and resources are some challenges.

Throughout my teaching career spanning over 12 years, I have integrated practical applications, games, and hands-on projects into my teaching philosophy. This perspective not only helps to improve understanding and retention of knowledge, but also contributes to a more comprehensive learning experience. This is based on classroom observation where hands-on knowledge, and games are used as a model of instruction to improve instruction and increase student engagement.

Hands-on activities, and simulations: Games (Desmos, Pay Day, Banzai!, Savings Predictor Game), mock budgeting exercises (Dream Vacation), Shark Bucks make learning concrete and fun. Connecting financial concepts to the things middle schoolers care about (saving for a concert, a new video game, a new phone) will help me overcome the challenges.

To bring in similar results for personal financial literacy, I would like to address an approach with games, and real-life investments which does not deviate from current 7th Grade Math TEKS expectations. In fact, it acts as a tool to provide an introduction with a proper blend of previous and upcoming content in a subtle manner.

This research aims to investigate the effectiveness of integrating games, simulations, and interactive activities in 7th grade math curriculum so that it can easily be applied later to day-to-day life. By demonstrating the practical relevance of personal financial literacy through real-life investment examples, the goal is to improve student engagement, understating, and appreciation of mathematics and real-life. Developing an economic way of thinking and problem solving is useful in one's life as a knowledgeable consumer and investor.

Literature Review

Table 1 briefly summarizes other reported approaches teaching about financial literacy.

Table 1. Comparison of Reported Approaches to Teaching Financial Literacy

Topic	Pros	Cons
Applying a Business Simulation Game in a Flipped Classroom to Enhance Engagement, Learning Achievement, and Higher-Order Thinking Skills [1]	The simulation games help students understand real-world experience and practice in a safe environment.	The use of simulation games in different contexts is lacking.
New Examination Approach for Real-World Creativity and Problem-Solving Skills in Mathematics [2]	Innovative examination method designed to foster creativity, problem-solving, and collaboration in mathematics education.	Implementing innovative assessment methods can be time-consuming, particularly if they involve the development of complex tasks, collaborative projects, or personalized feedback.
Investigating the Role of Digital Game Applications in Enhancing Mathematical Thinking Skills in Primary School Mathematics Students [3]	Digital gamification develops critical thinking skills through engaging students in problem-solving via interactive learning challenging tasks.	The study is limited to the city where the data was collected from students.
Daily Life Context Based Didactic Games in Mathematics Lessons to Develop Mathematical Competence [4]	Reduces mathematical anxiety and foster positive attitudes towards mathematics.	Limited area. Students need to apply their mathematical knowledge and skills to everyday situations in which money is involved.
Exploring the Impact of Educational Games on Numeracy Skill Development Among the Elementary Learners: A Systematic Review [5]	Describes innovative teaching strategies and techniques and provides instructional materials such as educational games that improve numeracy skills.	It is limited by the schools where the testing was done.
A Review of Financial Literacy Education Programs for Children and Adolescents [6]	Assesses the intention to practice good behaviors. Studies based on self-reported behavior also report positive effects.	The retention results prove to be small, and the studies measure mainly short-term effects.
Teaching About Saving and Investing in the Elementary and Middle School Grades [7]	The materials in the K-5 guide provide readings and vocabulary items to help parents in their efforts to promote children's personal financial literacy	Requires a long time to apply the curriculum.
Improving Financial Literacy in Secondary School Students. A Randomized Experiment [8]	It provides for students during secondary school as a natural context in which to establish young people's financial literacy.	A fidelity assessment was not performed, although we believe the impact thereof is somewhat low.

