

# The Effect of Project Supported Education in Elementary Number Theory Course on Student Achievement

Ahmet S. Ozdemir  
 Department of Mathematics Teaching in Elementary Education, Marmara University,  
 Istanbul, 34722, Turkey

Yasemin Sert  
 Department of Secondary Education, Mathematics Education, University of South Florida,  
 Tampa, Florida, 33620, USA

## ABSTRACT

The aim of the study is to examine the effect of Project Supported Education (PSE) on preservice teachers' achievement and thinking style. 'Post – test control group Model' is used to examine achievement results. Pre-post test control group model is used to examine thinking styles differences based on a "Thinking Style Inventory". The subjects of the study are 46 students enrolled in an Elementary Number Theory course in the Primary Mathematics Education Department in a large university in Istanbul, Turkey. Results indicate that 1) project supported education has no significant effect on student achievement and thinking styles, 2) students in the experimental group scored higher than the control group for their post-tests regarding both Anarchic and Oligarchic Thinking Styles. The reasons for these are discussed further and suggestions are provided.

**Key Words:** Project Supported Education, Elementary Number Theory, Thinking Styles.

## INTRODUCTION

The significance of project management by teachers and designing projects by students is emphasized with the introduction of the new curriculum in Turkey. The importance of projects is highlighted by competitions implemented by the TUBITAK (The Scientific Research Council of Turkey).

In the light of this new trend, we studied the similarities and differences between Project Supported Education (PSE) and Project Based Learning (PBL). PBL is a comprehensive approach to classroom teaching and learning that is designed to engage students in investigation of authentic problems [2]. Students engaged in PBL behave as teachers who are active in the designing, implementing and teaching the class the information obtained as part of their project. In contrast, the researchers define PSE as an approach that allows the teacher to maintain responsibility for the course, but allows students to engage in project-based experience that may be interdisciplinary in nature. In PSE, the teacher maintains his or her role and guides students in the development and preparation of their project independently or with a partner.

This study involves the examination of thinking styles. Thinking styles are defined as a way of thinking [5]. It is not ability, but rather a preferred way of using the abilities one has.

Ability shows how someone can do something well. Compared to ability, style shows how someone likes to do something.

Thinking styles provide a theory that can shed light on how people think and learn differently. The essential idea of this theory of Mental Self-Government is that "people need somehow to govern or manage their everyday activities and that there are many ways of doing so [7]." This theory includes 13 thinking styles which are placed in five dimensions. These five dimensions and thinking styles are outlined in Tables below:

**Table 1: The Function Dimension and Its Thinking Styles with Their Properties**

Thinking Styles	Properties
Legislative	enjoys being engaged in tasks that require self-instruction and self direction.
Executive	finds more satisfaction in the implementation of tasks with clear instructions.
Judicial	focuses attention on evaluating the products of activities.

**Table 2: The Form Dimension and Its Thinking Styles with Their Properties**

Thinking Styles	Properties
Monarchic	enjoys being engaged in tasks that allow full concentration on one thing at a time.
Hierarchic	prefers to allocate attention to several prioritized tasks within the same period of time.
Oligarchic	likes to work toward achieving multiple goals within the same time frame but may be reluctant to set priorities.
Anarchic	enjoys working on tasks that would allow extreme flexibility as to what, where, when, and how the task is fulfilled.

**Table 3: The Level Dimension and Its Thinking Styles with Their Properties**

Thinking Styles	Properties
Global	tends to direct attention to global and abstract ideas.
Local	tends to enjoy being engaged in tasks that allow work with concrete details.

**Table 4: The Scope Dimension and Its Thinking Styles with Their Properties**

Thinking Styles	Properties
Internal	enjoys being engaged in tasks that allow him or her to work independently.
External	prefers being engaged in tasks that allow him or her to work with and cooperate with other people.

**Table 5: The Leaning Dimension and Its Thinking Styles with Their Properties**

Thinking Styles	Properties
Liberal	enjoys engaging in tasks that involve substantial novelty and ambiguity.
Conservative	prefers to adhere to established rules and procedures in performing tasks.

The purpose of the study is to examine the effect of PSE on students' achievement and thinking style. The approaches used in the study are described below.

## METHOD

### Participants

The participants of this study are 46 students out of 157 students who took Elementary Number Theory course in Primary Mathematics Education Department in Marmara University, Istanbul, Turkey. Both the experimental and control groups consist of 23 students. The experimental group is composed of students who volunteered to engage in PSE; the control group is composing of 23 randomly selected students who decided not to participate in PSE. The same instructor taught both the control and the experimental group.

### Data Collection

"Thinking Styles Inventory" was developed by Sternberg and Wagner [6]. It was based on the "Mental Self-Government Theory" of Sternberg's study [5]. This inventory was given to the experimental and control groups before and after the implementation of PSE. The validity and reliability of the Turkish translation of this inventory is investigated by Fer [3]. The 104 items questionnaire with 7 point Likert scale decreased to 70 items questionnaire with 7 point Likert scale after it was adapted into Turkish.

The success of students who received PSE is examined by looking at their final grades.

### Analysis

The researcher and the instructor provided information about the project to the students and guided them about the project topics. This study was carried out over 12 weeks and 2 days.

The normality of the data was evaluated by using the One Sample Kolmogorov Smirnov Test and the Shapiro- Wilk Test. None of the tests indicated a significant difference in normality.

Differences among independent variables differences according to the one factor with two samples are analyzed by using an Independent Samples t-test.

SPSS was used to analyze the data and to determine whether or not there was statistically significant difference between variables by using alpha .05 levels. If the SPSS output shows there are statistically significant differences, the means of variables will be compared.

