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MATHEMATICS CURRICULA IN FRANCOPHONE COUNTRIES

POLITICAL INEQUITIES AND IMPLICATIONS FOR GRADE 1 AND GRADE 2

CURRICULOS DE MATEMÁTICA NOS PAISES FRANCÓFONOS

Desigualdades políticas e implicações para grau 1 e grau 2

CURRICULOS MATEMÁTICOS EN PAISES FRANCOFONOS

Desigualdades políticas e implicaciones para grado 1 y grado 2

Annie Savard
(McGill University, Canada)
annie.savard@mcgill.ca

Alexandre Cavalcante
(University of Toronto, Canadá)
alexandre.cavalcante@utoronto.ca

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RESUMO

Este artigo apresenta um estudo qualitativo de quatro currículos nacionais de matemática de 1º e 2º anos do ensino fundamental provenientes de países francófonos: Costa do Marfim, Djibuti, Canadá (Québec) e França. Uma análise comparativa foi realizada para identificar diferenças que podem, possivelmente, se tornar inequidades entre esses países. Identificamos todos os conceitos presentes no currículo de matemática dos 1º e 2º anos usando a estrutura de alfabetização matemática desenvolvida pela OCDE por meio de sua avaliação PISA: quantidade, variações e relações, incerteza e dados, e espaço e forma. Em seguida, cruzamos a análise dos países para encontrar as principais diferenças entre eles. Os resultados mostram três categorias de possíveis inequidades entre os diferentes currículos: alguns conceitos matemáticos não se aproximam de aspectos culturais relevantes para os alunos, alguns conceitos presentes nos currículos de matemática não são conceitos matemáticos, e alguns conceitos matemáticos importantes não fazem parte dos currículos de matemática. Nossos resultados mostram que essas iniquidades aparecem nos quatro países analizados. Em vez disso, elas aparecem em todos os quatro currículos analisados aqui. Essas descobertas destacam a necessidade de questionar as inequidades políticas e globais entre os currículos de matemática, a fim de proporcionar a todos os alunos a oportunidade de aprender matemática de maneira forte e significativa

Palavras-chave: países francófonos. currículos em matemática. inequidades. OCDE.

ABSTRACT

This paper presents a qualitative study of four Grade 1 and Grade 2 national mathematics curricula coming from francophone countries: Côte d'Ivoire, Djibouti, Canada (Québec), and France. A comparative analysis was performed to identify differences that potentially lead to inequities among the countries. We identified all the concepts present in the Grade 1 and Grade 2 mathematics curriculum using the mathematical literacy framework developed by the OECD through its PISA assessment: quantity, change and relationship, data and uncertainty, and space and shape. Then we looked across countries to find the major differences among them. The findings show three categories of possible inequities among the different curricula: some mathematical concepts are not presented in culturally relevant ways to students, some concepts present in the mathematics curricula are not mathematical concepts, and some important mathematical concepts are not part of the mathematics curricula. Our results show that these inequities appear in all four national curricula analysed here. Those findings highlight the need to question the political inequities among mathematics curricula around the world in order to give a chance for all students to learn strong and meaningful mathematics.

