THE RECENT MANITOBA K-8 MATHEMATICS CURRICULUM REVISION: INTERROGATING ITS RATIONALE AND OUTCOME[6]

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Abstract

Recently, the Government of Manitoba revised its K-8 Mathematics Curriculum. This article discusses two aspects of the review and the process involved: the rationalization provided for the review and the interpretation of the outcome of the review. The conclusion section makes briefly the case for a different direction in reviewing the school mathematics curriculum, a direction that would give greater consideration to the mission of public education promoted by the provincial government.

The Recent Manitoba K-8 Mathematics Curriculum Revision: Interrogating Its Rationale and Outcome

In 2012, Manitoba Education (Manitoba's ministry of education) undertook a review of the province's 2008 K-8 Mathematics Curriculum (Manitoba Education, Citizenship and Youth, 2008), which led to a revised curriculum in 2013 (Manitoba Education, 2013). In this article, I discuss a number of aspects linked to (a) the rationalization of the review and (b) the interpretation of the outcome of the review. I do not report on a formal research study of the review process. Rather, I draw for some parts on my own observations of aspects of the review process as someone who was directly involved in the process, and on my understanding of the scholarly literature on school mathematics education and related fields of study.

Rationalizing the Curriculum Review

In 2012, the quality of K-8 mathematics education in Manitoba was discussed quite intensely in the local media and other venues. The most media-published critics of the quality of current K-8 mathematics teaching in Manitoba made ample reference to (a) Manitoba students' standing in national and international standardized tests and (b) students' perceived lack of "basic skills in mathematics," in their rationale for the inadequacy of K-8 school mathematics teaching in Manitoba and for shortcomings of the 2008 K-8 Mathematics Curriculum (for example, see Stokke, 2012). In the first section, I question a rationale for this critique and for the curriculum review that is grounded in Manitoba students' standing in large-scale mathematics testing. In the second section, I do the same for a rationale for the critique and for the curriculum review that is grounded in a claim of a lack of "basic skills" in Manitoba students.

Large-Scale Mathematics Test Results as a Rationale

The curriculum review process was explicitly structured by Manitoba Education to include a direct comparison between the 2008 K-8 Mathematics Curriculum and curricula from jurisdictions that had been ranked relatively higher on international and national standardized

[6] This article draws on two earlier publications, *Challenging the claim of the inadequacy of the 2008 Manitoba K-8 Mathematics Curriculum* and *Challenging the claim of the inadequacy of the 2008 Manitoba K-8 Mathematics Curriculum*, both available at http://home.cc.umanitoba.ca/~falkenbe/Essays/Essays.html

tests. I have the following concerns with this approach to rationalize a critique of inadequate K-8 mathematics teaching in Manitoba and of the 2008 curriculum.

First, according to the 2009 PISA study (OECD, 2010), Canadian students "perform[ed] significantly above the OECD average in mathematics" (p. 14).[7] While on the 2010 Pan-Canadian Assessment Program (PCAP) Manitoba students ended up second last among eleven Canadian provinces and territories and a bit lower than in the 2007 assessment, Manitoba students are still relatively close to the average Canadian mean score. The smaller giants might be small among giants, but they are still giants. The results of Manitoba students on these national and international standardized tests should be taken seriously as one of a number of indicators for the quality of school mathematics teaching and learning, but they should not give rise to concern about the K-8 mathematics teaching in Manitoba, and particularly not to an out-of-cycle curriculum review. Rationalizing a curriculum review based on the standing of Manitoba students on the 2010 PCAP is particularly questionable in light of the fact that students in Alberta scored significantly higher on the mathematics component of the 2010 Pan-Canadian Assessment Program testing (third highest) than students from Manitoba (second lowest) (see Council of Ministers of Education Canada, 2011), while the general and the specific learning outcomes of the Alberta K-8 Mathematics Curriculum almost completely match those of the 2008 Manitoba Mathematics Curriculum.

Second, there are many reasons to be cautious in using results from large-scale standardized tests. To draw helpful conclusions from the performance of Manitoba students on those tests, one needs to look closer at the types of problems that Manitoba students found challenging. A thorough analysis of the types of problems that Manitoba students may have had on such national and international tests has not been part of the discussion in the review process.

