THE ROLES OF LEARNING TRAJECTORY IN TEACHING MATHEMATICS USING RME APPROACH

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Realistic Mathematics Education (RME) is a didactic approach or a domain-specific instruction theory for teaching mathematics that was developed in the Netherlands ((Van den Heuvel-Panhuizen, 2003; Van den Heuvel-Panhuizen & Drijvers, 2014). RME has its roots in Freudenthal's interpretation of mathematics as a human activity. Freudenthal (1991) suggests that mathematics education has to be organized as a process of guided reinvention, where students can experience a similar process to the process in which mathematicians invented mathematics.

Gravemeijer (1999) sees the guided reinvention principle as long-term learning process in which the reinvention process evolves as one of gradual changes. The stages always have to be viewed in a long-term perspective, not as goals in themselves, and the focus has to be given on guided exploration. To realize this view, a learning route (learning trajectory (LT)) has to be mapped out (by a developer or instructional designer) that allows the students to find the intended mathematics by themselves.

A LT is the sequences of activities and tasks that might support the development of students' understanding of a specific instructional goal (Simon, 1995). Gravemeijer (1994) said that neither teachers, nor researchers can rely on fixed teaching sequences, since a teacher continuously has to adapt to the actual thinking and learning of her students. Therefore, the preliminary version of a LT is a hypothetical one, and it is called a hypothetical learning trajectory (HLT) (Simon, 1995; Gravemeijer, 1994, 2004; Gravemeijer & Cobb, 2013). Gravemeijer (1994) says that the HLT should be emphasized on the nature of the learning process rather than on inventing mathematics concepts/results. It means we have to give students the opportunity to gain knowledge so that it becomes their own private knowledge, knowledge for which they themselves are responsible.

A HLT consists of three components: the learning goal that defines the direction, the learning activities, and the hypothetical learning processes-a prediction and anticipation of how the students' thinking and understanding will evolve in the context of the learning activities (Simon, 1995). After a cyclic process of designing, testing, and re-designing, a HLT becomes a theory (LT) that can be used as a lesson learned by other mathematics educators to teach a certain mathematics topic. Gravemeijer (1994) and Liljekvist at al (2016) called the theory as a local instructional theory (LIT), while Cobb at al (2003) called it as domain specific theories.

The activities to design and develop a HLT for teaching a mathematics topic will be discussed further in this paper. The paper will also present the research on developing the learning trajectories conducted in Indonesia (see Fauzan at al, 2013, 2018a, 2018b; Khairuddin at al, 2020).

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