Keywords: francophone countries. mathematics curriculum. inequities. OCDE

RESUMEN

Este artículo presenta un estudio cualitativo de cuatro currículos nacionales de matemáticas para el 1° y 2° año de educación primaria de países francófonos: Costa de Marfil, Yibuti, Canadá (Québec) y Francia. Se realizó un análisis comparativo para identificar las diferencias que eventualmente podrían convertirse en inequidades entre estos países. Identificamos todos los conceptos presentes en el currículo de matemáticas de 1° y 2° grado utilizando el marco de competencia matemática desarrollado por la OCDE a través de su evaluación PISA: cantidad, variaciones y relaciones, incertidumbre y datos, y espacio y forma. A continuación, realizamos un análisis entre países para encontrar las principales diferencias entre ellos. Los resultados muestran tres categorías de posibles desigualdades entre los diferentes currículos: algunos conceptos matemáticos no se acercan a aspectos culturales relevantes para los estudiantes, algunos conceptos presentes en los currículos de matemáticas no son conceptos matemáticos, y algunos conceptos matemáticos importantes no forman parte del planes de estudios de matemáticas. Nuestros resultados muestran que estas desigualdades aparecen en los cuatro países analizados. En cambio, aparecen en los cuatro currículos revisados aquí. Estos hallazgos resaltan la necesidad de cuestionar las desigualdades políticas y globales entre los currículos de matemáticas para brindar a todos los estudiantes la oportunidad de aprender matemáticas de manera sólida y significativa.

Palabras clave: países francófonos. currículos de matemática. inequidades. OCDE

Background of the study

Over the years, our work brought us to study different mathematics national curricula in elementary and secondary schools. These curricula are official government documents that present the content expected to be taught, as well as the major orientations regarding teaching and learning mathematics (Schoenfeld, 2014). They also could be considered as frameworks or standards (Hjalmarson, 2008). Each time we looked at a different curriculum, we were very surprised by the major differences we observed between them such as the numbers students have to learn in Grade 1. We wondered about the social and political implications of these differences regarding equity for students to access mathematics. This paper is an opportunity to get a deeper look at those possible inequities for students to learn mathematics. The research questions are: What are the possible inequities present in Grade 1 and Grade 2 national curricula and what are the implications for students?

Inequities in Mathematics Education

Inequity in teaching and learning mathematics is not new. According to Zhu (2018), some members of the mathematics education community raised concerns at least four decades ago. In the 70's, questions about gender equity were raised. Twenty-five years later, back in 2002, Gutiérrez questioned inequity in students' mathematics achievement and participation. These inequities are based on students' characteristics such as "race, class, ethnicity, sex, beliefs and creeds, and proficiency in the dominant language" (2002, p. 153). Weissglass (2002) also raised important questions for educators on how attitudes, beliefs, values, and emotions affect inequities in mathematics education. More specifically, he raised questions about how racism, gender, sexual orientation, and culture affect student learning. He highlighted the role of the curriculum developer in engaging students and challenging inequalities. Another source of inequity, the income environment and the social and cultural capital have also been questioned by Boaler, Altendorff and Kent (2011) and more recently by Wright, Fejzo and Carvalho (2022). Burkhardt and Schoenfeld (2018) highlighted the fact that equity is also about having equal opportunities to engage with rich mathematical content and practices. As pointed out by the National Council of Teachers of Mathematics (NCTM)[1], equity requires high expectations for all students, which means to bring challenging mathematical concepts and processes for all students in a way that makes them accessible. We noticed that accessibility is, under some circumstances, restricting students to learn complex mathematical ideas. Therefore, it is so important to us to delve deeper into the phenomenon. In this paper, we define inequity as curriculum which are not providing rich mathematical concepts and processes for students to learn.

The organization of mathematics content

We acknowledge that the organization of mathematics content varies across different countries. To operationalize a comparison of the national curricula of countries who share a common language outside of the anglosphere, we looked for frameworks of mathematical content. Among international studies in mathematics, two major assessment frameworks stand out: the Programme for International Student Assessment (PISA), and the Trends in International Mathematics and Science Study (TIMSS).

The framework of TIMSS (Mullis & Martins, 2017) for early grades of elementary school is composed of three categories of mathematical content: number, measurement and geometry, and data. These categories are rather limited as they have a strict and rigid set of concepts in the assessment, not allowing a comparison of different content. For example, we know some of the countries in our study had elements of algebraic thinking or relational reasoning in their curricula, which is not considered in the TIMSS framework.

The PISA framework, on the other hand, is composed of four categories of mathematical content that are flexible and open to different concepts: quantity, change and relationship, data and uncertainty, and space and shape (OECD, 2018). These content categories enable a comparative perspective by ensuring consistency in the analysis given that some concepts can be allocated into different domains (e.g., in some curricula, measurement concepts are located in geometry while others are located in arithmetic).

