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The Effect of Personalization in Physics Teaching

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Abstract

The objective of this study is to propound whether personalized teaching affects achievement in accordance with Physics word problems and whether achievement in Physics differs according to different learning modalities. The study is an experimental study conducted using posttest control group design. Experimental and control group had been taught the subject, motion (projectiles) on Earth in Physics lesson for three weeks. However, personalized instruction was used in experimental group and traditional instruction was applied to control group. At the end of the program, students' achievements were determined using posttests. Study group is formed with 59 10th grade students and it consists of 36 girls and 23 boys who were selected from a high school in Ankara. To be able to apply personalized teaching, information like the names of students' favorite subject, best friend, favorite animal, favorite fruit and food and the name of the secondary school they had graduated as well as some student information like their name and surname, gender, the name of parents and siblings were taken through information form. Ten questions in course books related to Motion on Earth (projectiles) existed in tenth grade Physics lesson education program were personalized by the field experts and used in measuring achievement. Learning Modality Inventory developed by Simsek (2002) was used in determining students' learning modalities. At the end of the research, there was not a significant difference between the group who had taken personalized questions and the group with non-personalized questions. It was seen that there was no significant difference between the achievement of solving personalized and non-personalized Physics word problems in terms of gender and learning modalities.

Keywords: personalization of teaching; learning modality; students' interests;

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1. Introduction

When you look around in your environment and the society, you can see people with different characteristics. These differences have created a need for new learning environments in education. Students' interests, learning styles, levels of readiness and learning experiences are different. In this context, it cannot be expected that one material can meet all needs; the needs must be identified to keep student's attendance for the course and to enable them to reach for acquisitions. Personal solutions must be found for a successful learning process and a high performance and this brings us to personalization in teaching (Xu and Wang, 2006).

The way of providing personalized learning environments is to determine the characteristics of the students. According to Kuzgun and Deryakulu (2004), students' levels of benefiting from a certain teaching practice, their preferences about learning and teaching approaches and their reactions against teaching practices differ according to their personal characteristics. The principle of personal differences indicates that in learning students differ from each other largely in terms of learning styles and degrees of learning; individual activities are adapted to each student's learning pace and style and when it is flexible, it can be accomplished in the best way (Ozerbas, 2010).

Personalized teaching is the kind of teaching where the teaching program is accomplished through adapting to students' personal characteristics in their daily lives or in their backgrounds as well as their learning characteristics. Personalized teaching of which history goes back years ago describes a learning experience as a learner's interest and learning style (Ozarslan, 2010). In literature, the term, adaptive teaching can be used instead of the concept of personalized teaching. The main idea behind the personalized learning is the idea of aptitude-treatment action (ATI) (Sampson, Karagiannidis and Kinshuk, 2002). Personalized teaching was based on cognitivism when the learner reconstitutes and organizes the information through the cognitive structure existent in his/her mind and creates a new schema. It is based on constructivism when the learner becomes an active participant of the procedure, develops his/her own strategies to understand the information and contributes to the design of an appropriate environment of his/her own (Sampson, Karagiannidis and Kinshuk, 2002). The idea of a learning environment where individual differences are taken into consideration plays an important role in developing personalized learning environments. These individual differences could be many characteristics such as students' learning styles, learning pace, talents, expectations, readiness, experiences and motivation. At this point, personalized learning environments provide students an atmosphere in a flexible structure according to their learning pace and styles in appropriate time and place for them (Baylari and Montazer, 2009; Sampson, Karagiannidis and Kinshuk, 2002).

Jonassen and Grabowisky (1993) described personalization in teaching as the individual's interaction with his/her environment and especially with other people. Personalization of teaching can be achieved by being student-based, in other words, structuring according to students' personal needs (Diack, 2004). Personalized teaching argues that learned concepts must be framed according to the individual contrary to the traditional teaching system where students try to adapt themselves to the concepts (Karagiannidis, Sampson, and Cardinali, 2001). Personalization is framing the main content of education according to students' backgrounds and fields of interest. The personalization used in this study is a kind of personalization that was achieved by using variables such as students' friends, familiar places and favorite team. Familiar people and stories about students' past experiences can build a bridge between the new information and existing ones (Hart, 1996).

Many studies exposed positive effects of personalized problems on affective and mental learning outcomes such as interest, motivation and comprehension. Students generated these problems by placing names and information from their experiences into the problems they had been solving. These studies (Bates and Wiest, 2004; Anand and Ross, 1987; D'Ailly, Simpson and MacKinnon, 1997; Davis-Dorsey, Ross, and Morrison, 1991; Hart, 1996; Ku and Sullivan, 2002; Lopez and Sullivan, 1991, 1992;

Ross and Anand, 1987; Ross, McCormick and Krisak, 1985; Ross, McCormick, Krisak and Anand, 1985) corroborate the positive effects of personalization on the before mentioned variables. Herndon (1987) found out that students who followed a program prepared based on common interests had a much more positive attitude and had a high level of task awareness compared to others. Some other studies like adaptive personalized teaching proved that those who had taken this education based on personalized teaching had a more positive attitude than those who did not have this education (Ross, 1983, Ross, McCormick, Krisak and Anand, 1985). The findings in this aspect were also confirmed by some other studies.

