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Attitudes of 7^{th} Class Students Toward Mathematics in Realistic Mathematics Education

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Abstract

In this study the aim is to determine the variation of students' attitude levels through Mathematics by performing an education in which Realistic Mathematics Education is used. In the inclusion of this aim, a Likert type attitude scale containing 26 items was prepared. The scale's validity and reliability were made and for this aim the scale was applied to 167 students as a plot group before it was applied to the real student group. The scale's Cronbach Alpha reliability coefficient was determined as .94. According to the result, this scale is reliable. The scale has taken form from 13 positive and 13 negative attitude items. In the study, pre-attitude, post-attitude control groups' design was applied. The experiment and control groups were determined by impartial appointment. The pattern has been taken form from 73 students. Using Realistic Mathematics Education for experiment group and traditional method for control group made the education. At the beginning of the education and at the end of the education pre-attitude scale and post-attitude scale was applied to both of the groups. The obtained data was analyzed by SPSS packet program. The analyze result shows that the education made by using Realistic Mathematics Education makes positive variations in students' attitude levels through mathematics.

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1 Introduction

Mathematics is, a lesson which is about abstract models and relations between them, a science branch, a way to think, an art and it has an order and stability in its character, it is a language and tool which has come into existence with carefully defined terms and symbols[1]. A famous mathematician said that: "Mathematics' greatness is in its uselessness." It is interesting that mathematics, which is invented like this, is harmonious with universe and always finds an application area [2]. Consequently, Realistic Mathematics Education has born from the idea of to bring mathematics a cross-section of his/her life.

1.1 Realistic Mathematics Education

RME theory is a promising direction to improve and enhance learners' understandings in mathematics. RME has its roots in Hans Freudenthal's interpretation of mathematics as a human activity [3],[4] and accentuates the actual activity of doing mathematics. This is an activity, which he envisaged should predominantly consist of organizing or mathematising subject matter, taken from reality. These real situations can include contextual problems or mathematically authentic contexts for learners where they experience the problem presented as relevant and real. Learners therefore learn mathematics by mathematising subject matter from real contexts and from their own mathematical activity, contrary to the traditional view of presenting mathematics to them as a ready-made system with general applicability [4].

Two of his important points of views are mathematics must be connected to reality and mathematics as human activity. First, mathematics must be close to children and be relevant to every day life situations. However, the word 'realistic', refers not just to the connection with the real world, but also refers to problem situations which real in students' mind. For the problems to be presented to the students this means that the context can be a real world but this is not always necessary De Lange [5] stated that problem situations can also be seen as applications or modeling. Second, the idea of mathematics as a human activity is stressed. Mathematics education organized as a process of guided reinvention, where students can experience a similar process compared to the process by which mathematics was invented. The meaning of invention is steps in learning processes while the meaning of guided is the instructional environment of the learning process. For example, the history of mathematics can be used as a source of inspiration for course design. Moreover, the reinvention principle can also be inspired by informal solution procedures. Informal strategies of students can often be interpreted as anticipating more formal procedures. In this case, the reinvention process uses concepts of mathematization as a guide [6].

Three guiding heuristics for RME instructional design should be considered [7]. The first of these heuristics is reinvention through progressive mathematization. According to the reinvention principle, the students should be given the opportunity to experience a process similar to the process by which the mathematics was invented. The reinvention principle suggests that instructional activities should provide students with experientially realistic situation and by facilitating informal solution strategies; students should have an opportunity to invent more formal mathematical practices [3]. Thus, the developer can look at the history of mathematics as a source of inspiration and at informal solution strategies of students who are solving experientially real problems for which they have not know the standard solution procedures yet [4],[8] as starting points. Then the developer formulates a tentative learning sequence by a process of progressive mathematization.

The second heuristic is didactical phenomenology. Freudenthal [3] defines didactical phenomenology as the study of the relation between the phenomena that the mathematical concept represents and the concept itself. In this phenomenology, the focus is on how mathematical interpretations make phenomena accessible for reasoning and calculation. The didactical phenomenology can be viewed as a design heuristic because it suggests ways of identifying possible instructional activities that might support individual activity and whole-class discussions in which the students engage in progressive mathematization [4]. Thus the goal of the phenomenological investigation is to create settings in which students can collectively renegotiate increasingly sophisticated solutions to experientially real problems by individual activity and whole-class discussions [7]. RME's third heuristic for instructional design focuses on the role which emergent models play in bridging the gab between informal knowledge and formal mathematics. The term model is understood in a dynamic, holistic sense. As a consequence, the symbolizations that are embedded in the process of modeling and that constitute the model can change over time. Thus, he students first develop a model-of a situated activity, and this model later becomes a model-for more sophisticated mathematical reasoning [9].

Two types of mathematization that were formulated explicitly in an educational context by Treffers [10] are horizontal and vertical mathematization. In horizontal mathematization, the students come up with mathematical tools, which can help to organize and solve a problem located in a real-life situation. The following activities are examples of horizontal mathematization: identifying or describing the specific mathematics in a general context, schematizing, formulating and visualizing a problem in different ways, discovering relations, discovering regularities, recognizing isomorphic aspect in different problems, transferring a real world problem to a mathematical problem, and transferring a real world problem to a known mathematical problem. On the other hand, vertical mathematization is the process of reorganization within the mathematical system itself. The following activities are example of vertical mathematization: representing a relation in a formula, proving regularities, refining and adjusting models, using different models, combining and integrating models, formulating a mathematical model, and generalizing.

Freudenthal [11] stated ”horizontal mathematization involves going from the world of life into the world of symbols, while vertical mathematization means moving within the world of symbols.” But he adds that the difference between these two types is not always clear-cut. The process of reinvention can be illustrated and it shows that both the horizontal and vertical mathematization take place in order to develop basic concepts of mathematics or formal mathematical language.