Assessments such as the PISA reflect a global trend toward internationalization and globalization in mathematics curricula. According to Cai and Howson (2012), the characteristics of such a trend include common learning goals (related to formal knowledge, skills and higher-order thinking), common emphasis (particularly algebra and statistics/probability), influence of public examinations (in the form of graduation exams or university entrance exams), and common issues associated with mathematics pedagogy (which include creativity vs. critical thinking, conceptual understanding vs. procedural fluency, and mathematics for all vs. differentiation for gifted students). The authors also mention critiques of such a trend of internationalization and globalization of mathematics curricula. Arguments against this trend emphasize the lack of relevance to local communities as well as the reproduction of

[1] https://www.nctm.org/Standards-and-Positions/Principles-and-Standards/Principles,-Standards,-and-Expectations/

neoliberal discourses associated with mathematics as a gatekeeping science and necessity for economic development (Ahn et. a., 2021; Dogan & Haser, 2014; Cai and Howson, 2012). In this paper, we acknowledge both trends of internationalization and cultural relevance and interpret the tensions arising from differences in elementary mathematics curricula as a product of these two forces in education policy making.

Methodology

We selected four national curricula from francophones countries, where French is an official language. We assume here that the language used to write the official documents has cultural implications of the conceptualisation of mathematics. For instance, France has a long tradition of having famous mathematicians such as Descartes, Fermat, Pascal, Poincarré and Poisson. Therefore, French country speaking might be strongly inspired by mathematics curricula coming from France. In addition to that, countries are usually inspired by other countries to write their documents. Sharing the same language makes them more accessible. Within the Francophonie, we selected three curricula (Côte d'Ivoire, Djibouti and Canada) where the first author was asked to work on these curricula with officials of the Ministries of Education, and one curriculum easily accessible (France). Canada does not have one unique national curriculum; each province and territory has its own. We selected the Québec curriculum because it was conceptualized and written in French at first, it is not a translation of an English document.

Three of the selected countries were former French colonies. As pointed out by Nwanosike & Onyije (2011), colonialism affects education system in a quite negative way that "perpetuate their underdevelopment and dependency" (p. 45). For instance, French is the language of instruction in Côte d'Ivoire and Djibouti, even if it is not the mother tongue of the majority of students. In this paper, we wish to learn from each curriculum, so that it might create learning conditions to empower students in those four countries in meaningful ways.

The Côte d'Ivoire curriculum was launched around 2016, while the Djibouti curriculum was launched in 2008. For each country, the curriculum was presented by grade levels. France' curriculum was launched in July 2020. The document presents the mathematical content to be taught in Grade 1 to Grade 3 (Cycle 2). However, the content is not associated with a specific grade, it is written generally. Québec curriculum was launched in 2001. The content is presented by cycles: Grade 1 and Grade 2 are Cycle 1. In all countries, students enter in Grade 1 at 6 years-old and Grade 2 at 7 years-old.

For each of the four curricula selected, we first write the mathematical domain and an overview of the content within each domain. In some curricula, another name was given to a mathematical domain. For example, Space and Geometry was used in France for Geometry. For each mathematical domain, we compared the mathematical concepts and processes presented. We identified the differences and the possible inequities within these differences, and the implications for students.

We present the findings under each of the four content areas in the PISA framework: quantity, change and relationship, data and uncertainty, and space and shape. For each content area, we present which concepts and processes are presented in the curricula, along with the possible inequities and the implications for students.

