

## Reflections from Research Methods Education Program: Effect on Pre-service Teachers' Attitudes and Anxieties

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### Abstract

*Background:* Most higher education institutions are now proposing to introduce courses about reading and carrying out research studies as part of their program of instruction at undergraduate and graduate levels. Affective characteristics play an important role in learning and achievement. They influence the amount of effort that one is willing to expend on learning a subject, which also influences the selection of more advanced courses in similar areas (e.g., research and statistics courses) beyond the minimum requirements. Therefore, assessing students' affective characteristics toward research methods courses is important in enabling instructors to develop instructional techniques that lead to more positive attitudes toward the subject.

*Aims:* To investigate the effect of a Research Methods Education Program which focused on planning and carrying out educational research – on pre-service teachers' attitudes and anxiety toward educational research, and to determine their views about the program.

*Sample:* 40 secondary mathematics education majors from a university in western Turkey enrolled in Research Methods Education Program.

*Method:* Research Methods Education Program was implemented in three semesters. Two scales, namely "Attitudes toward scientific research" and "Research anxiety" scales were used as pre-, mid- and post-tests in the study. At the end of the program, pre-service teachers were requested to record their views about the program.

*Results:* The study showed that pre-service teachers' attitudes toward undertaking educational research changed in a positive direction. Their anxiety level did not change after the theoretical courses related to educational research methods and statistics, but reduced after they carried out an educational research project by themselves.

*Conclusion:* The Research Methods Education Program indicated that pre-service teachers may have an active role in improving their teaching and in changing their affective characteristics in a positive manner.

**Keywords:** teacher education, research methods, attitudes

## 教育研究法課程的反思：對職前教師態度和焦慮的影響

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### 摘要

*背景：*現今大多數高等教育院校，建議將教授閱讀和進行研究的部分，放在大學本科和研究生課程中，情意因素在學習和成績上發揮著重要的作用，影響學生願意花在學習該科的精力，也影響了在最低要求之外選讀類似領域更高級的課程（例如研究和統計課程）。因此，評估學生對研究方法課程的情意因素，能使教師促進教學技巧，帶領學生對該科有更正面的態度是重要的。

*目的：*調查聚焦在教授規劃和開展研究的教育研究方法課程，對職前教師在教育研究的態度和焦慮的影響，並找出他們對課程的意見。

*調查對象：*40名在土耳其西部一所大學修習教育研究方法主修中學數學教育的學生。

*方法：*教育研究方法課程分在三個學期授課，採用“科研態度”和“研究焦慮”兩個量表來作為前期、中期和後期測試的研究。在課程結束時，要求職前教師寫下他們對課程的意見。

*結果：*研究表明，職前教師修習教育研究方法課程，對教育研究的態度有正向的改變；焦慮程度維持不變，在他們進行了自己的教育研究項目後才減少。

*結論：*研究顯示，職前教師修習教育研究方法課程，可能提高他們對教學的積極性，並改進他們的情意因素。

**關鍵詞：**教師教育、研究方法、態度

## Introduction

The main function of universities is to instruct and train people for different professions and to conduct research to advance scientific and technological knowledge. To promote education for all, many institutions of higher education are now proposing to introduce courses about reading and carrying out research studies as part of their regular program of instruction at undergraduate and graduate levels (Sanyal, 2005).

Lopatto (2003) investigated the benefits that students derive from performing undergraduate research projects by asking faculty members. The most frequently mentioned items were: learning a topic area in depth; learning subject matter in detail; constructing a meaningful research problem; learning to use appropriate methodology; learning to work and think independently; learning to design solutions to problems; learning to analyze data; improving oral and written communication skills; appreciating the scientific method; learning what scientific research actually entails; developing an orientation toward future work and education; clarifying career plans; and learning to use scientific literature. As is clear from the benefits mentioned by Lopatto (2003), conducting research at undergraduate level is considered as an effectual strategy in the professional development of students in universities (Unrau & Beck, 2004).

Teacher research, which is defined as systematic, intentional inquiry by teachers into their own school and classroom work, is also considered as important in the professional development of teachers (Cochran-Smith, 2003). Having student teachers read only the summaries of the research that experts in the field have carried out will make the teachers wait for directions on how to improve their

instruction. Besides reading academic literature it is important to have teachers take responsibility for improving student learning by conducting research into improving their practice. This is possible when the teachers are aware of the research methods (Frager, 2010). Cochran-Smith, Barnatt, Friedman and Pine (2009) state that carrying out research encourages student teachers to engage in critical reflection, develop a questioning stance, understand school culture, construct new curricula and pedagogy, modify instruction to meet students' needs, and become socialized into teaching by participating in learning communities. Dobber, Akkerman, Verloop and Vermunt (2012) state that teacher research is motivated by different aims such as professional development of teachers, improvement in certain aspects of pupil or student outcomes, influence on policy on the basis of research outcomes, and potential contribution of teacher research to theory.

