

Numeracy

by Peter Liljedahl & Minnie Liu

Peter Liljedahl is an Associate Professor of Mathematics Education at SFU and co-editor of Vector. Minnie Liu is a PhD candidate in the math education program at SFU and a secondary teacher in Vancouver at Gladstone Secondary.

Over the last 10 years, numeracy – or mathematical literacy as it is often called - has become more and more prominent, showing up in curriculum documents and special government initiatives around the world and in BC. Within our local context, numeracy (or mathematical literacy) is featured within our BC Integrated Resource packages within the front matter of each curriculum from Kindergarten to grade 12.

Students are curious, active learners with individual interests, abilities and needs. They come to classrooms with varying knowledge, life experiences and backgrounds. A key component in successfully developing numeracy is making connections to these backgrounds and experiences. (Mathematics K to 7: integrated resource package 2007, p.11; Mathematics 8 and 9 : integrated resource package 2008, p.11)

Students are curious, active learners with individual interests, abilities, needs and career goals. They come to school with varying knowledge, life experiences, expectations and backgrounds. A key component in developing mathematical literacy in students is making connections to these backgrounds, experiences, goals and aspirations. (The Common Curriculum Framework for Grades 10-12 Mathematics, p. 2)

Students need to explore mathematics through solving problems in order to continue developing personal strategies and mathematical literacy. (The Common Curriculum Framework for Grades 10-12 Mathematics, p.2)

Students need to explore mathematics through solving problems in order to continue developing personal strategies and mathematical literacy. (The Common Curriculum Framework for Grades 10-12 Mathematics, p.2)

So what is this thing called Numeracy? Clearly it is related to, but somehow different from, mathematics

Numeracy, in the form of Early Numeracy, also appears in the K-1 IRP's as examples of classroom assessment models in Kindergarten and Grade 1 (p. 184 and 198). In addition to these curricular documents, Numeracy also lives within BC ministry documents in the Numeracy Performance Standards (http://www.bced.gov.bc.ca/perf_stands/), and the Early Numeracy Project (http://www.bced.gov.bc.ca/early_learning/pdfs/assessing_numeracy.pdf).

So what is this thing called Numeracy? Clearly it is related to, but somehow different from, mathematics. To answer this question we need to first understand where the Numeracy movement is coming from.

Numeracy Movement

Around the world it has long been recognized that students are completing their compulsory education without the mathematical skills to cope with the demands that life and work will require of them. Our reaction to this may be to want to increase the amount of mathematics being taught, to lengthen the period of compulsory mathematics, to increase or deepen the mathematics contents within our curriculum, or to raise the standards within mathematics. On deeper reflection, however, it becomes evident that many of our best students – those taking mathematics beyond the compulsory level and achieving the highest marks – are just as ill-equipped to put their mathematics education to use in life and work.

This realization led to the rise of the numeracy movement – a movement designed to foster those exact skills that the world was thirsting for in its graduates. This movement was driven on the principle that what was lacking was not more mathematics, or deeper mathematics, or greater fluency with mathematics, but a greater flexibility with mathematics – a flexibility to use the mathematics we know to tackle the ever changing and shifting landscape of life's encounters.

... efforts to intensify attention to the traditional mathematics curriculum do not necessarily lead to increased competency with quantitative data and numbers. While perhaps surprising to many in the public, this conclusion follows from a simple recognition—that is, unlike mathematics, numeracy does not so much lead upwards in an ascending pursuit of abstraction as it moves outward toward an ever richer engagement with life's diverse contexts and situations. (Orrill, 2001, p. xviii)

Numeracy is not mathematics. It is something different. Instead of diving deeper into the formal and abstract world of mathematics, learning more mathematics, and become more fluent with mathematics, numeracy fosters the understanding and application of our mathematical knowledge in a

quantitative sense. Unlike the field of mathematics, which continues to expand, the mathematics needed by a numerate individual is relatively finite. That is, numeracy isn't about being able to flexibly use all of mathematics to deal with "life's diverse contexts and situations", but rather to flexibly draw on that subset of mathematics that is most useful in dealing with these "diverse contexts and situations".

Numeracy as a Toolkit

In other words, numeracy can be seen as a toolkit of mathematical skills.

Numeracy "empowers people by giving them tools to think for themselves, to ask intelligent questions of experts, and to confront authority confidently. These are the skills required to thrive in the modern world." (Steen et al., p. 2)

A numerate person is able to "[use] mathematics to make decisions and solve problems in everyday life. ... [Mathematics] is not something done only in mathematics class but a powerful tool for living, as useful and ingrained as reading and speaking." (Steen et al., p. 8)

A handyman is not handy because he has tools, he is handy because he is willing to get his hand dirty

What the skills are that populate this toolkit is debatable ... and contextual. In mathematics, the toolkit would contain ALL mathematics learned. In numeracy, however, the toolkit contains only those skills that are mastered and useful across a wide variety of contexts. So, while a formula for an arithmetic sequence may be the most efficient way to solve a problem, multiplication (or repeated addition) may be the more accessible way to solve it. That is, the formula for arithmetic series is like a specialty tool that, for most people, lies forgotten in a bottom drawer somewhere. Multiplication, on the other hand, is the well-worn, well-used, familiar tool that is easily found near the top of the toolkit. It may not be as elegant or as impressive as the formula for arithmetic series, but it is comfortable, and reliable, and easily accessible.

