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NUMERACY IS MORE THAN NUMBER: THE TEACHING OF MATHEMATICS FOR NUMERACY

JUDITH MILLS
University of Waikato
New Zealand

I was in a school recently when a teacher commented in passing that she no longer taught numeracy and only taught mathematics. I observed the teacher's mathematics lesson which included all students using manipulatives (Unifix cubes, number lines, counters and ten frames), discussion and talk among the students as they shared strategies and explained to each other how they had solved the given problem, and an environment where questioning was encouraged in a non-threatening manner. After observing the teacher in practice, followed by a further conversation, it confirmed for me the uncertainty and discrepancy many teachers have around the use of the terms mathematics and numeracy. I have thus attempted here to unpack some of the fundamental ideas around the teaching of mathematics for numeracy in the twenty-first-century primary school classroom.

In recent years, the term numeracy has been commonly used in reference to school mathematics education, alongside its counterpart literacy. While many teachers appear comfortable differentiating between the curriculum area, English and the term literacy, they are not so clear about the terms mathematics and numeracy. However, the development and conceptualisation of the term numeracy has been an important influence on the teaching of mathematics, after first being attributed to the United Kingdom's Crowther report in 1959, where numeracy was described as the mirror image of literacy (Tout & Motteram, 2006). Just as the skills associated with reading and writing are taught and discussed in order to enable students to become literate, so too are the key ideas of mathematics taught with understanding, in order to enable students to become numerate.

Mathematics is about the exploration and use of patterns and relationships in quantities, space and time, representing and symbolising these ideas, and eventually learning to abstract and generalise (Ministry of Education, 2007, p. 26). Where once it was sufficient to master basic arithmetic and school mathematics focused on computation, the requirements of mathematics and numeracy in today's world are different. With the introduction of computational tools and the associated requirement for higher-order thinking skills, the need for people to be able to transfer their mathematics understandings to everyday life has increased, and alongside this, use of the term numeracy. The Effective Teachers of Numeracy Project describes numeracy as "the ability to process, communicate, and interpret, numerical information in a variety of contexts" (Askew, Rhodes, Brown, Wiliam, & Johnson, 1997, p. 6). Numeracy is often referred to in terms of what it means to be numerate, which is defined as: "To have the ability and inclination to use mathematics effectively in our lives – at home, at work, and in the community" (Ministry of Education, 2001, p. 1). Thus, the concept of numeracy is closely related to that of functional mathematics, where numeracy is often described as applying mathematics in context.

Being numerate includes thinking mathematically about situations. It is not the same as knowing how to calculate, it is about being able to think about, and have an understanding of, numbers using conventions (e.g., measurement systems, terminology, tools etc.), relevant to one's own culture (e.g., in English the base-ten counting system), and using one's mathematical thinking meaningfully and appropriately in different situations (Nunes & Bryant, 1996). Numeracy builds on number sense, which means that working with numbers and numerical problems is based on a feeling for numbers and insight into number relationships. Numeracy is thus an essential capability for individuals who wish to participate fully in a democratic society and to utilise knowledge and skills and critical reasoning capabilities, in everyday life. "It is not enough to learn procedures: it is necessary to make these procedures into thinking tools" (Nunes & Bryant, 1996, p. 19).

Askew et al., (2007) built on their definition of numeracy, to define effective teachers of numeracy as teachers who help their pupils:

Judith Mills
judith.mills@waikato.ac.nz
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> "acquire knowledge of and facility with numbers, number relations and number operations based on an integrated network of understanding, techniques, strategies and application skills; learn how to apply that knowledge of and facility with numbers, number relations and number operations in a variety of contexts." (p. 10).

Teaching should stimulate learners to develop the ability to give meaning to numbers and numerical facts in everyday life (Ministry of Education, 2007; Perso, 2006; Tout & Motteram, 2006). Therefore, mathematics lessons need to allow students to see the relevance it has to them by making connections between what they are learning inside the classroom and the things they care about in the world around them. This has required a change in teaching style for many teachers, with a shift from the more traditional didactic model that focused on students' proficiencies in reproducing existing solution methods and strategies, to one that encourages students to construct their own meaningful mathematical concepts through an inquiry-based model (Boaler, 2008).

The numeracy classroom emphasises concepts and meanings, rather than rote learning and promotes integrated, rather than piecemeal usage of mathematical ideas. Therefore, in the numeracy classroom, concepts are taught first and foremost. Procedures are also learned, but not without first acquiring a conceptual understanding. Developing procedural knowledge at the expense of conceptual understanding has often been cited as part of the reason for poor mathematics proficiency (Kazemi & Stipek, 2001; Scharton, 2004). When students are drilled in methods and rules that do not make sense to them, it is not only a barrier for their mathematics understanding, but it also leaves the students frustrated and with a negative disposition towards mathematics in the long term (Boaler, 2008; Davis & Renert, 2014). One of the benefits of emphasising conceptual understanding to students is that they are less likely to forget concepts than procedures, and once conceptual knowledge is gained they can use it to reconstruct a procedure they may have otherwise forgotten.

Associated with the importance of conceptual understanding in numeracy, is the use of tools and manipulatives within classroom lessons. A tool refers to any object, drawing, or picture, that represents that concept (Swan & Marshall, 2010). For example, drawings may be used as a tool for emerging ideas as sometimes it is difficult for students to think about, and understand, abstract relationships if relying only on words and symbols. A manipulative is defined as, "any object that can be handled by an individual in a sensory manner during which conscious and unconscious mathematical thinking will be fostered" (Swan & Marshall, 2010, p. 14). Manipulatives are frequently used in numeracy lessons as they extend students' learning of mathematical concepts and operations, and make them more comprehensible. Manipulatives are used to represent the mathematical concepts underlying the procedure, while at the same time making connections need to be made between the two – the manipulative and the mathematical idea. However, simply taking manipulatives, picking them up and using them, will not magically impart mathematical knowledge and understanding (Swan & Marshall, 2010). An appropriate discussion is required alongside the use of manipulatives to make the links to the mathematics explicit, or the students may end up with misconceptions.

The inquiry-based approach to group work when teaching numeracy is aligned to power-sharing interactions between teachers and students (Higgins, 2005). Mathematical discussions are now considered a key component of mathematical inquiry and effective mathematics teaching. Effective teachers are responsive, in that they constantly elicit, monitor, and respond spontaneously to their students' thinking (Franke & Kazemi, 2001). The teacher has the responsibility for developing a community where students share ideas about mathematics, while searching for solutions, and developing and buildings on individual and collective sense-making of the students rather than merely acknowledging they are correct.

Numeracy is more than mathematics and may be seen as making sense of mathematics as it builds bridges between itself and the real world. Given the recent reforms in mathematics education, and the current cultural and social aspects of primary schooling, primary school teachers need to focus on mathematics as the fundamental prerequisite for numeracy for all students. Teachers could now be known as "teachers of mathematics for numeracy" (Perso, 2006, p. 40), as they prepare their students for life skills in the world beyond the classroom.

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