The learning process starts from contextual problems. Using activities in the horizontal mathematization, for instance, the student gains an informal or a formal mathematical model. By implementing activities such as solving, comparing and discussing, the student deals with vertical mathematization and ends up with the mathematical solution. Then, the student interprets the solution as well as the strategy, which was used for another contextual problem. Finally, the student has used the mathematical knowledge.

Treffers classifies mathematics education into four types with regard to horizontal and vertical mathematization (see Table I). These classifications are described clearly by Freudenthal [11] :

Table I: Four types of mathematics education [11]

Type	Horizontal Mathematization	Vertical Mathematization
Mechanistic	-	-
Empiristic	+	-
Structuralist	-	+
Realistic	+	+

In the mechanistic (or arithmetic) trend, no real phenomenon is used as a source of mathematical activity, little attention is paid to applications and the emphasis is on rote learning. This results in weaknesses in both horizontal and vertical mathematization. The empiricist trend places a strong emphasis on horizontal mathematization in that the emphasis is on environmental rather than on mental operations. Formal mathematical goals do not feature as a high priority there is little pressure for learners to pass to a higher level, thus demonstrating the weakness with relation to vertical mathematization. In structuralist instruction mathematical structures are emphasized, the vertical component is dominant. This is proved in this approach in that the principle part of the mathematical activity operates within the mathematical system.

Instead of real phenomena, embodiments and materializations of mathematical concepts or structures or structural games are used to create a concrete basis for learners from which to work and real phenomena subsequently do not function as models to support operating within the mathematical system. In realistic mathematics instruction however, careful attention is paid to both components.

Verschaffel & Corte [12], Heuvel [13], Rasmussen & King [14], Altun [15], Kwon [16], Bintaş et al [17], Widjaja & Heck [18] ext. used RME in their studies. The researches found that the more the subject comes to the students as real, the best the learning occurs and the analysis of the data indicates that there is a meaningful distance towards the experimental group in which RME was used. As Heuvel-Panhuizen [19] pointed out realistic mathematics education is by no means a closed book and it continues to be developed. During the last quarter of the past century this field of inquiry has produced a vast body of investigations, resulting in an enriched conception of mathematics learning as involving the (social) construction of meaning and understanding based on modeling of reality.

2 Method

2.1 Research Question

Will the usage of RME change students' attitude toward mathematics?

Hypothesis: There is no significant difference in the change in Mathematics Attitudes Scales scores between students grouped by experimental treatment.

2.2 Instrument

An attitude instrument was used in this study. It is a Mathematics Attitudes Scale (MAS). The Mathematics Attitudes Scale is a Likert-type instrument consisting of 26 items, which present statements of attitude toward mathematics.

The MAS consists of 26 statements, such as "Working mathematics relaxes me." The individuals indicate the degree to which they agree with the statement on a five-point scale, with "agree strongly" on one end and "disagree strongly" on the other. Each response is given a value of 1 to 5, with 5 indicting a more positive attitude towards mathematics.

Using Realistic Mathematics Education for experiment group and traditional method for control group made the education. At the beginning of the education and at the end of the education pre-attitude scale and post-attitude scale was applied to both of the groups. The obtained data was analyzed by SPSS packet program.

2.3 Validity

The scale was applied to 167 students as a plot group before it was applied to the real student group. The scale's Cronbach Alpha reliability coefficient was determined as .94. According to the result, this scale is reliable. The scale has taken form from 13 positive and 13 negative attitude items.

2.4 Population

The 7th class students in Çiğdem Batubey Primary School in Balıkesir centre district in 2004-2005 education year forms the pattern of this study. While choosing this school, the schools' achievement rank in 2003 LGS exam in Balıkesir centre district was taken into consideration. The schools were separated into 3 groups according to their achievement rank and a school was chosen at random between the schools in the medium group.

3 Results

Although the sample size was relatively small, (36 persons in the control group and 37 in the experimental group), there were some interesting results obtained from the data collected, which could form the basis for further study in this area with a larger sample size. Due to the nature of the research design, the results were interpreted cautiously.

Table II contains the pre-attitude means and standard deviations for the experimental and control groups. It reveals that the mean pre-attitude scores were higher for the control group than for the experimental group. From Table II it can be seen that there is no significant differences before the education (p= .333 > .05).

Table II: Mean Pre-Attitude Scores By Group

Type of Group	N	Mean($\overline{x}$)	Std.Deviation(SS)	df	t value	Sig.
EG	37	110.6757	26.4744			
CG	36	105.0000	23.1270	72	0.974	0.333

Table III contains the post-attitude means and standard deviations for the experimental and control groups. It reveals that the mean post-attitude scores were higher for the control group than for the experimental group. From Table III it can be seen that there is a significant difference after the education (p= .042 > .05), and it is in experiment group's favour.

Table III: Mean Post-Attitude Scores By Group

Type of Group	N	Mean($\overline{x}$)	Std.Deviation(SS)	df	t value	Sig.
EG	37	116.1622	19.5498			
CG	36	105.4722	24.3797	72	2.070	0.042

4 Discussions and Conclusion

From the study it is proved that pupils have a positive attitude towards mathematics after realistic mathematics education is used. The results of this study showed that students in experiment group are aware of the usefulness of mathematics in daily life after instruction. However, the data from the survey also indicate that they do not want to take mathematics lessons with traditional method.

Future studies with students from different mathematics units need to be conducted and then compared with this study. This future research could be used to determine whether students from other units have a similar attitude toward mathematics.

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