This is not to say that we should have a small toolkit. We want to continue to expand our toolkit, to add new tools to our repertoire of familiar mathematical skills that we can use to deal with our ever expanding set of experiences. But the acquisition of a new tool should come out of necessity and be grounded in the specificity of our experiences. And it should be immediately and repeatedly useful to us. Otherwise it runs the risk of getting lost in the bottom of a drawer somewhere.

Numeracy as a Disposition

But having a toolkit full of well-worn and familiar tools is not enough. A numerate person must also be willing to use their tools to resolve the situation at hand. As such, numeracy is also a disposition – a willingness to engage with the day's problems through the use of mathematical tools.

“Mathematical literacy is an individual’s capacity to identify and understand the role that mathematics plays in the world, to make well-founded judgments, and to engage in mathematics in ways that meet the needs of that individual’s current and future life as a constructive, concerned and reflective citizen. (De Lange, 2003, p.76, from OECD, 1999)

Numeracy is “an aggregate of skills, knowledge, beliefs, dispositions, habits of mind, communication capabilities, and problem solving skills that people need in order to engage effectively in quantitative situations arising in life and work.” (Steen et al., p. 7)

A handyman is not handy because he has tools, he is handy because he is willing to get his hand dirty using them. Likewise, a numerate individual has to be willing to engage in the work – to be willing, when the situation calls for it, to pull out his tools and use them.

Numeracy as Stepping Up

Taken together, a numerate person is someone who is both willing and able to get the job done. This person knows the tools in his/her toolkit, has the confidence that s/he can get the job done, and is willing to engage in the problems that they encounter in work and life. This has implications for what it is we expect from our students within the context of numeracy. Is the student who uses multiplication to solve a real life problem more numerate than the one who uses repeated addition? Both students, in this case are exhibiting all of the qualities of a numerate person implied in the sections above. They are both willing to get the job done. They are both using tools comfortable and familiar to them. The main difference between them is the efficiency of their strategies, but not necessarily their choice of strategy, for the second student may not have multiplication as a tool readily available to choose from. In mathematics we are concerned very much with the choice of strategy, as evolving and abstracting strategy is what moves the mathematics curriculum forward. In numeracy, however, we are much more concerned with stepping up and getting the job done with whatever tools are available to us.

“Numeracy is getting the job done with the tools you have.” (Liljedahl, 2012)

References

Assessing early numeracy : BC Early Numeracy Project. (2003). Retrieved April 2013, from British Columbia Ministry of Education: http://www.bced.gov.bc.ca/early_learning/pdfs/assessing_numeracy.pdf

BC Performance Standards. (n.d.). Retrieved April 2013, from British Columbia Ministry of Education: http://www.bced.gov.bc.ca/perf_stands/

De Lange, J. (2003). Mathematics for Literacy. In B. Madison, & L. Steen (Eds.), *Quantitative Literacy: Why Numeracy Matters for Schools and Colleges* (pp. 75 - 89). Princeton, NJ: The National Council on Education and the Disciplines.

Liljedahl, P. (2010). Numeracy Tasks FOR and AS Assessment. Grade 12 Mathematics Examinations Specifications meeting. Victoria, BC.

Mathematics 8 and 9 : integrated resource package 2008. (2008). Retrieved April 2013, from British Columbia Ministry of Education: <http://www.bced.gov.bc.ca/irp/pdfs/mathematics/2008math89.pdf>

Mathematics K to 7: integrated resource package 2007. (2007). Retrieved April 2013, from British Columbia Ministry of Education: <http://www.bced.gov.bc.ca/irp/pdfs/mathematics/2007mathk7.pdf>

Orrill, R. (2001). Mathematics, Numeracy, and Democracy. In L. A. Steen (Ed.), *Mathematics and Democracy* (pp. xiii - xx). The Woodrow Wilson national Fellowship Foundation.

Steen, L. A. (Ed.). (2001). *Mathematics and Democracy: The Case for Quantitative Literacy*. The Woodrow Wilson National Fellowship Foundation.

The Common Curriculum Framework for Grades 10-12 Mathematics. (2008, January). Retrieved April 2013, from British Columbia Ministry of Education: http://www.bced.gov.bc.ca/irp/pdfs/mathematics/WNCPmath1012/2008math1012wncp_ccf.pdf

Further Readings on Numeracy

Hold Fast Consultants Inc. (2004). Numeracy and Mathematical Literacy. In WNCP MATHEMATICS RESEARCH PROJECT: FINAL REPORT. Available at: http://www.wncp.ca/media/39083/final_report.pdf.

Orrill, R. (2003) WHY NUMERACY MATTERS. NCED: VA. Available at: <http://www.maa.org/ql/WhyNumeracyMatters.pdf>

Steen, L. (2001). MATHEMATICS AND DEMOCRACY. NCED: VA. Available at: <http://www.maa.org/ql/MathAndDemocracy.pdf>