ABSTRACT. Engaging mathematics students with modelling activities helps them learn mathematics meaningfully. This engagement, in the case of model eliciting activities, helps the students elicit mathematical models by interpreting real-world situation in mathematical ways. This is especially true when the students utilize technology to build the models. Researchers have been interested in the phases of modelling processes that students go through when engaging with modelling activities, where looking at these phases from a cognitive aspect gives us insight regarding students’ processes of mathematizing real situation. This was the goal of this research, specifically when middle school pre-service teachers use technology in model eliciting activities. Six groups of pre-service teachers participated in the research engaging in modelling the “summer reading activity.” Three different cycles of modelling processes were identified, differing in the phase of technology use and in its role in building the models. This variability in pre-service teachers’ utilization of technology, in our case the spreadsheets, imply that the technology which is appropriate for a specific modelling activity could be a flexible tool used by the learners to mathematize the real-life situation expressed in the activity.

KEY WORDS: mathematical modelling, mathematical modelling with technology, model eliciting activities, pre-service teachers, technology

INTRODUCTION

Mathematical modelling can be described as the process of representing real-world problems or situations in mathematical terms and relations in order to understand and find solutions to these problems. As a consequence of this description, a mathematical model can be considered as a product of mathematizing a real world problem or situation. Thus, modelling real-world situations engages students with different social, mathematical and communicational processes, which gives students a wide range of learning possibilities, and thus motivates them to learn mathematics.

More possibilities are added to students’ learning through mathematical modelling when they work with technology and technology tools (applets, midlets, spreadsheets, geogebra, etc.), for technology, and technology tools provide students with capabilities of visualization,
organization and problem solving. Little research has been done on technology utilization in students’ modelling while engaged in model eliciting activities. The current research attempts to study when pre-service teachers work with the spreadsheets to build in groups models appropriate for real-life situations.

Theoretical Framework

Modelling is one of the emphasized topics in mathematics education during the last few decades (Blum & Ferri, 2009; NCTM, 2000), where it has been mentioned as preparing students for responsible citizenship and as helping them to understand the world. Furthermore, modelling activities offer students the opportunity to meet mathematical and everyday challenges and requirements (English & Walters, 2004; Lesh & Doerr, 2003; Lesh, Hoover, Hole, Kelly & Post, 2000). In addition, modelling activities help students develop various mathematical competencies, communicational processes and social skills (Blum & Ferri, 2009; Lesh & Doerr, 2003).

The above advantages of mathematical modelling to students’ learning of mathematics can be realized in different types of modelling activities. Kaiser & Schwarz (2006) categorized modelling activities according to their central aims, mentioning six types: the real or applied modelling, the contextual modelling, the educational modelling, the socio-critical modelling, the epistemological modelling and the “model eliciting” modelling. In addition, Kaiser & Schwarz (2006) add the cognitive modelling as “meta-perspective” which can be combined with each of the previous types. In the current research, we will investigate mathematics pre-service teachers’ work in model eliciting activities from a cognitive perspective.

The model eliciting activity (MEA) involves modelling real situations, where it contains incomplete, ambiguous or undefined information of the situation (English & Fox, 2005). The students are required to interpret and make sense of the situation in a meaningful way. Throughout the engagement with model eliciting activities, students get the opportunity to elicit conceptual tools which function as mathematical models. Doing so, they are engaged with multiple repeated cycles of translation, description, prediction of data and deliverables in solution paths. These processes of iterative cycles are termed mathematizing the situation (Lesh & Doerr, 2003).

Specifically, MEAs help accomplish four objectives (Chamberlin & Coxbill, 2012): (1) they help analyse how students think mathematically, (2) they help provide students with various capabilities in doing mathematics due to the multiple entry points that they have, (3) they