Topic	Pros	Cons
A Review of Large-Scale Youth Financial Literacy Education Policies and Programs [9]	Teenage financial literacy is positively correlated with asset accumulation and net worth at age 25.	More work is needed to ensure that they deliver services that effectively meet students' needs
Using Design Thinking to Develop an Educational Game [10]	Subject-specific educational games, including those in mathematics, have demonstrated potential in enhancing the learning of concepts and skills for both students and teachers	The use of simulation games in different contexts is lacking.
Choosing the Right Store: How Open-Ended Tasks Help Middle School Students Learn Financial Literacy [11]	Activities help students recognize discounts in everyday life, develop problem-solving strategies, and improve math skills.	Misunderstanding promotion or division strategies, indicating the need for further guidance from teachers.
The Impact of Financial Literacy Education on Subsequent Financial Behavior [12]	It gives the knowledge of financial literacy to the youth and adults.	Additional study is needed to determine more appropriate approaches to teaching financial literacy.
Experiences of Middle School Students Following a Financial Literacy Simulation [13]	Describes experiences of middle school students' following the Reality Store®, a financial simulation.	Some simulations do not have realistic scenarios and clear instructions.
Teaching Mathematical Connections to Financial Literacy in K-8: Clarifying the Issues [14]	Financial education is a valid curriculum concern. Inadequate personal finance literacy and mathematics standards exist.	The issue presents a matter of inconsistent objectives among stakeholders that find children caught in the middle.
Childhood Roots of Financial Literacy [15]	Deepens our understanding of the determinants of financial literacy.	Approaches that stimulate regular savings and investment habits through easy-to-understand rules and advice, may be worth considering.

The goal of the work reported in this paper is to teach basic math skills using board games, online games, and real-life scenarios that keeps students engaged, and help them learn as I improve their critical thinking skills, and problem solving abilities in a safe environment.

Methodology

For this study a lesson plan was designed to integrate three tools: Save Smart! (a game created using Desmos (an interactive teaching and learning platform), PayDay Game (a board game, to teach savings, loan, money) and Banzai! (an online game to help students connect math with real life experiences).

1. Save Smart! Save Smart! is a game created by Ishan Sharma using Desmos, an online suite of math tools (Figure 1). Playing this game will help students to learn to save smart so they can meet their saving goals.

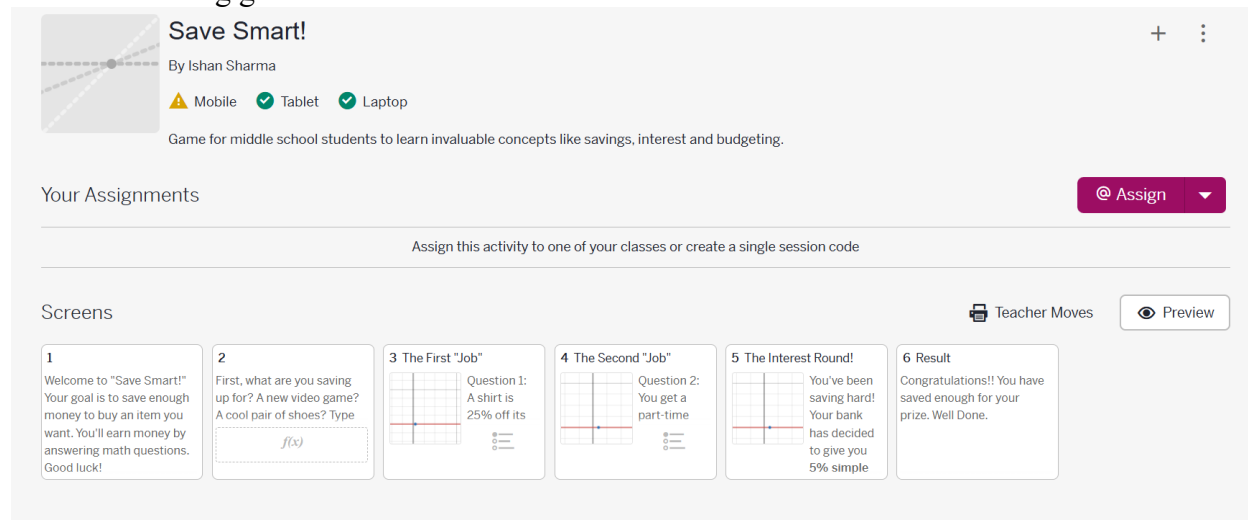


Figure 1. Screenshot of Save Smart! game

2. Banzai. Banzai is an online platform to teach real-world finance and practical life skills with an interactive financial education platform. Students interact with real-life scenarios to make money, have a budget, and make choices about how to spend their money.