Third, other factors might have had an impact on Manitoba students' performance in mathematics assessment. For instance, might there be a link between the relative low performance of Manitoba students in the mathematics component of the 2010 Pan-Canadian Assessment Program testing and the relative low performance in the reading component? Mathematics problems in such assessment programs are mostly presented as word problems. A certain level of English language proficiency is thus required to perform well in those assessment programs.

Fourth, in some of the discussions about K-8 mathematics education in Manitoba and in the review process, comparisons were explicitly drawn between the performance of Manitoba students and the performance of students from countries that performed at the top (by scores) of the mathematics portion of the PISA studies, such as students from Singapore. Such comparisons per se are not very helpful, unless they serve to support a position already taken about the flaws of K-8 mathematics education in Manitoba. Provincial and national mathematics education programs – as is true for all educational endeavours – are value driven. For one, they are driven by a vision of what it means to be mathematically literate; and the question needs to be asked, to what degree do these kinds of testing tools do justice to the respectively developed visions of being mathematically literate? Also, educational endeavours are driven by educational issues such as gender and socio-economic equality and the development of other human capacities such as artistic and creative capacities. Provincial and national decisions made on these educational issues are not reflected in a province's or country's standing in the score ranking of the respective assessments.

[7] For information on the PISA studies undertaken every three years by the Organization for Economic Cooperation and Development (OECD), see http://www.oecd.org/pisa/aboutpisa/

Lack of "Basic Skills" as a Rationale

The underlying structure of the 2008 K-8 Mathematics curriculum puts constraints on any curriculum review. A sole focus on a perceived lack of "basic skills" as a rationale for a curriculum review does not give sufficient consideration to these constraints.

The 2008 K-8 Mathematics Curriculum was quite explicit about the overall mathematics education objectives for Manitoba students, rephrased here as follows (in no particular order):

- that students understand what they do (conceptually as well as procedurally)
- that they develop a positive attitude towards mathematics and the life-long use of mathematics;
- that students develop strategic competency, i.e., students have a variety of strategies available to solve problems mathematically and can select intelligently the use of particular strategies in particular problem contexts
- that students can communicate mathematically;
- that students can reason mathematically
- that students develop competency in fundamental mathematical skills (such as counting and the four basic number operations)

Memorization of procedures can be counterproductive in achieving these objectives if understanding of the procedure (i.e., understanding why and how they work the way they do and in what contexts they can be used) has not been developed. What a curriculum built on the objectives described above would want to see happen in its implementation is learning opportunities that integrate these objectives, as illustrated in the following quotation from the well-referenced report by the US-based Mathematics Learning Study Committee:[8]

> A fourth observation is that children can and do devise or invent algorithms for carrying out multidigit computations. Opportunities to construct their own procedures provide students with opportunities to make connections between the strands of proficiency. Procedural fluency is built directly on their understanding. The invention itself is a kind of problem solving, and they must use reasoning to justify their invented procedures. Students who have invented their own correct procedures also approach mathematics with confidence rather than fear and hesitation. (Kilpatrick, Swafford, & Findell, 2001, p. 197)

In this sense, memorization of procedures – including algorithms – that are not linked to understanding, reasoning, and strategic competency can be counterproductive in achieving the stated objectives of the curriculum.

The last objective listed above, the developing of fundamental mathematical skills, must include the development of fluency in executing mathematical procedures for which a student has develop conceptual and procedural understanding. Successful teachers of mathematics have always known that, and have engaged students in developing fluency in executing procedures as appropriate for the context. My knowledge of K-8 classrooms in mathematics suggests that that is indeed happening in Manitoba. However, I also know from experience as a mathematics teacher and from observations of classrooms that rote calculations, drill, and practice of not-understood procedures and algorithms have traditionally been very prominent in Canadian K-8

[8] The quotation includes references to the literature that are not reproduced here.

mathematics classrooms. For that reason, the 2008 curriculum tries to represent an approach to the teaching of mathematics that is more balanced in regards to the development of fundamental mathematical skills and the other curricular objectives, as expressed in the following statement from the 2008 curriculum: "By decreasing emphasis on rote calculation, drill and practice, and the size of numbers used in paper-and-pencil calculations, more time is available for concept development" (Manitoba Education , Citizenship and Youth, 2008, p. 17).[9]