Findings

Change and Relationships

Change and Relationships are presented in the four curricula under different forms. In Québec and France, mathematical concepts about the change and relationship are part of quantity, mainly about equality (such as a + ? = c) or about solving word problems. In those two countries' curricula, patterns are part of the space and shape domain. The focus is on visual objects. However, in the Djibouti Grade 1 curriculum, there is another mathematical subdomain: rhythms. Rhythms involve patterns using visual objects, sounds and gestures. Côte d'Ivoire also has rhythm in Grade 1, but it falls within the domain titled Before numerical. Such rhythms can be an effective culturally responsive way for students to learn about patterns. In the Djibouti Grade 1 curriculum, structuring time is also part of this mathematical domain. Students learn about time patterns by exploring the idea of "the day before" and "the day after".

Difference #1- We noticed that some national curricula (namely Québec and France) do not present mathematical concepts close to cultural aspects relevant for students when it comes to change and relationships. The implication for students is that they might not have the opportunity to learn about the mathematical practice of identifying patterns in a culturally relevant way. Therefore, it is a possible inequity for students living in those countries.

Quantity

Under this domain, each of the four curricula present mathematical concepts in different facets: Before numerical, Arithmetics/numbers and operations, and Measurement.

Before numerical

In Djibouti and Côte d'Ivoire, this domain appears only in Grade 1. The reason for such a domain is the ongoing effort to implement kindergarten for all students nationwide. Consequently, most students do not have any schooling experience when starting Grade 1 at 6 years old. The mathematical concepts and processes presented in this domain are meant to develop reasoning through categorization of different objects. No numbers are presented here; students should use figures, objects, and colours. While categorization can be seen as a mathematical practice (particularly without the use of number systems), in Djibouti, colours are also taught as part of the mathematics curriculum. Instead of using colours to establish categories of objects, the curriculum expects students to learn colours as mathematical concepts in their mathematics class.

Difference #2- One national curriculum presents concepts that are not mathematical concepts. The implication for students that we identified is the risk of occupying the mathematics classroom time with concepts that are not mathematical or do not promote mathematical reasoning. Consequently, the time spent on doing mathematics is reduced, which is possibly inequitable for students living in those countries.

Arithmetic/numbers and operations

This domain appears in all four curricula under different names, but it overall refers to the development of number sense arithmetic operations. In Djibouti and Côte d'Ivoire, students in Grade 1 learn numbers from 0 to 20 and in Grade 2 from 0 to 100. In Québec and France, students learn numbers from 0 to 1 000 in both Grades 1 and 2. This is a major difference, because developing number sense using only units and tens limits understanding of the numeration system (particularly in countries whose currencies use thousands). In addition to that, Djibouti and Côte d'Ivoire dedicate space and time in their curricula for students to learn how to write numbers in French. Therefore, students spend a certain amount of time writing numbers in letters instead of reasoning about those numbers.

Another major difference relates to the learning of arithmetic operations. In Côte d'Ivoire, the Grade 1 curriculum presents addition only, while there is no operation at all in the Grade 1 Djibouti curriculum. In other words, these curricula represent the arithmetic operations through the operational paradigm (Polotskaia et al, 2022). Through this paradigm, the four operations are taught and learned based on their algorithms and developing number sense is quite limited. Developing number sense goes along with developing understanding of operations: how to compose and decompose a number is an important element of understanding quantities. In fact, developing the meaning of operations is not explicitly presented in these two countries' curricula while it is explicitly done in Québec and France. Thus, relationships among quantities and their representations in words problems are explicitly addressed. In our previous work (Cavalcante et al, 2019), we have argued that working with multiple representations of quantities provides students the opportunity to learn and show their understanding in mathematical problem solving. But that process takes time. Hence, by introducing all operations from Grade 1, Québec and French students seem to have more time to develop conceptual and procedural fluency with operations and their respective algorithms.

	Côte d'Ivoire	Djibouti	Canada (Québec)	France
Numbers	G1: 0 to 20 G2: 0 to 100	G1: 0 to 20 G2: 0 to 100	G1 & G2: 0 to 1,000	G1 & G2: 0 to 1,000
Addition	G1 & G2	G2	G1 & G2	G1 & G2
Subtraction	G2	-	G1 & G2	G1 & G2
Multiplication	G2	G2	G1 & G2	G1 & G2
Division	-	-	G1 & G2	G1 & G2

Table 1: Arithmetic concepts in each curriculum.

