

Financial Education and Mathematics Education: A Cross-Cutting Analysis of the Epistemological Intersection of Financial Numeracy



Annie Savard and Alexandre Cavalcante

1 Introduction

This chapter examines the epistemological intersection between Financial Education (FE) and mathematics education (ME), and explores the importance of mathematics educators in the teaching of FE.

The parallel development of mathematics and finance can be observed through historical examples. According to Ifrah (2000), thousands of years ago, shepherds needing to know the number of animals they were bringing to market used pebbles. The invention of money to replace the barter system established a standard measure for the exchange of goods and services (Ifrah, 2000). This shared development remains important, especially in the context of teaching and learning FE and ME.

This chapter begins by briefly defining and discussing FE and ME, showing how the definitions are grounded in the literature. We then examine the intersection between FE and ME, which we refer to as financial numeracy. This intersection can be regarded as a developmental construct, derived from financial contexts, in which mathematics becomes the pragmatic measurement of financial practices.

A. Savard (✉)

Department of Integrated Studies in Education, Faculty of Education, McGill University, 3700 McTavish Street, Montreal, QC, Canada

e-mail: annie.savard@mcgill.ca

A. Cavalcante

Ontario Institute for Studies in Education, University of Toronto, 252 Bloor Street West, Toronto, ON, Canada

e-mail: alexandre.cavalcante@utoronto.ca

© Springer Nature Switzerland AG 2021

A. Savard and A. Cavalcante (eds.), *Financial Numeracy in Mathematics Education*, Mathematics Education in the Digital Era 15, https://doi.org/10.1007/978-3-030-73588-3_1

2 Definition(s) of Financial Education: Moving from Financial Literacy to Financial Education

This project began with current definitions of financial literacy (FL) grounded in the literature. The emerging field of FL is, it seems to us, moving from knowledge to competency. Researchers from a number of different fields have tried to define financial literacy in various ways, and over time the definition has come to mean a set of financial knowledge and its use in human behaviours (Huston, 2010; Johnson & Sherraden, 2007). Hogarth (2002) described three consistent themes emerging from the literature to define individuals who are financially literate: they (1) are knowledgeable, educated and informed on the issues of managing money and assets, including banking, investments, credit, insurance and taxes; (2) understand the basic concepts of managing money and assets; and (3) use that knowledge and understanding to plan and implement financial decisions (pp. 15–16). It is clear from this that knowledge is key. Knowledge of financial concepts and products includes, for example, knowing, what a profit is, how a credit card works and how you buy insurance. However, knowing is not enough: it is necessary to understand this knowledge in order to use it in life. The use of this knowledge and understanding can be seen in the conduct or actions of individuals in regard to personal finances, in other words, financial behaviours. Defining financial literacy in terms of knowledge and behaviours, and focusing on aspects of participation in economic life without considering competency to act and how personal decisions are linked to institutions, however, is quite limited and difficult to operationalise (Johnson & Sherraden, 2007). Financial literacy has therefore been reconceptualised as financial capability (Sherraden & Ansong, 2016), in which skills, behaviours and knowledge in four domains are articulated: managing money, planning ahead, choosing products and staying informed (Atkinson et al., 2007). In fact, financial capability can be understood as the ability to make informed judgements and decisions, using skills, behaviour and knowledge (Atkinson et al., 2007). According to Xiao and O'Neill (2016), financial capability is the ability to use financial knowledge to adopt financial behaviours that will achieve financial well-being. Such a definition focuses on specific aspects of participation in economic life, without taking into consideration competency to act and how personal decisions are linked to institutions (Johnson and Sherraden, 2007). In fact, as pointed out by Xiao and O'Neill (2016), financial capability can be regarded as a synonym for financial literacy. The term capability is largely used in different fields such as business, economics, and social development and social work. In a report on financial literacy in the US, Vitt and his colleagues (2000) suggested including complexity in the definition of competency:

personal financial literacy is the ability to read, analyse, manage and communicate about the personal financial conditions that affect material well-being. It includes the ability to discern financial choices, discuss money and financial issues without (or despite) discomfort, plan for the future, and respond competently to life events that affect everyday financial decisions, including events in the economy generally. (Vitt et al., 2000, p. xii)

The notion of competency seems more productive to us than capability, because financial capability is a generalisable behavioural outcome, a desirable aim in general. A competency, by contrast, is a situated aptitude or disposition held by a person. In education, a competency entails the development of a person. We agree with Perrenoud's (2002) definition of competency as the mobilisation of a set of resources according to the context. These resources are knowledge, skills, tools, humans, everything to which an individual might have access in their environment. It could even be an online search or advice from a financial adviser. Mobilisation is not the application or transfer of knowledge, it is the adaptation or transformation of the knowledge in a particular situation. Thus, knowing how a financial product works does not in itself render you competent. Being competent means deciding whether this financial product is relevant and needed in your own situation, taking into account your personal needs, which includes your family's or community's needs. It also means using this financial product in a productive way for oneself and others.

