

The Effects of Realistics Mathematics Education on Cognitive and Affective Learning Outputs

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Abstract: This study is concerned with an experimental research study on the application of Realistics Mathematics Education (RME), which is known as a new approach of mathematics teaching in our country, to the teaching of mathematics. The research aims at determining the effects of learning activities organised according to the RME on fifth graders' cognitive and affective learning outputs. A mixed research model composed of pre-test, post-test, control group design and a set of qualitative data was used in the research, which was conducted in two fifth grades in a state primary education school located in Ankara. The t test was used in the analysis of the data collected through "Achievement Test", "Problem Solving Skills Test" and "Mathematical Attitude Scale" –the three quantitative data collection tools- in dependent and independent groups whereas content analysis was employed in the analysis of the data collected through interviews with the experimental group students and the teacher. In consequence it was found that the RME was more effective in students' mathematical achievement and in their developing problem solving skills and positive attitudes towards mathematics than the curriculum of the Ministry of Education (ME). It was also found that experimental group students' social, cognitive and affective characteristics also developed.

Key words:Realistics Mathematics Education • Problem solving skills • Mathematical achievement • Affective characteristics

INTRODUCTION

Realistics Mathematics Education (RME), which is regarded as one of the recent approaches in mathematics teaching in Turkey, was developed by Dutch mathematician and educator Hans Freudenthal in the 1970s[1].

The approach, having been developed by Freudenthal Institute in the Netherlands, was adopted and accepted in many countries such as England, Germany, Denmark, Spain, Brazil and the United States. Today, the Netherlands stands as one of the most successful countries in mathematics education [2].

In the RME, students should learn mathematics in daily life situations by using and developing the mathematical concepts and instruments (Heuvel-Panhuizen, 2003:10). Freudenthal suggests that, throughout history, mathematics started with real life problems and the real life was mathematicated and later on formal mathematics was reached [3].

The most basic difference between the RME approach and the traditional approaches is its starting point [4]. The problems which are regarded as the starting point are called contextual problems in the RME. They are the mathematical problems in which real life situations familiar to children are presented in a large perspective. For instance, it may be in the form of a verbal problem, a game, a picture, a newspaper article, a graph or a combination of them [5]. Heuvel-Panhuizen emphasise that, in the RME, students should start learning with rich content situations requiring mathematical operations rather than with abstract concepts and definitions to be used later on. Attempts were made to carry out radical changes mathematics education pursuing the changes in mathematics education throughout the world [6,7].

Purpose of the Research: This research aims at determining the effects of teaching activities organised according to the RME approach in the fifth grade mathematics unit "Numbers in Our Life" on students'

mathematical achievement, problem solving skills and their attitudes towards mathematics; and identifying students' views and development in classes where teaching activities based on the RME are applied.

MATERIALS AND METHODS

This research, which employs experimental design and qualitative research methods, uses a mixed research model. The quantitative data were obtained through the experimental design with control group, pre-test and post test while the qualitative data were obtained through the interviews with the students and the teacher in the experimental group.

The Achievement Test (AT) and the Problem Solving Test (PST) prepared by the researcher was used in order to determine students' cognitive field access whereas a 5-pointed Likert type mathematics attitude scale (MAS) developed by Nazlıççek and Erkin was used to determine students' affective characteristics. The t test was employed with independent groups in the analysis of the quantitative data. In the analysis of the qualitative data, on the other hand, the interview findings were put to content analysis; and codes as well as themes were formed [8].

RESULTS AND DISCUSSION

Findings Concerning the Quantitative Data: As is clear from Table 1, a significant difference was found between groups in achievement test, problem solving test and mathematics attitude scale final application scores at the level of .05 ($t=2.21$; $p=.03 < .05$; $t=2.19$; $p=.032 < .05$ ve $t=2.27$; $p=.026 < .05$). This research has shown that the RME was more effective in teaching the unit of "Numbers in Our Life" than the ME mathematics curriculum in terms of students' mathematical achievement and of improving their problem solving achievement. Besides, it might also be said that the RME applications in the experimental

group were more effective in changing students' levels of attitudes towards mathematics than the curriculum employed in the control group.

According to the findings of the research entitled "The effects of Realistics Mathematics Education on the Teaching of Fraction Concept in the 6th Grades", a class taught in the RME method was significantly more effective than that taught in the traditional method in terms of students' achievement. This is supportive of our research findings [9].

Findings Concerning the Qualitative Data: According to the findings of the content analysis results of the experimental group students' and teacher's views to solve the research sub-problem "What are the students' perceptions of the teaching-learning process in classes where the Realistics Mathematics Education approach was employed?", three basic learning properties that were gained in classes with the RME approach application were identified. They were:

Social Properties: Fulfilling the responsibilities, communicating effectively and active participation in the learning process,

Affective Properties: Motivation and sensorial formations,

Cognitive Properties: Realistics Mathematics Education, the quality of learning and upper level thinking skills.

It was found in the doctoral dissertation entitled "The effects of RME Assisted Education on Students' Achievement in the 7th Grade Mathematics Education" produced by Üzel that the attitudes of students towards mathematics in the experimental group where RME assisted education was conducted were more positive than those in the control group where the traditional method was used. That finding also supports the current research findings [3].

Table 1: Comparison of pre-test and post test achievement scores of experimental and control group with respect to the arithmetic means, p and t values related with AT, PST and MAS.

AT	Group	N	X	S	X dif.	Sd	t	p
	Control	36	0.41	9.51	4.54	74	2.21	.03
	Experimental	40	4.95	8.35				
PST	Control	36	0.27	5.94	2.94	74	2.19	.32
	Experimental	40	3.22	5.77				
MAS	Control	36	-1.11	14.97	7.83	74	2.27	026
	Experimental	40	6.72	14.97				

CONCLUSION

The findings obtained here revealed that the learning environment organised on the basis of the RME approach which was applied in the experimental group was more effective in students' mathematics achievement, problem solving skills and their attitudes towards mathematics. This was, in our opinion, basically because of the learning activities and learning environment organised on the basis of the fundamental principles of the RME approach. In those activities, students learnt mathematics by experiencing and discovering it in real life problems or in situations seeming meaningful to them. Students were given the opportunity to form their products or models by focussing on the process rather than the outcome. Thus, mathematics became more meaningful and more attractive to them. In the light of the research findings, following recommendations are made in relation to mathematics education.

- Curriculum development is performed through interaction between the dimensions of objectives, content, teaching-learning process and evaluation-all of which are the components of a curriculum. The results of this current research reveal that the new ME curriculum for mathematics may also benefit from the RME approach in accordance with the curriculum development activities. In the dimension of "teaching-learning process", which is regarded as the most important dimension of curriculum development, learning activities prepared on the basis of the RME principles may be employed.
- Curriculum development specialists should organise their curriculum plans and teachers should organise their teaching plans by moving away from efforts based on mechanical learning views, they should organise mathematics teaching by treating students as if they were scientists, by enabling them to keep mathematics alive and to discover it in real situations.

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