Difference #3- We noticed that some curricula do not present mathematical concepts needed to develop a robust understanding of number sense and operations. The implication for students is that they might not have the opportunity to develop a deep understanding of mathematics in later grades. We see this as an inequity, because in those countries, students in Grade 1 and Grade 2 use bigger numbers in their daily life, such as money to buy snacks at the recess. Their currencies allow the use of big numbers like 1000 to buy inexpensive things and young students have opportunities to manipulate money on a regular basis. For example, a Grade 2 student can have 150 FDJ to buy his snack (Savard, 2018). In this case, those curricula restrain students to learn mathematics and could be seen as an effect of colonialism.

Measurement

Measurement is presented in all four curricula, but not in both grades. In Côte d'Ivoire and Djibouti, this content area is only presented in Grade 2. Particularly with regards to specific subdomains of measurement, length is presented in all four curricula; time is presented in three; capacity and mass in two; and price in one curriculum. Table 2 presents the units of measurement presented in each curriculum.

	Côte d'Ivoire	Djibouti	Canada (Québec)	France
Length	G2	G2	G1 & G2	G1 & G2
Time	-	G2	G1 & G2	G1 & G2
Capacity	G2	-	-	G1 & G2

Mass	-	G2	-	G1 & G2
Price	-	-	-	G1 & G2

Table 2: Measurement concepts in each curriculum.

It is important to notice that, while price only appears in the French curriculum, money is a measurement concept (Savard et al, 2020). It refers to the measure of economic value of a product or service. Unlike other measures, it is not physical but pragmatic (it depends on a variety of factors). Broadly speaking, time, capacity, mass, and price are used in daily life to provide information about objects, ideas and social activities. For instance, capacity, mass, and price are used at the market for buying food. Most students face situations where they need those mathematical concepts in economic activities. Yet, in only one of these countries (France) do students have opportunities to learn about and make sense of such economic activities in mathematics classes. Consequently, the opportunities for developing financial numeracy (Savard & Cavalcante, 2021) are limited to these students. As we have argued in our work, different types of mathematical reasoning are necessary for authentic participation in economic activity, hence students should be afforded those opportunities from an early age.

Difference #4- Some curricula do not present mathematical concepts that are necessary for making sense of the world around students. The implication is that students might not have the opportunity to develop an understanding of economic activities (among others) from an early age, which is a possible inequity.

Space and shape

The content area of space and shape is presented in all four curricula using various terminologies such as geometry, space, or structuring the milieu. All four curricula present concepts associated with space, lines, solids, and figures. Again, because of ongoing efforts to implement kindergarten classrooms for all students, Côte d'Ivoire and Djibouti focus the content of Grade 1 on lines and location in space: above, below, behind, left, etc. That is done at the expense of other concepts such as solids and polygons. In addition to that, in Côte d'Ivoire and Québec, grids and paths are part of both Grade 1 and Grade 2 curricula. Students are introduced to the coordinate system of a cartesian plane (first quadrant). Finding a path on a grid and locating objects using code or algorithms is important for learning coding subsequently in school. In France, coding appears more explicitly in the curriculum for both grades. Students learn about creating a pathway and coding it so another student (or a robot) can follow instructions and develop the same path.

Difference #5- We noticed that some curricula do not present mathematical concepts necessary for learning coding. Although this research focused only on the first two years of elementary school, the implication for students is the lack of opportunity to develop foundations for coding for a prolonged amount of time (which is typically required to galvanize their understanding of the nature of coding). This is a possible inequity for students living in those countries.

