ABSTRACT. The purpose of this paper is to investigate the processes themselves where students appropriated mathematical ideas and to gain an insight into how they can appropriate those cultural ideas. For this purpose, two actual processes where 4th and 5th graders learned cultural practices involving mathematical ideas were closely analyzed, focusing upon the similarities and differences between the standard methods introduced by others and the methods the target students invented during their learning. Such analyses illustrated the following characteristics of their appropriation processes: (a) the students created kinds of hybrids of old ideas they had drawn upon and new ideas introduced by others; (b) when new ideas were presented by others, the students tried to interpret them in the framework of the old ideas they had drawn upon; (c) the students tended to use old ideas or kinds of hybrids until they realized the limits of old ideas and the values of new ideas. These characteristics were also discussed from the viewpoint of resistance and active learning observed in the intramental effects of intermental functioning.

KEY WORDS: appropriation, cultural artifacts, learning process, mathematical ideas

1. INTRODUCTION

While many of studies have illuminated social aspects of mathematics classes and deepened our understanding of mathematics teaching and learning, some researchers have pointed out the necessity of investigating what and how individual students learn in the settings where students learn mathematics with others. For example, in his discussion with Cobb about relations between social and psychological aspects in mathematics learning, Thompson indicated the importance of “the question of how we hope to affect individual children so they are able to act productively in a variety of settings” (Thompson & Cobb, 1998, p. 19). Waschescio (1998) critically reviewed some research about social constructivism in mathematics education and pointed out that we should pay attention to both assimilative and accommodative aspects of development. Waschescio (1998) insisted on the importance of the internalization process that involves “an interaction between the subject’s existing concepts and new concepts” (pp. 237–238). To
emphasize the active roles of learners in such internalization process, some researchers have used the notion of appropriation (e.g., Rogoff, 1993).

Although investigating the processes where students appropriate mathematical ideas is essential for our understanding of students learning, there seems little research which has conducted a close analysis of these processes. The purpose of this paper is to closely analyze the processes where students appropriate mathematical ideas in order to deepen our understanding of students’ learning mathematics with others. This analysis will give rather concrete insights into the internalization process that involves “an interaction between the subject’s existing concepts and new concepts.”

2. APPROPRIATION OF MATHEMATICAL IDEAS

Wells (1999) stated that “learning is seen very generally in terms of appropriation” (p. 155) and that learners appropriate cultural artifacts and practices in the course of engaging in joint activities in which the functional significance of these artifacts and practices is modeled and the learners receive assistance in their use. When using the term “appropriation,” some researchers seem to focus on the learning of individual students and emphasize the active roles of learners, as well as the cultural aspects of artifacts and practices to be appropriated. For example, Rogoff (1993) stated that “appropriation occurs in the context of engagement (often with others) in sociocultural activity, but focuses on the personal processes of transformation that are part of an individual’s participation” (p. 138). She also stated as follows: “Rather than viewing the process as one of internalization in which something rather static is taken across a boundary from the external to the internal, I see the child’s active participation itself as being the process by which the child gains in skill and understanding of the activity” (p. 139). Hung (2001) defined the notion of appropriation as “the active dialectical assimilation of some idea, concept, or word that was once alien and now one’s own, albeit in a novel form” (p. 252). The appropriation can be seen as the notion for investigating internalization processes of students focusing on “the active construction by the child” (Waschescio, 1998, p. 238).1

While it illuminates the active roles of individual learners, appropriation seems to imply the existence of more enculturated others and does not preclude “the fundamental asymmetry of the teacher-student(s) relationships, and of peer interaction” (Lerman, 2002, p. 58). Göncü and Rogoff (1998) investigated the conditions under which the appropriation could be facilitated in the setting where adults sometimes provided leadership in an activity (see also Radziszewska & Rogoff, 1988, 1991). It can be assumed