Teacher education programs have included courses related to educational research in their curriculums since the 1950s (Burn, 2007; Kwan, 2001). The goal is to help pre-service teachers become life-long learners who raise questions and continuously learn how to teach by researching and reflecting on practice throughout their professional life-span (Cochran-Smith et al., 2009). Hammerness, Darling-Hammond and Bransford (2005) found that graduates from teacher education programs that make extensive use of teacher research reported significantly higher feelings of preparedness and were rated more highly by employers. Hall (2009) carried out a three-year action research project in which teachers in primary and secondary schools across the UK completed three cycles of practitioner inquiry to explore tools, pedagogies, and other innovations which would promote dispositions of

“learning to learn”. The findings showed that the process of teacher inquiry as practiced grounds the individual in context in relevance to the learners and sustains the process through the increased motivation brought about by rapid and responsive feedback. Teachers gain in confidence in articulating their embodied practical knowledge and in translating the contextual understandings of their own classrooms to a wider audience. Moreover, this participation in the wider learning community of the project fosters the critical engagement with ideas and approaches, which underpins teachers’ future decision-making about innovation and changes in their practice.

Affective characteristics play an important role in learning and achievement. Prior research studies have found that negative attitudes toward a course (e.g., mathematics) have been found to explain a significant portion of the variance in student learning (Ma, 1995). These attitudes also influence the amount of effort that one is willing to expend on learning a subject, which also influences the selection of more advanced courses in similar areas (e.g., research and statistics courses) beyond those required. Therefore, assessing students’ affective characteristics toward a research methods course is important in order to enable instructors to develop instructional techniques that lead to more positive feelings toward the subject (Waters, Martelli, Zakrajsek, & Popovich, 1988). Sanders (2001) states that many graduate students have an intense anxiety toward research methods courses and delay taking them. As cited in Wang and Guo (2011), learning difficulties in research methods classes affect students’ interest and attitude toward research and future research productivity. The study of research design and statistics elicits even graduate students’ anxiety and resistance; students exhibit low self-efficacy with insufficient training in graduate

programs and are inclined to dismiss the research relevance in professional practice. However, there are studies which show that research methods courses make a positive impact on students’ expectations related with research and on their research studies. Teachers who took research methods courses carry out more research studies in their classes (Bard, Bieschke, Herbert, & Eberz, 2000), have more self-efficacy and less anxiety in undertaking research (Lei, 2008; Saracaloğlu, Varol, & Ercan, 2005; Unrau & Beck, 2004). Studies investigating the attitudes of graduate and undergraduate university students toward conducting research also show that attitudes are affected in a positive manner when the students take research methods courses (Ravid & Leon, 1995; Saracaloğlu, 2005; Saracaloğlu et al., 2005; Walker & Cousins, 1994).

The goal of this study is to investigate the effect of a three semester program – focusing on conducting educational research – on pre-service teachers’ attitudes and anxieties toward undertaking educational research, and to understand their feelings and opinions about the Research Methods Education Program. The research problems investigated in this study are:

1. Is there a significant difference in the attitudes toward research of pre-service secondary school mathematics teachers in the pre-, mid- and post-research methods education program?
2. Is there a significant difference in the research anxiety scores of pre-service secondary school mathematics teachers in the pre-, mid- and post-research methods education program?
3. What do pre-service teachers think about the educational research methods education program?

## **Method**

### **Participants**

The study was conducted in a teacher education program in a university in the western part of Turkey. The program offers a five-year bachelor's degree in teaching secondary mathematics. A cohort of 40 secondary mathematics education majors enrolled in a three semester program on planning and conducting educational research.