In their studies, Ku and Sullivan (2002) used the most popular items for all students in the questionnaires completed according to field of interests in personalizing the problems. In personalized problems, students got high problem solving points both in pretest and posttest. Both personalized and non-personalized problems were used in course presentation and revision of the units with 53 minutes in between. In their studies conducted in 2000 and 2002, Ku and Sullivan discovered that students who took personalized courses had considerably more positive attitude than those who did not take personalized courses. Hart (1996), conducted a study to test the effect of personalized word problems over sixth grade students, 13 boys and 8 girls. Students' attitude towards the solution of word problems and the ability of problem solving when the problems were presented in a personalized context were tested. Hart performed attitude research using attitude scale towards word problems that he himself had developed and studied on the problems in the course book and their personalized versions. Ku and Sullivan studied over 136 Taiwanese fourth grade students and it is found that group personalization has also a positive effect. According to this study, both students and teachers who used personalized problems exhibited more positive attitudes than those who used non-personalized problems. Ku and Sullivan (2002) claimed that similarities (conceptual, reducing concrete loading) and interests are the basic factors that enable a greater achievement in solving personalized problems than solving non-personalized problems. In this study, it was seen that students with a low achievement level could be much more successful in personalized education than in traditional education. They have reached a conclusion that personalization of word problems is a more effective way in understanding and solving the problems.

There are studies in the literature that demonstrate no differences as well as studies with positive results in terms of achievement. Bates and Wiest (2004) applied a test of 10 questions, five of which were personalized and five of which were non-personalized questions. This study was conducted over 42 fourth grade students. After two weeks, they applied another test by personalizing non-personalized questions and changing personalized questions into non-personalized ones. As a result, there was no significant difference between personalized and non-personalized questions. In the case of personalization of word problems without considering the student's reading skills and the type of word problem, it was seen that it did not cause a significant increase in student's achievement and attitude. Researchers attributed the reason as to why there was no significant difference between them to the fact that the study was applied in fourth grades.

The objective of this study is to propound whether personalized teaching affects achievement in accordance with Physics word problems and whether achievement in Physics differs according to different learning modalities.

2. Method

2.1. Design

The study is an experimental study conducted using posttest control group design. Experimental design is as follows:

G_1 R X $O_{1.2}$
G_2 R $O_{2.2}$

Experimental and control group had been taught the subject, motion (projectiles) on Earth in Physics lesson for three weeks. However, personalized instruction was used in experimental group and traditional instruction was applied to control group. At the end of the program, students' achievements were determined using posttests.

2.2. Participants

Fifty-nine tenth grade students, who were attending Suzan-Mehmet Gonc Trade Vocational High school in Mamak-Ankara, were included in the study group. The demographic information about the students is given in Table 1.

Table 1. Demographic Factors

		Frequency	Percent	Valid Percent	Cumulative Percent
Non-Personalized	Kinesthetic	4	13,3	13,3	13,3
	Visual	21	70,0	70,0	83,3
	Audial	5	16,7	16,7	100,0
	Total	30	100,0	100,0	
Personalized	Kinesthetic	2	6,9	6,9	6,9
	Visual	17	58,6	58,6	65,5
	Audial	10	34,5	34,5	100,0
	Total	29	100,0	100,0	
Non- Personalized	Male	13	43,3	43,3	43,3
	Female	17	56,7	56,7	100,0
	Total	30	100,0	100,0	
Personalized	Male	10	34,5	34,5	34,5
	Female	19	65,5	65,5	100,0
	Total	29	100,0	100,0	

2.3. Instruments

2.3.1. Information Form

To be able to apply personalized teaching, information like the names of students' favorite subject, best friend, favorite animal, favorite fruit and food and the name of the secondary school they had graduated as well as some students' personal information like their name and surname, sex, the name of parents and siblings were taken through information form.

2.3.2. Physics Word Problems

Ten questions in course books related to Motion on Earth (projectiles) existed in tenth grade Physics lesson education program were personalized by the field experts and used in measuring achievement.

2.3.3. Learning Modality Inventory

Learning Modality Inventory developed by Simsek (2002) was used in determining students' learning modalities. The inventory was prepared in Five Point Likert model. The findings obtained by the researcher showed that the inventory of 48 items could be used in determining the learning modalities of high school and university students between the ages of 16-25 in Turkey's conditions. The inventory with three factors explains 42.93 % of total variance. Reliability co-efficient of the scale measured using Cronbach Alpha co-efficient was found as .684 for kinesthetic modality sub-scale, .771 for audial modality sub-scale and .793 for visual modality sub-scale. Cronbach alpha coefficient for the whole scale was measured as .844. The findings related to the reliability of the inventory proved that the results obtained could be satisfactory.