## RESULTS

Using the final grades of the experimental and control group in Table 6, it was concluded at the .05 level of confidence that there is no significant difference in achievement after the project supported education ( $t = -0.029, p = 0.977$ ).

**Table 6: The Independent t test between Post-Test of Experimental and Control Group for Final Grades**

Group	N	$\bar{X}$	t	p
Experimental	23	39.7391	-0.029	0.977
Control	23	39.9130		

In addition, there is no significant difference between the thinking styles of Pre and Post test affect for both experimental and control groups. However, there is a significant difference between the Post tests of experimental and control group in Oligarchic and Anarchic Thinking Styles as shown respectively in Table 7 and Table 9.

For Anarchic Thinking Style in Table 7, there is a significant difference between Experimental and Control Group Post-test scores ( $t = 3.363, p = 0.002 < 0.050$ ). In addition, Table 7 shows that the mean of Experimental Group Post-Test (25.5652) is more than Control Group Post Test (20.8261).

**Table 7: The Independent t test between Post-Test of Experimental and Control Group Anarchic Thinking Style**

Sub-factor	Group	N	$\bar{X}$	t	p
Anarchic Thinking Style	Experimental	23	25.5652	3.363	0.002
	Control	23	20.8261		

The effect size was calculated as 1.00391(d) in Table 8. It is a very large effect size which means there is very noticeable difference between groups.

**Table 8: The effect size for Anarchic Thinking Style**

Sub-factor	Group	$\bar{X}$	s	d
Anarchic Thinking Style	Experimental	25.5652	3.9752	1.0039
	Control	20.8261	5.4660	

For Oligarchic Thinking Style in Table 9, there is a significant difference between Experimental and Control Group Post-test scores ( $t=3.171$ ,  $p=0.003<0.050$ ). In addition, Table 9 shows that the mean of the Experimental Group Post-Test (15.2174) is more than the Control Group Post Test (12.1364).

**Table 9: The Independent t test between Post-Test of Experimental and Control Group Oligarchic Thinking Style**

Sub-factor	Group	N	$\bar{X}$	t	p
Oligarchic Thinking Style	Experimental	23	15.2174	3.171	0.003
	Control	23	12.1364		

The effect size was calculated as 0.9470 (d) in Table 10. It is a very large effect size which means there is a very noticeable difference between groups.

**Table 10: The effect size for Oligarchic Thinking Style**

Sub-factor	Group	$\bar{X}$	s	d
Oligarchic Thinking Style	Experimental	15.2174	2.9841	0.9470
	Control	12.1364	3.5226	

## DISCUSSION and CONCLUSION

The results of this study indicate that project supported education has no significant effect on student achievement. A conclusion drawn is that this may be the case because students had multiple tasks that required them to manage projects during PSE. They may have spent their time working on the projects instead of studying for the final exam. Alternatively, Gorecek found that teaching supported with project studies does have an effect on student achievement [4]. Also Akdeniz and Keser found that preservice teachers lack techniques in creating project methods [1]. It might be the case that the students in this study also lacked background knowledge about how to create projects and therefore the PSE did not positively affect their learning.

The results of this study indicate that project supported education has no significant effect on student thinking styles. However, there is a significant difference between the Post tests

of experimental and control group in Oligarchic and Anarchic Thinking Styles. If we look at the means, for Anarchic Thinking Style and Oligarchic Thinking Style Experimental Group Post tests are much larger than Control Group Post-Tests. According to the study of Zhang and Sternberg, the main characteristic of the people who have “Anarchic Thinking Style” is that they enjoy working on tasks that would allow extreme flexibility as to what, where, when, and how the task is fulfilled. The main characteristic of the people who have “Oligarchic Thinking Style” is that they like to work toward achieving multiple goals within the same time frame but may be reluctant to set priorities [7].

The students in experimental group prefer these thinking styles as a thinking way compared to students in control group according to this sample. However, it may be possible that these students who volunteered to participate in project supported education have specific thinking styles. Maybe there is a relationship between their thinking styles and program of study being the Math Department, only. In the future replications of this study, there should be participants from different departments to see how thinking styles are affected.

## REFERENCES

- [1] R. A. Akdeniz & F.O. Keser, “Fizik Ogretmen Adaylarinin Proje Hazirlama Becerilerinin Gelistirilmesi Icin Bir Yaklasim”, **XII. Egitim Bilimleri Kongresi**, Ankara:Gazi University, Institute of Educational Sciences, 2003, pp.1211-1215.
- [2] P.C. Blumenfeld, E. Soloway, R.W. Marx, J.S. Krajcik, M. Guzdial & A. Palincsar, “Motivating Project-Based Learning Sustaining The Doing, Supporting The Learning”, **Educational Psychologist**, Vol. 26, No. 3-4, 1991, pp. 369-398.
- [3] S. Fer, “Validity and Reliability of the Thinking Styles Inventory”, **Educational Sciences: Theory & Practice**, Vol. 5, No. 1, 2005, pp. 31-68.
- [4] M. Gorecek, **Mavi gezegenimizi taniyalim ve koruyalim unitesinin proje calismalari ile destekli ogretimini ogrenci basarisina ve tutumuna etkisinin belirlenmesi**, Master Thesis, Mugla University, Turkey, Institute of Natural Sciences, 2007.
- [5] R.J. Sternberg, **Thinking styles**, New York: Cambridge University Press, 1998.
- [6] R.J. Sternberg & R.K. Wagner, **Thinking Styles Inventory**, Unpublished test, Yale University, 1992
- [7] L. F. Zhang & R.J. Sternberg, “Thinking styles and teachers' characteristics”, **International Journal of Psychology**, Vol. 37, No. 1, 2002, pp. 3-12.