Data and Uncertainty

The content area of data and uncertainty is only present in Québec under its Probability and Statistics strand. In the first two grades, concepts of descriptive statistics include formulating questions of a survey, collecting data, representing, and interpreting data. Probability, on the other hand, includes experimenting, predicting, and enumerating events. Together, these two areas develop probabilistic thinking, which is reasoning under uncertainty (Savard, 2014). This type of reasoning is complex and takes time to develop because it is very different from deterministic reasoning, which is mainly used in other mathematical content areas (Savard, 2014).

Difference #6-Some national curricula do not present mathematical concepts on probability and statistics in Grades 1 and 2. The implication for students is that they don't have the opportunity to develop probabilistic and statistical reasoning from an early age, which can create a learning obstacle regarding variability and uncertainty later in life. This is a possible inequity.

Discussion

Our findings show three categories of inequities: some mathematical concepts might not be culturally relevant for students, some concepts present in the mathematics curricula are not mathematical concepts, and some important mathematical concepts are not part of the mathematical curricula. It is interesting to note that these categories are coming from developing countries and also from developed countries. We can learn from all of them. Table 3 presents the three categories of differences among the four national curricula studied

Possible iniquities	Difference	Côte d'Ivoire	Djibouti	Canada (Québec)	France
Cultural relevance	Difference #1			X	X
Non-mathematical concepts	Difference #2		X		
Absence of some mathematical concepts	Difference #3	X	X		
	Difference #4			X	
	Difference #5		X		
	Difference #6	X	X		X

Table 3: The Differences into the four Grade 1 and Grade 2 national curricula.

Our findings suggest that possible inequities emerging from national curricula impact students at a country level. For instance, within the same country using the same national curriculum, it seems to have the same opportunities for all students to learn in Grade 1 and in Grade 2. That is because these possible inequities are about the mathematics presented in the curricula and not about students. Consequently, these are three categories of possible inequities across countries instead of being possible inequities within countries. Therefore, we can say that these possible inequities are political because they are coming from national curricula.

It is worth mentioning two limitations in this study. Firstly, the low number of curricula analysed in this paper have generated four preliminary categories, but we recognize that other categories of possible inequities are possible. In order to gather more data and potentially generate new categories, we intend to compare these findings with the analysis of anglophone countries' mathematics curriculum coming from other countries.

Secondly, we recognize that curriculum is just one factor to impact student learning. Many other factors have an (sometimes bigger) impact: resources, textbooks, technology, teacher training, infra-structure, socioeconomic status, gender, race/ethnicity, etc. The analysis we proposed here focused on an external force that fosters or constrains the mathematics practices in class.

Concluding remarks

These findings highlight the necessity to have an equitable mathematics curriculum for each country around the world. Thus, we recommend to stakeholders to take in consideration the cultural relevance of the mathematical concepts and processes. We also recommend making critical decisions regarding the mathematical content in the mathematics curricula: each concept should be a mathematical concept and challenging mathematical concepts should be presented to all Grade 1 and Grade 2 students, in an accessible way.

References

Ahn, A., Brown, J., Coles, A., Le Roux, K., Mellone, M., Ng, O. L., & Solares, A. (2021). Researching mathematics curriculum innovation in complex, changing, uncertain times. In Inprasitha, M., Changsri, N., & Boonsena, N. (Eds). *Proceedings of the 44th Conference of the International Group for the Psychology of Mathematics Education* (Vol.1). Khon Kaen, Thailand: PME.

Boaler, J., Altendorf, L., & Kent, G. (2011). Mathematics and science inequalities in the United Kingdom: When elitism, sexism and culture collide. *Oxford Review of Education*, 37(4), 457–484.

Burkhardt, H., & Schoenfeld, A. (2018). Assessment in the service of learning: Challenges and opportunities or Plus ça Change, Plus c'est la même Chose. *ZDM Mathematics Education, 50*(4), 1–15.