### **Research Design**

The study was a quasi-experimental study which aimed to determine whether the Research Methods Education Program had an effect on the attitudes and anxieties about educational research of pre-service teachers. Quantitative data on participants' anxiety and attitudes regarding the educational research was collected at three successive stages, namely pre-, mid- and post-research methods education program. The purpose of these data was to monitor and describe in quantitative terms any changes that occurred in pre-service teachers' anxiety and attitudes as related to educational research, and which change could be attributed to the intervention contrived. Mid-test was conducted after the course "Introduction to statistical analysis in educational research", namely after the theoretical courses but before practical research project course, to investigate whether carrying out a research study impacted upon attitudes and anxieties of pre-service teachers. Qualitative data was also collected from the pre-service teachers about the Research Methods Education Program.

### **Design of the Research Methods Education Program**

The Research Methods Education Program in which students were enrolled was designed to

teach pre-service teachers about the process of research, to increase their confidence and ability to understand research, as well as to conduct research specific to their professions (Unrau & Beck, 2004; Papanastasiou, 2005). This program covered the fundamental concepts of research methodology, as well as basic statistical terms and techniques required to analyze research data. Primary emphasis was placed on various stages of research: defining a research problem, conducting literature reviews, collecting and analyzing data, as well as writing and interpreting results, discussions, and conclusions in research articles. The program also placed substantial emphasis on measurement issues, including measurement scales, along with validity and reliability issues. Homework, classwork, discussion, research critiques, and oral presentations were also essential components of this course. Finally, pre-service teachers in this program were required to design and execute a research project related to educational issues throughout the semester. The courses were given using active learning strategies.

The Research Methods Education Program was a collection of three courses, taught in successive semesters. The courses were 3 hours for 14 weeks in each semester. The pre-service teachers attended these courses in their 7th, 8th, and 9th semesters. The courses and their goals were as follows:

- a. Introduction to Research in Education. This course is an introduction to the process and practice of research in education. It provides an overview of a variety of educational research methods and introduces both quantitative and qualitative approaches. In this course, students are assisted to recognize research paradigms as examples of disciplined inquiry, situate various models

of inquiry, such as experimental, correlation, and single-subject designs, ethnography, and case studies. Within these models of inquiry, students are guided to understand, interpret, and critique studies conducted using a variety of methodological approaches. They then plan a study with a research design appropriate to a selected topic.

- b. Introduction to Statistical Analysis in Educational Research. This course provides an overview of descriptive and inferential statistics commonly used in educational and psychological research. Students successfully completing this course should be able to comprehend the assumptions, limitations, and uses of statistical methods; compute and interpret descriptive and selected inferential statistics; comprehend research that reports frequencies, means, t-tests, F-tests, and nonparametric tests; engage in statistical thinking; and develop a positive attitude toward the use of statistical methods. Pre-service teachers use SPSS to carry out the statistical analysis.
- c. Research Projects in Education. Pre-service teachers in this course plan and conduct a study in the topic they determine under the supervision of a faculty member. The pre-service teachers work collaboratively to design and write a research proposal, gather and analyze data, and report the research results.

### Data Collection and Instruments

Two scales, namely "Attitudes Toward Scientific Research" and "Research Anxiety" scales, were used as pre-, mid- and post-tests in the study. Data was

gathered using these scales at the beginning of the program; after the course "Introduction to statistical analysis in educational research", before the course "Research Project in Education"; and at the end of the program.

1. Attitudes Toward Scientific Research scale, which is a 23 item, 5 point Likert type scale, was developed by Köklü (1992). Higher points show more positive attitudes toward research. The Cronbach  $\alpha$  value of the scale was 0.86 (Köklü, 1992) and in this study Cronbach  $\alpha$  value was found as 0.91.
2. Research Anxiety scale, developed by Büyüköztürk (1997), was a 12 item, 5 point Likert type scale. The higher point shows higher anxiety. The Cronbach  $\alpha$  value of the scale was 0.87 (Büyüköztürk, 1997) and in this study Cronbach  $\alpha$  value was found to be 0.90.

At the end of the Research Methods Education Program, pre-service teachers were also requested to write a reflection about the program. Reflection papers required the pre-service teachers to give some explanations about their views related with educational research and were a follow up of the intervention implemented in this study.

### Data Analysis

The data analysis of pre-, mid- and post-tests was done through One-way ANOVA for repeated measures using SPSS 17.00 at the 0.05 significance level. Pre-service teachers' reflections were analyzed through categorizing the answers of the students.

