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The Theoretical Structure of Realistics Mathematics Education

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Abstract: Realistics mathematics education (RME) is an approach of mathematics teaching which was developed by Dutch mathematician and pedagogue Hans Freudenthal in the 1970s. It was found that Dutch students' mathematical achievement in national and international tests rose through this approach of teaching which had been developed by Freudenthal Institute. Freudenthal pointed out that the process of doing mathematics started with real life problems and that the mathematical concepts and formulas were reached at the final stage. Realistics mathematics education may be defined as the process in which the learner re-discovers mathematics, just like a scientist, by relating it to real life situations. In this sense RME is considered to be the contemporary mathematics teaching approach and is thought to be compatible with the mathematics curriculum developed by the Ministry of Education in our country based on the constructivist approach and is believed to be significant in making contributions to curriculum development activities. This study aims to explain the theoretical basis of the RME and to reveal its relations with the constructivist theory.

Key words: Realistics Mathematics Education (RME) · Contextual Problems · Constructivist Theory

INTRODUCTION

Many countries such as the USA, UK, Australia and the Netherlands have been emphasising strongly the acquisition of problem solving skills, the application of those skills in real life problems and the development of positive attitudes towards mathematics in their work of educational reforms [1]. The changes in social structure and its function and obtaining new scientific findings make it obligatory to modify the curricula [2].

Realistics Mathematics Education is an approach of mathematics teaching whose foundation was laid by Dutch mathematican and educator Hans Freudenthal in Utrecht University, the Netherland in the 1970s so as to carry out the reform needed in teaching and learning mathematics [3]. The approach, which was developed in the Freudenthal Institute of Utrech University, was soon received worldwide acceptance and was accepted and implemented in the educational systemof many countries such as England, Germany, Denmark, Spain, Japan and Malaysia.

According to Freudenthal, mathematics is a human activity to be learnt rather than a closed system or topic to be learnt and it has to have ties with reality [4]. Freudenthal claims that mathematics started with real life problems in history, real life was made mathematical and that formal mathematics was reached later. The mathematician called the process beginning with real life problems and moving on to the mathematical concepts "mathematication" [5]. Özsoy (2002) also believes that mathematics is a part of human experience and emerged owing to the practical needs of life. Mathematical thinking, based on the ability to perceive the universe through its quantitative features, initally emerged in the form of simple counting and measuring operations as a result of daily life needs. [6].

1-The Essentials of Realistics Mathematics Education: Gravemeijer grouped the key principals of Realistics Mathematics Education into three categories:

- Guided Discovery: in accordance with this principle, students must be given the opportunity to try a method or activity similar to the discovery of mathematics.
- *The stimulation of contextual problems and the acquisition of a concept through the process of re-discovering (Didactic phenomenology):* Didactic phenomenology is the ability to analyse the mathematical concepts and thus to explain the way they are formed. Provided that we comprehend the fact that mathematics evolved historically through

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the solutions of practical prblems, we can expect that mathematics can also be generated with the same approach from today's applications. Contextual problems are stimulant and the concept is acquired through the re-discovery of the process (Quoted by Altun 2006). [7].

Contextual problems are the problems in which children are presented the real life situations that they are familiar with in a large perspective. They can be presented to students in various ways. For instance, a verbal problem may be in the form of a game, a picture, a newspaper article, a graph, or a combination of them all [8]. The concepts of contextual problem and verbal problem should not be considered synonymous. Verbal problems may not always bear the properties of contextual problems [9].

- *Inclusion of Models*: The third principle is the inclusion of models which may develop by playing a role of bridging between informal mathematical knowledge and formal mathematical knowledge. Models may also be developed by students in the RME (Quoted by Altun, 2006). [7].

Learning mathematics means students' going through various levels of comprehension. The term longitudinal coherency reflects one of the basic properties of the RME. There is a strong point in the relation between what has been learnt and what is to be learnt next. A good example according to the longitudinal model is the line of numbers. For example, first graders buy a necklace with beads on it and they can perform any counting activities with the beads on the necklace. In the next grade levels the beads are transformed into a line of numbers through which students can perform the operations of addition and subtraction. In the later years, the beads are transformed into a double line of numbers to be used with fraction problems and later on into a percentage bar [10].

The differences between the RME approach and constructivism are discussed so as to demonstrate the relations between Realistics Mathematics Education and constructivism, which seems to be akin to the RME.

2-Realistics Mathematics Education and Constructivism: Constructivist learning is basically an epistemology and is related to the way we obtain knowledge; it is not a teaching theory. RME, on the other hand, is a theory of teaching. In constructivism, the programme usually starts with a philosophy giving students freedom to form or to re-form their construction. The approach of RME is an approach regarding the principles of constructivism. The RME labels mathematics teaching with the steps of horizontal mathematication and vertical mathematication. In horizontal mathematication, the problem situation is presented to the student through the models encountered in daily life. The process of vertical mathematication, however, is the process in which the student reaches the formulas and the concepts [11]. The aim in this process is to enable the student to experience the situation of re-discovering. But in constructivism, this case may not always be experienced. While the student constructs the knowledge, he may also discover through the teacher'sguiding. The teacher directly gives the formulas and concepts also in that case without going through discovery process.

CONCLUSION

Because new curricula were developed based on constructivist theory in the teaching of mathematics in our country, the need to employ contemporary teaching methods was felt. This current study makes an attempt at introducing the RME in our country and at demonstrating its compatibility with the curriculum of the Ministry of Education. Curriculum development is performed through the mutual interaction of objectives, content, teaching-learning process and evaluation- all of which are the elements of curriculum.The mathematics curriculum of the Ministry of Education should also form learning environments in a way so as to enable learners to reach mathematical concepts and formulas which we call formal knowledge at the final stage and to go through the rediscovery process in line with the activities of curriculum development and in concordance with the philosophy of the RME approach especially in the dimension of teaching-learning process. Turkey has the wealth in terms of cultural structure, history and geography which is required in preparing the learning environmetn needed by the RME. Learning activities designed in accordance with the principles of RME may be employed in the teaching-learning dimension of curriculum development, which is regarded as the most important dimension of curriculum development.

Teachers should be provided with long duration in-service training in the theory and application of theRME approach. Pritor to that, the RME approach and the application activities related to the approach should be included in teacher training programmes. Thus, it could

be easier for prospective teachers who encounter the RME approach beforehand to put the approach into practice during their teaching service.

In order for the Ministry of education to be able to use the RME approach in school applications and to make it widespread, it should support teachers with learning materials and resources prepared in accordance with the RME approach. It should be assured that students re-discover mathematics just like a scientist and that they reach raw data and wealthy materials. The RME compatible course activities should be prepared by curriculum development experts and field teachers and teachers should be helped.

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