Cai, J., Howson, G. (2012). Toward an International Mathematics Curriculum. In: Clements, M., Bishop, A., Keitel, C., Kilpatrick, J., Leung, F. (Eds.) *Third International Handbook of Mathematics Education. Springer International Handbooks of Education*, vol 27. (pp. 949-974). Springer, New York, NY.

Cavalcante, A., Polotskaia, E., Savard, A., Fellus, O. (2019). Teacher noticing of student thinking: An analysis of a teacher's interpretation of mathematics problem solving. *Bulletin of The Transilvania University of Brasov, 12*(61), 9-18.

Doğan, O., & Haser, Ç. (2014). Neoliberal and nationalist discourses in Turkish elementary mathematics education. *ZDM*, *46*(7), 1013-1023.

Gutierrez, R. (2002) Enabling the Practice of Mathematics Teachers in Context: Toward a New Equity Research Agenda, *Mathematical Thinking and Learning*, 4:2-3, 145-187, DOI: 10.1207/S15327833MTL04023_4

Margret A. Hjalmarson (2008) Mathematics Curriculum Systems: Models for Analysis of Curricular Innovation and Development, *Peabody Journal of Education*, 83:4, 592-610, DOI: 10.1080/01619560802414965

Mullis, I. V., & Martin, M. O. (2017). *TIMSS 2019 Assessment Frameworks*. International Association for the Evaluation of Educational Achievement. Herengracht 487, Amsterdam, 1017 BT, The Netherlands.

Nwanosike, O. .F, & Onyije, L. E. (2011). Colonialism and Education. *Mediterranean Journal of Social Sciences*, 2(4), 41. Retrieved from https://www.richtmann.org/journal/index.php/mjss/article/view/10879

OECD. (2018). *PISA 2022 Mathematics Framework.* OECD Publishing.

Polotskaia, E., Fellus, O., Cavalcante, A., Savard, A. (2022). Student Problem Solving in the Transition from Numerical to Relational Thinking. *Canadian Journal of Science, Mathematics and Technology Education, 22*(2), 341-364.

Savard, A., Cavalcante, A. (2021). Financial Numeracy as Part of Mathematics Education. In: Savard, A., Cavalcante, A. (Eds) *Financial Numeracy in Mathematics Education.* Mathematics Education in the Digital Era, vol 15. Springer, Cham. https://doi.org/10.1007/978-3-030-73588-3_2

Savard, A., Cavalcante, A., Turineck, L., Javahepour, A. (2020). Epistemological considerations towards the concept of money: Money as a measurement. *For the Learning of Mathematics, 40*(3), 21-23.

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 edition). (p. 137- 152). New York, Peter Lang.

Savard, A. (2014). Developing probabilistic thinking: What about people's conceptions? In E. Chernoff & B. Sriraman (Eds). *Probabilistic Thinking: Presenting Plural Perspectives.* Vol. 2. (p. 283-298). Berlin/Heidelberg, Springer.

Schoenfeld, A.H. (2014). Reflections on Curricular Change. In: Li, Y., Lappan, G. (eds) *Mathematics Curriculum in School Education.* Advances in Mathematics Education. Springer, Dordrecht. https://doi.org/10.1007/978-94-007-7560-2_4

Weissglass, J. (2002). Inequity in mathematics education: Questions for educators. *Mathematics Educator, 12*(2), 34–43.

Wright, P., Fejzo, A., & Carvalho, T. (2022) Challenging inequity in mathematics education by making pedagogy more visible to learners, I*nternational Journal of Mathematical Education in Science and Technology*, 53:2, 444-466, DOI: 10.1080/0020739X.2020.1775320

Zhu, Y. (2018). Equity in Mathematics Education: What Did TIMSS and PISA Tell Us in the Last Two Decades?. In: Kaiser, G., Forgasz, H., Graven, M., Kuzniak, A., Simmt, E., Xu, B. (eds) *Invited Lectures from the 13th International Congress on Mathematical Education.* ICME-13 Monographs. Springer, Cham. https://doi.org/10.1007/978-3-319-72170-5_43