Because memorization and fluency of the skill-aspects of procedures are not learning objectives per se – compared to the development of fundamental mathematical skills – but are rather ways of achieving some of the objectives of mathematics education as characterized above, memorizing and practicing skills should not appear in the curriculum as specific learning outcomes, but should rather be considered aspects of good mathematics instruction. The 2008 curriculum did exactly that, when learning outcomes, for instance, expect that students will "demonstrate an understanding of multiplication," "demonstrate multiplication facts," and "apply mental math strategies for multiplication." The specific learning outcomes provided in the 2008 K-8 Mathematics Curriculum provided a very good curricular basis for achieving the stated general objectives of mathematics education in Manitoba.

The 2008 curriculum provided a range of general objectives for the teaching and learning of K-8 Mathematics, and research suggests an integrated approach to addressing those objectives (see above). Therefore, any review of any aspect of the curriculum needs to give consideration to the group of general learning objectives and the integrative nature of accomplishing those objectives. To focus on only one aspect – such as (the perceived lack of) "basic skills" in the curriculum – in a curriculum review does not give due consideration to the complex structure and the range of curricular objectives, and to the integrative approach needed to address them.

Interpreting the Outcome of the Review Process

In the media, the dominant interpretation of the outcome of the review process in Manitoba was described as a "back to basics curriculum" (McDonald, 2013) that brings "basic arithmetic back" (Martin, 2013), which now (as compared to the 2008 curriculum) requires of students "to memorize their times tables and learn to multiply and divide on paper and in their heads" (Martin, 2013). The changes made to the 2008 curriculum are actually rather minor in scope.

The claim that "basic arithmetic [is] back in class" (Martin, 2013) is completely misleading because it wrongly suggests that basic arithmetic was not in the previous version of the curriculum. It also suggests that there is a fundamental shift in the orientation of the arithmetic objectives in the curriculum. That is not the case at all. There are basically two types of changes made to the curriculum. The first change is the explicit mentioning of the standard algorithms for the four basic number operations as means of solving problems and understanding the operations. However, students are also expected to use other means, such as personal strategies and estimation. As I know from my own work with Manitoba school teachers, good classroom teachers have always helped their students to develop multiple ways of solving those types of problems – and the previous version of the curriculum made room for exactly that approach. Furthermore, the revised curriculum continues to insist that students understand what they are doing when using any of the strategies to solve problems.

The second change concerns the explicit reference to recalling number facts in the early grades. The same as above applies here: There continue to be many more ways for students to

[9] This statement has been removed from the revised version of the curriculum.

arrive at number facts, and good classroom teachers have always helped their students to develop arithmetic fluency. The changes to the curriculum are, indeed, minor and blown out of proportion in light of the fundamental ideas of good mathematics education that are still the basis of the new curriculum, just as they were the basis of the 2008 curriculum.

Conclusion

The recent mathematics curriculum review in Manitoba had no substantial rationale to its credit, and the outcome of the review process was quite inadequately characterized by those whom the media have primarily drawn upon. The latter point is particularly concerning, because public education is – and should be – at its core a political endeavour, which requires a well-informed public and a rich public discourse about purpose and success in public education. I suggest that we indeed could have used a mathematics curriculum review, but one of a different kind.

The students affected by the curriculum changes will graduate from high school in 8 to 12 years. At that time, paper and pencil calculations – one of the central foci of the review concerns – will be as obsolete as writing with a pen will be and partially already is at this time. The expansion of technology use and availability in our day-to-day living will include in the near future, for instance, the extensive use of sophisticated voice recognition programs that will have us dictate any arithmetic problems at the time they occur and provide us with an answer faster than we will be able to find a pencil and a piece of paper. In eight to twelve years, there will be no practical use to learn an effective standardized paper and pencil algorithm for the four basic whole number operations, as there is today no practical use for Newton's algorithm of finding square roots to any desired accuracy. On the other hand, the ministry's vision for public education is for it to prepare students "for lifelong learning and citizenship in a democratic, socially just and sustainable society" (Province of Manitoba, 2013). Mathematics education in Manitoba can and should contribute explicitly to this vision much more than it currently seems to do through curriculum and practice. Would this not be a worthy point of a mathematics curriculum revision?

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