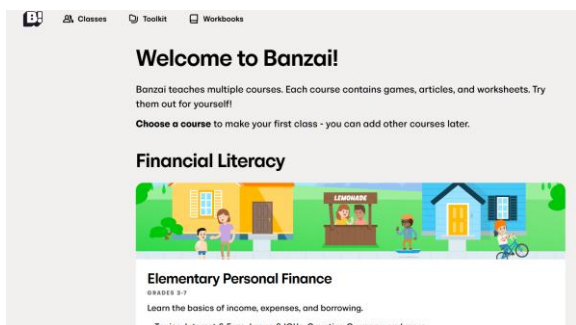


Figure 2. Screenshot of Banzai



Figure 3. Pay Day Board Game

3. PayDay: Pay Day is a board game where players navigate a monthly calendar, dealing with bills, deals, and other financial events to accumulate more cash. The goal is to have the most cash and savings at the end of the game, after playing for a set number of months.

Using these games, simulations, and interactive activities to teach personal financial literacy allows us to address common challenges in math education, such as difficulty of making real life connections, staying motivated/engaged to learn math and lacking knowledge of daily usage of it. The goal is to make abstract math principles-personal financial literacy more tangible, relevant, preparing students for practical applications in their future lives and careers. Ultimately, this approach aims to build a solid foundation in basic math, and personal financial literacy, equipping students with essential problem-solving skills.

These activities were incorporated within a middle school math course for five days of instructional time. The lesson consisted of 6 activities. Each activity is 20 minutes (0.5 day of instructional time). The online activities were also made available on Google classroom for students to access any time of day.

Results

The lesson plan was taught to a group of 15 middle school students. The lesson ended up lasting more than five days because the games took longer than initially planned. The students enjoyed playing with the simulations

The mean score on the pre-test was 5.33 and the mean score on the post-test was 6.25, suggesting there was a slight improvement in knowledge. A two-tailed t-test was used to compare the means. The t-score was 0.11, suggesting that the improvement was not significant at the 0.05 level. This may be because the post-testing occurred just after a holiday and the students were distracted. The questions may also need to be more difficult—i.e., more intentionally based on the new content rather than on concepts students may already be familiar with.

The mean score on the pre-survey was 14 and the mean score on the post-survey was 13.58. . A two-tailed t-test was used to compare the means. The t-score was 0.42, suggesting that the difference was not significant. This may be because the survey choices needed to have a greater range, such as a 5-point or 7-point scale rather than a 3-point scale. Also, the questions may need to focus more on thought process or behavior rather than on the learner's perception of what they know; e.g., "I make sure I have enough money before I make a purchase."

Conclusion/Future Directions

This study suggests that integrating educational games and real-life investment simulations into the middle school math curriculum can increase student interest and engagement and enhance their understanding of personal financial literacy. By combining interactive tools such as Desmos, PayDay, and Banzai! with structured lesson planning, students were able to engage with abstract concepts like budgeting, saving, debt, interest, and investment in a relatable and meaningful manner. The hands-on, inquiry-based approach not only improved students' financial vocabulary but also helped bridge the gap between mathematical theory and real-world application.

The positive student engagement observed through the implementation of these modules suggests that game-based and real-life simulation learning can reduce financial anxiety, improve retention of financial concepts, and foster critical thinking. Students reported increased confidence in managing personal finances and showed a greater interest in applying these concepts to their own lives.