## Results and Discussion

### Results of One-way ANOVA for Repeated Measures Test for Attitude Scores of Participants

Mauchly's test indicated that the assumption of sphericity was violated  $\chi^2(2)=12.11$ ,  $p<0.05$ , therefore degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity  $\epsilon=0.57$ . The difference between the mean attitude scores of pre-service teachers in pre-, mid- and post-tests was significant [ $F(1.593, 66.898)=284.357$ ,  $p<0.05$ ], which meant that the attitude scores of pre-service teachers in the pre-test, mid-test and post-test were significantly different. In order to trace the source of the difference of the multiple comparisons of the pre-test, mid-test and post-test knowledge scores of subjects, Bonferroni correction was carried out. It showed that the mean difference between the pre-test ( $x=59.71$ ) and mid-test score ( $x=69.60$ ) was significant. It also revealed the mean difference between the mid-test ( $x=69.60$ ) and the post-test scores ( $x=85.23$ ) to be significant.

### Results of One-way ANOVA for Repeated Measures Test of Anxiety Scores of Participants

Mauchly's test indicated that the assumption of sphericity was violated  $\chi^2(2)=77.91$ ,  $p<0.05$ , therefore degrees of freedom were corrected using Greenhouse-Geisser estimates of sphericity ( $\epsilon=0.57$ ). The difference between the mean anxiety scores of pre-service teachers in pre-, mid- and post-tests was significant [ $F(1.081, 45.394)=177.257$ ,  $p<0.05$ ], which meant that the anxiety scores of pre-service teachers in the pre-test, mid-test and post-test were

significantly different. The results of Bonferroni correction showed that while the mean difference between the pre-test and the mid-test anxiety scores was not significant, the mean difference between the mid-test and post-test anxiety scores was significant. This implies that while there was no appreciable change in the anxiety scores of pre-service teachers from pre-test ( $x=39.77$ ) to mid-test ( $x=39.51$ ), there was statistically significant decline in the anxiety scores of pre-service teachers from mid-test ( $x=39.51$ ) to post-test ( $x=30.09$ ). This may be due to the reason that the research process was clearer when students applied the research stages actively by themselves.

The results were parallel with the literature that found research methods courses lead students to develop a positive attitude toward research and to experience less anxiety about undertaking research (Beard & Williams, 1992; Ravid & Leon, 1995; Saracaloğlu, 2005; Saracaloğlu et al., 2005; Walker & Cousins, 1994).

### Student Reflections about Research Methods Education Program

Student reflections about the program were analyzed by developing coding strategies and identifying categories in the data. The categories determined from student reflections were: benefits of research methods courses, difficulties in research methods courses, and the changes that the research methods courses made to students' views of research. Categories and their subcategories are given in Table 1.

Table 1

*Categories and Subcategories Labeled from Student Reflections*

Benefits of research methods courses	Difficulties in research methods courses	Changes in pre-service teachers' views about research
<ul style="list-style-type: none"> <li>• Understanding statistics better</li> <li>• Reading the research articles critically</li> <li>• Being aware of the literature in their field</li> <li>• Being aware of the importance of undertaking research in teaching</li> <li>• Understanding and following the scientific process</li> <li>• Being aware of different research methods</li> </ul>	<ul style="list-style-type: none"> <li>• Deciding on the research problem</li> <li>• Reporting the research report</li> <li>• Reporting the literature review.</li> <li>• Language problems in literature review</li> <li>• Time constraints</li> </ul>	<ul style="list-style-type: none"> <li>• Motivating pre-service teachers to do research in their future classes</li> <li>• Motivating pre-service teachers to get masters degree</li> <li>• Motivating pre-service teachers to read more books and articles from scientific journals</li> </ul>

**Benefits of Research Methods Courses**

Most of the pre-service teachers expressed the benefits of research methods courses as improved understanding statistics, reading the research articles critically, being aware of the literature in their field, being aware of the importance of undertaking research in teaching, and being aware of different research methods.

Although it is stated in the literature that most students have difficulty with, and negative opinions toward, statistics (Onwuegbuzie, 1997), the pre-service teachers participating in this study had positive opinions about statistics. Since the pre-service teachers' major is mathematics, they took statistics and probability courses in their regular program. They mostly stated that those mathematics courses were theoretical and they were pleased to see the practical applications of statistical techniques.

“It is really helpful to see the practical applications of t-test, ANOVA. I understand the statistics course better, now.”

During the program, pre-service teachers answered a series of questions regarding a research report in a scientific journal. They discussed their answers as a class, identified flaws in the article, generated recommendations for better reporting, and then completed a similar homework assignment in which they critiqued an article by themselves. Some of the pre-service teachers stated that they are now more critical in reading articles. Pre-service teachers were also interested in reading documents related with educational issues and teaching.

