UNDERSTANDING STUDENTS’ OUT-OF-SCHOOL MATHEMATICS AND SCIENCE PRACTICE

ABSTRACT. This study examined standard 6 and 8 (Standards 6 and 8 are the sixth and eighth years, respectively, of primary level schooling in Kenya.) students’ perceptions of how they use mathematics and science outside the classroom in an attempt to learn more about students’ everyday mathematics and science practice. The knowledge of students’ everyday mathematics and science practice may assist teachers in helping students be more powerful mathematically and scientifically both in doing mathematics and science in school and out of school. Thirty-six students at an urban school and a rural school in Kenya were interviewed before and after keeping a log for a week where they recorded their everyday mathematics and science usage. Through the interviews and log sheets, we found that the mathematics that these students perceived they used outside the classroom could be classified as 1 of the 6 activities that Bishop (Educ Stud Math 19:179–191, 1988) has called the 6 fundamental mathematical activities and was also connected to their perception of whether they learned mathematics outside school. Five categories of students’ perceptions of their out-of-school science usage emerged from the data, and we found that 4 of our codes coincided with 2 activities identified by Lederman & Lederman (Sci Child 43(2):53, 2005) as part of the nature of science and 2 of Bishop’s categories. We found that the science these students perceived that they used was connected to their views of what science is.

KEY WORDS: everyday mathematics and science practice, fundamental mathematical and science activities, Kenyan students, out-of-school mathematics and science practice, perceptions

INTRODUCTION

Students gain mathematical and scientific power when their in-school mathematics and science experiences build on and formalize their knowledge gained in out-of-school situations and when their out-of-school mathematical and scientific experiences apply and concretize their knowledge gained in the classroom. Furthermore, an important part of mathematical and scientific experiences in school is the guidance and structure that teachers provide to help students make connections among mathematical and scientific ideas. By building on the mathematical and scientific knowledge that students bring to school from their everyday
experiences, teachers can encourage students to (a) make connections between in-school and out-of-school mathematics and science practice in a manner that will help formalize the students’ informal knowledge and (b) learn mathematics and science in a more meaningful, relevant way. “Mathematics teaching can be more effective and will yield more equal opportunities, provided it starts from and feeds on the cultural knowledge or cognitive background” of the students (Pinxten, 1989, p. 28).

Writing with a view of science teaching and learning, Driver, Guesne & Tiberghien (1985a) observed that “many children come to science classes with ideas and interpretations concerning the phenomena that they are studying” before they have even studied these phenomena in school; they have formed “these ideas and interpretations as a result of everyday experiences in all aspects of their lives” (p. 2). They further encouraged teachers to consider taking “account of general trends in children’s thinking, both in planning learning activities and in order to improve communication in the classroom” (p. 8).

Cobb (1986) noted that “cognition is context-bounded …the elaboration and coordination of contexts is essential to the achievement of the most general of goals, the construction of a world that makes sense” (p. 5). Since cognition is context-bounded, mathematics and science practice can be context specific. In other words, the way a carpenter solves a problem in the work context may not influence how that person reasons mathematically or scientifically in another context. Suggesting that students’ in-school mathematics and science practice and learning can and should be connected to their out-of-school mathematics and science practice and learning may seem to be at odds with the goals of each; however, this does not have to be the case.

There are at least two goals for mathematics and science classroom instruction: (a) to prepare students to deal with novel problems (those involving physical phenomena and those not) and (b) to help students acquire the concepts and skills that are useful to solve many of the routine activities people encounter in life (those involving physical phenomena and those not). To achieve (b), it is important that students work with concepts and procedures that they can generalize. In out-of-school mathematics and science practice, persons may generalize procedures within a context but may not be able to generalize to another context since problems tend to be context specific. For example, a skilled carpet layer possesses generalized procedures for laying carpet, even when encour-