Making decisions is a complex process that requires the use of mathematics to be able to generate and assess alternatives (Halpern, 2003; Savard, 2008). In fact, it seems that being able to make decisions about personal financial choices cannot be done without strong mathematical knowledge (Agarwal & Mazumder, 2013; Cole et al., 2014). Recent work by Savard (2018) highlights the use of mathematical models by grade 4 students to make sense of financial concepts such as purchasing power, investment and risk.

The complexity of financial competency was recognised and included in the definition of financial literacy for young people promoted by OECD in their PISA 2012 International Assessment Programme (OECD Programme for International Student Assessment 2014):

Financial literacy is knowledge and understanding of financial concepts and risks, and the skills, motivation and confidence to apply such knowledge and understanding in order to make effective decisions across a range of financial contexts, to improve the financial well-being of individuals and society, and to enable participation in economic life. (p. 33)

Four areas of knowledge and understanding are thus defined as the content: money and transactions, planning and managing finances, risk and reward, and the financial landscape. Four processes and four contexts are also defined. Identifying financial information, analysing information in a financial context, evaluating financial issues, and applying financial knowledge and understanding are processes present in situations where financial knowledge, skills and understanding have to be used. The contexts range from personal to global: education and work; home and family; individual; and societal.

Other public organisations have also defined the content to be taught in schools. In 2013, the Council for Economic Education in the United States established national standards of financial literacy education to be taught in schools in six important areas: earning income, buying goods and services, saving, using credit, financial investing, and protecting and insuring (Council for Economic Education, 2013). Each standard statement has "benchmarks" explaining content to be taught, as well as information and lifelong insight (Bosshardt & Walstad, 2014). Also in the United States, the

Jump\$tart Coalition for Personal Financial Literacy launched the fourth version of its educational programme in 2015. Six standards to be taught from kindergarten to grade 12 are presented: spending and saving, credit and debt, employment and income, investing, risk management and insurance, and financial decision making. In the content areas to be taught, there are consistent key concepts: for example, spending, saving and managing risk are part of all of them. It is also possible to combine them to cover a wider range of financial concepts. For instance, spending and saving is related to the concept of consumerism.

However, as this project unfolded, we noticed that some important aspects of education, particularly mathematics education, were missing from these definitions. We changed our way of looking at FL to incorporate broader views on the subject. Instead of focusing only on personal finance (which is the current state of the art in the literature), we decided to embrace aspects of critical thinking, citizenship and community. For us, the focus on mathematics is also crucial, because without numeracy, finances and economics cannot be modelised. In this way we moved from financial literacy to Financial Education. Our working definition of FE for the purposes of this project is:

Financial Education is the field of teaching and learning the financial dimension of the production and management of resources mediated by financial instruments (currency, models, concepts). The use of financial instruments can also lead to assigning a value to an action (service) or an object (good).

The cognitive and social aspects are considered, such as financial praxis in different contexts. Producing resources, for example, means developing both actual and new resources. For example, a student might produce new resources from existing available resources, such as recycling fabric to make pencil cases. The student can produce this resource for their own use, or they can sell it and obtain money. In this case, entrepreneurship education is included in our definition. Managing resources means managing individual and collective resources to develop well-being for oneself and one's community. A student might decide to exchange a toy with a friend to get another one, instead of asking their parents to buy it. The cognitive and social aspects of the financial praxis should be understood in order to participate fully in the different communities. Financial Education should therefore aim to develop cognitive understanding of sociocultural practices about producing and managing individual and collective resources, thereby developing citizenship competencies in all students.

In Financial Education, a learning situation should involve studying an object or phenomenon derived from financial praxis in a sociocultural context. The financial practices might be buying things in a store, or a situation involving financial concepts such as profit or compound interest. Mathematics is thus a privileged tool that models the situation to develop cognitive understanding. Knowledge and understanding developed in the cognitive context are about finance and mathematics, in other words, financial numeracy. FE is also about making thoughtful decisions about financial praxis for oneself and one's community (Caprioara et al., 2020; Savard, 2017). Such decisions can also be regarded as the result of a critical thinking process (Lipman, 2003; Paul & Elder, 2001). Critically engaging students in financial praxis supports

the development of citizenship competencies. Ten Dam and Volman's (2004) definition of citizenship includes critical and responsible participation in social practices by a member of a community. This represents a democratic evolution of social practices and thus of the community itself. From this point of view, critical thinking and decision making can be considered citizenship competencies (Savard, 2008).

Citizenship may have varied profiles among the members of a community. Westheimer and Kahne (2004) identify three kinds of citizens: the personally responsible citizen, the participatory citizen and the justice-oriented citizen. The personally responsible citizen acts in a responsible manner in their community, while the participatory citizen is active in the community at the local, state or national level. The justice-oriented citizen analyses and questions issues of social justice. For instance, the responsible citizen might donate money or food to a local charity, the participatory citizen volunteers at the fundraising activity and the justice-oriented citizen will try to find a way to eradicate poverty.

Mathematics highlights the citizenship context that might be explicitly or implicitly present in the learning situation presented to students. For example, learning about buying goods in a store might lead to questions about fair trade, while learning about profit might lead to discussion of sustainability. Learning about compound interest might lead to saving money for education.