2.4. Implementation

First, students were made to fill in student information form, which included their personal information in order to get personalized course materials. For the group who had taken personalized course, personalized questions were prepared by inserting students' personal information into the questions prepared before about the subject of motion on Earth (projectiles) prepared by the field experts. For the group who had taken non-personalized course, students' personal information was not used. Same course was given to both personalized and non-personalized groups for three weeks. At the end of the course, a personalized achievement test was given to personalized group and non-personalized achievement test was given to non-personalized group. In this study, because it was difficult to provide a computer to each group, teaching materials were given as personalized in paper form.

2.5. Data Analyses

t- Test was used to determine whether there was a significant difference between personalized and non-personalized groups in terms of achievement and gender. Because the data did not have a normal distribution, Kruskal Wallis H test was done to control whether there was a difference in terms of learning modalities.

3. Findings

3.1. Related to achievement variable

Whether personalization has an effect on the achievement of word physics problems was controlled by t-test. At the end of the analysis, it was seen that there was not a significant difference between the scores personalized and non-personalized groups get from physics word problems [$t_{(57)}$=0,05, p > .05].

Table 2. Personalization- t-Test

	N	M	Std. Deviation	df	t	p
Personalized	29	57,83	9,87	57	0,05	0,96
Non-personalized	30	57,67	14,74			

3.2. Related to sex variable

An independent samples t-test was conducted to compare the personalized scores for males and females (Table 3). It did not show a significant difference in solving personalized Physics word problems in terms of sex [$t_{(27)}$= -1,69, p > .05].

An independent samples t-test was conducted to compare the non- personalized scores for males and females (Table 3). It did not show a significant difference in solving non-personalized Physics word problems in terms of sex [$t_{(28)}$=-1,25, p > .05].

Table 3. Sex Differences Personalized and non-Personalized t-Test

Groups	Gender	N	M	Std. Deviation	df	t	p
Personalized	Male	10	53,70	8,37	27	-1,69	,10
	Female	19	60,00	10,11			
Non-Personalized	Male	13	53,85	15,15	28	-1,25	0,22
	Female	17	60,59	14,16			

3.3. Related to learning modality

When the scores of personalized group were examined, it was seen that the scores they got from Physics word problems did not show a significant difference in terms of students' learning modalities [$\chi^2(2)$=2,40, p> .05]. This finding proved that no matter what their learning modality was, it had the same effect in increasing their achievement in solving Physics word problems.

When the scores of non-personalized group were examined, it was seen that the scores they got from Physics word problems did not differ significantly in terms of their learning modalities [$\chi^2(2)$=0,71, p> .05]. This finding proved that no matter what their learning modality was, it had the same effect in increasing their achievement in Physics word problems.

Table 4. Learning Modality Differences Personalized Kruskal Walllis H-Testi

Groups	Gender	N	Mean Rank	df	χ^2	P
Personalized	Kinesthetic	2	14,00	2	2,40	,30
	Visual	17	13,15			
	Audial	10	18,35			
Non-Personalized	Kinesthetic	4	13,62	2	0,71	,70
	Visual	21	16,38			
	Audial	5	13,30			

4. Conclusion and Discussion

When the Physics word problems about the subject of motion on Earth (projectiles) were examined in terms of personalized teaching, it was seen that there was not a significant difference between the group who had taken personalized questions and the group with non-personalized questions. For the

solution of Physics word problem, students' attention must be drawn, and then the problem must be understood by the students and later a mathematical equation must be created and this equation must be solved correctly. In this study, achievement score was controlled as the last outcome. In the interviews with the students, it was seen that there was not any problems about drawing attention of the students and understanding the problem. However, it was understood from their low averages that their knowledge about creating equations and solving them correctly were not sufficient.

It was seen that there was no significant difference between the achievement of solving personalized and non-personalized Physics word problems in terms of sex and learning modalities. It was seen that they had the same level of achievement independent of learning modalities.

Furthermore, at the end of the study, it was observed by the researcher that majority of the students got excited and tried to read the questions better and understand them correctly when they saw their personal information in the test. It was also observed that most of the students were more active and tried to understand and solve the problems. In the interviews with the students, they gave the information that they got excited when they saw their personal information in the questions and they read the questions more carefully and tried to understand them better.

In future studies, the study group could be enlarged. Study groups can be grouped according to students' level of achievement as low, average and high achievement groups and the study can be repeated. The effect of personalization as well as visualization can be controlled for the subject of motion on Earth in Physics lesson.

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