This work will be continued with larger groups of students. Future research can explore the long-term effects of such instructional approaches by conducting follow-up assessments after several months or years to measure retained knowledge and behavioral changes in money management. Future modules could involve family participation or community-based financial challenges to encourage students to apply their knowledge outside the classroom, promoting holistic financial awareness. Also, this program could be adapted for different grade levels and demographic contexts. A comparative study across various school districts or socioeconomic groups can evaluate scalability and effectiveness in diverse learning environments.

Acknowledgement

This work was supported by a grant from the National Science Foundation's Research Experience for Teachers (RET) Program (Award no. 2206953). Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

I would like to express my gratitude to Dr. Sheng-Jen Hsieh, Ishan Sharma, and Dr. Bart Taylor for their invaluable assistance and insightful suggestions for improvement during the process of working on this paper.

References

- [1] Y-M. Huang, L. M. Silitonga, and T-T. Wu, "Applying a business simulation game in a flipped classroom to enhance engagement, learning achievement, and higher-order thinking skills," *Comput. Educ.*, vol. 183, July 2022, Art. no. 104494.
- [2] J. Nilimaa, "New examination approach for real-world creativity and problem-solving skills in mathematics," *Trends High. Educ.*, vol. 2, no. 3, pp. 477-495, 2023.
- [3] A. A. Al-Barakat et al., "Investigating the role of digital game applications in enhancing mathematical thinking skills in primary school mathematics students," *Decis. Making: Appl. Manag. Eng.*, pp. 132-146, 2025.
- [4] I. Gretčina and M. Ročāne, "Daily life context based didactic games in mathematics lessons to develop mathematical competence," *Educ. Innovation. Diversity*, vol. 1, no. 8, pp. 54-61, 2024.
- [5] M. A. D. Abbacan et al., "Exploring the impact of educational games on numeracy skill development among the elementary learners: A systematic review," *Cognizance J.*, vol. 5, no. 1, pp. 274-286, 2025.
- [6] C. Amagir, W. Groot, H. Maassen van den Brink, and A. Wilschut, "A review of financial-literacy education programs for children and adolescents," *Citizenship, Soc. Econ. Educ.*, vol. 17, no. 1, pp. 56-80, 2017.
- [7] M. Suiter and B. Meszaros, "Teaching about saving and investing in the elementary and middle school grades," *Soc. Educ.*, vol. 69, no. 2, pp. 92-95, 2005.
- [8] A. Y. F. Zhu, C. W. M. Yu, and K. L. Chou, "Improving financial literacy in secondary school students: An randomized experiment," *Youth & Soc.*, vol. 53, no. 4, pp. 539-562, 2019.
- [9] M. Kasman, B. Heuberger, and R. A. Hammond, "A review of large scale youth financial literacy education policies and programs," The Brookings Institution, Washington, DC, USA, Rep., 2018.
- [10] A. Muralidhar, S. Gupta, and S. Kushwaha, "Using design thinking to develop an educational game," in *EXTENDED ABSTRACTS*, 2025, p. 178.
- [11] L. Sagita, R. I. I. Putri, and R. C. I. P. Zulkardi, "Choosing the right store: How open-ended tasks help middle school students learn financial literacy," *Jurnal Pendidikan Matematika*, vol. 19, no. 1, pp. 63-80, 2025.
- [12] L. Mandell and L. Schmid Klein, "The impact of financial literacy education on subsequent financial behavior," *J. Financial Counseling and Planning*, vol. 20, no. 1, 2009.
- [13] J. Caniglia and D. Mupinga, "Experiences of middle school students following a financial literacy simulation," *J. Educ. & Practice*, vol. 10, no. 15, pp. 45-53, 2019.

- [14] T. A. Lucey and S. A. Maxwell, "Teaching mathematical connections to financial literacy in grades K-8: Clarifying the issues," *Investigations in Mathematics Learning*, vol. 3, no. 3, pp. 46-65, 2011.
- [15] A. Grohmann, R. Kouwenberg, and L. Menkhoff, "Childhood roots of financial literacy," *J. Econ. Psychol.*, vol. 51, pp. 114-133, 2015.