Financial Education is thus broader than personal finances, it is about developing citizenship, and mathematics education plays a major role in this development. The next chapter identifies what we want for students: financial literacy using mathematics, in other words, financial numeracy.

References

- Agarwal, S., & Mazumder, B. (2013). Cognitive abilities and household financial decision making. *American Economic Journal: Applied Economics*, 5(1), 193–207.
- Atkinson, A., McKay, S., Collard, S., & Kempson, E. (2007). Levels of financial capability in the UK. *Public Money & Management*, 27(1), 29–39.
- Bosshardt, W., & Walstad, W. B. (2014). National standards for financial literacy: Rationale and content. *Journal of Economic Education*, 45(1), 63–70.
- Caprioara, D., Savard, A., & Cavalcante, A. (2020). Empowering future citizens in making financial decisions: A study of elementary school mathematics textbooks from Romania. In D. Flaut, S. Hoskova-Mayerova, C. Ispas, F. Maturo, & C. Flaut (Eds.), *Decision making in social sciences: Between traditions and innovations*. Springer.
- Cole, S. A., Paulson, A., & Shastry, G. K. (2014). Smart money? The effect of education on financial outcomes. *Review of Financial Studies*, 27(7), 2022–2051.
- Council for Economic Education. (2013). *National standards for financial literacy*.
- Halpern, D. F. (2003). *Thought and knowledge: An introduction to critical thinking* (4th ed.). Lawrence Erlbaum Associates.
- Hogarth, J. (2002). Financial literacy and family and consumer sciences. *Journal of Family and Consumer Sciences*, 94(1), 14–28.
- Huston, S. J. (2010). Measuring financial literacy. *The Journal of Consumer Affairs*, 44(2), 296–316.
- Ifrah, G. (2000). *The universal history of numbers. From prehistory to the invention of the computer*. Wiley.

- Johnson, E., & Sherraden, M. S. (2007). From financial literacy to financial capability among youth. *Journal of Sociology & Social Welfare*, XXXIV(3), 119–145.
- Lipman, M. (2003). *Thinking in education* (2nd ed.). Cambridge University Press.
- Organisation for Economic Cooperation and Development (OECD) (2013). OECD skills outlook 2013 first results from the survey of adult skills. OECD Publishing.
- Organisation for Economic Cooperation and Development [OECD]. (2014). *PISA 2012 results: Students and money: Financial literacy skills for the 21st Century* (Vol. VI). OECD Publishing.
- Paul, R., & Elder, L. (2001). *Critical thinking: Tools for taking charge of your learning and your Life*. Prentice Hall.
- Perrenoud, P. (2002). D'une métaphore à l'autre: transférer ou mobiliser ses connaissances? In J. Dolz & E. Ollagnier (Eds.), *L'énigme de la compétence en éducation* (pp. 45–60). Bruxelles: De Boeck.
- Savard, A. (2008). *Le développement d'une pensée critique envers les jeux de hasard et d'argent par l'enseignement des probabilités à l'école primaire: Vers une prise de décision* (Unpublished dissertation). Université Laval, Québec.
- Savard, A., Cavalcante, A., Turineck, L.-P., & Javaherpour, A. (forthcoming). Epistemological considerations towards the concept of money in school: Money as measurement. *For the learning of mathematics*.
- Savard, A. (2017). Making decisions in a complex world: Teaching how to navigate using mathematics. In C. Michelsen, A. Beckmann, V. Freiman, & U. T. Jankvist (Eds.), *Mathematics as a bridge between the disciplines. Proceedings of mathematics and its connections to the arts and science international symposium* (MACAS 2017), 27–29 June, Copenhagen, Denmark, 1–14.
- Savard, A. (2018). Teaching probability and learning financial concepts: How to empower elementary school students in citizenship. In K. S. Cooter & T. Lucey (Eds.), *Financial literacy for children and youth* (2nd ed., pp. 137–152). Peter Lang.
- Sherraden, M. S., Ansong, D. (2016). Financial literacy to financial capability: Building financial stability and security. In C. Aprea, K. Breuer, P. Davies et al. (Eds.), *International Handbook of Financial Literacy* (pp. 83–96). New York: Springer.
- ten Dam, G., & Volman, M. (2004). Critical thinking as a citizenship competence: Teaching strategies. *Learning and Instruction*, 14(4), 359–379.
- Vitt, L. A., Anderson, C., Kent, J., Lyster, D. M., Siegenthaler, J. K., & Watrd, J. (2000). *Personal finance and the rush to competence: Personal literacy in the US*. The Fannie Mae Foundation.
- Westheimer, J., & Kahne, J. (2004). What kind of citizen? The politics of educating for democracy. *American Educational Research Journal*, 41(2), 237–269.
- Xiao, J. J., & O'Neill, B. (2016). Consumer financial education and financial capability. *International Journal of Consumer Studies*, 40, 712–721. <https://doi.org/10.1111/ijcs.12285>