“Criticizing the articles in research methods courses made me more cautious about reading research and interpreting its results.”

“As a teacher, I think it is important to be aware of the literature. In these courses we read a lot of material related with education. It made me think more about educational issues.”

“As I read more about research studies and books in teaching mathematics, I started to think more on my teaching. I will follow the journals and magazines related with education and mathematics in the future.”

As a result of the program, the research process was clearer to students. Theoretically, it was considered a tough process to continue. However, as pre-service teachers carried out studies by themselves the stages became clearer.

“After the theoretical research method and statistics course, I was really afraid of doing research a lot. The process of research is long and you have to plan well to continue the research. When we do the work by ourselves, it was much clear.”

Pre-service teachers were also thinking that research studies in education were limited to survey studies. This is probably due to the reason that they mostly see the results of survey studies in real life, for example in newspapers. They had an introductory knowledge about different research methods.

“I was always thinking that research is only done with surveys. I learnt a lot about the other research methods. I am interested in the qualitative research methods in order to go into further detail to improve one’s understandings of some concepts.”

### **Difficulties in Research Methods Courses**

Pre-service teachers had some difficulties in the Research Methods Education Program. Most of them stated that they had difficulty in deciding the problem of the study. Literature review was another stage mentioned as difficult. Since most of the literature is in English, pre-service teachers could not read them owing to language problems. Synthesizing the results in the literature and writing the literature review was also considered hard. Time constraint was another issue. Pre-service teachers reported that for their own research study they needed more time to continue it. They also mentioned the importance of supervision during their practical study.

“Writing a research report is really difficult. You have to read a lot and grasp the meaning of those studies to write. It takes too much time.”

“Defining the research problem is difficult. Once you decide on the problem of the research, it easier to plan the rest of the study. I think the supervision of the instructor of the courses is very important.”

“Doing research is time consuming. We need a lot of time to read and interpret the articles and plan the study. Besides the other courses we took in the semester, it was difficult to find time to do the research.”

“Although there are studies in Turkish, educational literature is wide and we need to read the studies in other languages.

Especially, reading the articles in English was very difficult for us.”

### **Changes in Pre-service Teachers' Views about Research**

Some of the pre-service teachers stated that they were reluctant to do a research study at the beginning. They were questioning why they were taking research methods courses. At the end of the program, most of them stated that they started to think about taking graduate studies. Some students also stated that they will undertake research studies to find solutions to their classroom problems in their teaching profession. These findings contradict prior research. For instance, Coleman and Conrad (2007) stated that students generally do not value such courses in terms of their application to their own careers. These contradictions might be explained by the fact that these pre-service teachers were aware that theoretical courses are a prerequisite for their project lessons, and that they appreciated the usefulness of reading literature and finding solutions to class problems (Gladys, Nicholas, & Crispen, 2012). Providing educational research methods and statistics courses – with many practical examples and the opportunity to apply knowledge in carrying out educational research – motivated the pre-service teachers to pursue masters studies and use research in their future professional life.

“I was thinking that doing research was a very big thing. I didn't think about doing graduate study. Now, I am eager to get a masters degree.”

“At the beginning, I was thinking why we take research method courses. I just want to be a teacher

and I will teach mathematics to students. However, as I read the articles on teaching mathematics, class problems, student behaviors, I realized that I may have some problems in my future classes and I can find solutions to those problems by doing research by myself.”

The reflections of pre-service teachers about the benefits of the Research Methods Education Program were parallel to the literature. Pre-service teachers specified that, as a result of attending research methods courses, they read articles more critically, felt more confident in finding solutions to class and student problems, and had improved their teaching, which are the benefits indicated in the literature (Cochran-Smith et al., 2009; Dobber et al., 2012; Lopatto, 2003). The teachers became aware of the ethical issues and writing format of an academic report. The pre-service teachers were also using a limited number of sources to do their homework and assignments. They were mostly using books recommended by their instructors and Google to find information. After the Research Methods Education Program they were aware of a fuller range of sources which they might use and they became eager to make use of them. They also expressed the desire to make use of these educational sources during their professional teaching. It is important to note this desire to become lifelong learners.

Although the pre-service teachers generally held positive views about the relevance of the course in their teacher education program they struggled with some obstacles while they were conducting their research projects. These obstacles were mostly

related to time limitations in conducting the research project, in generating suitable research questions and in reviewing the literature. Nor could pre-service teachers transfer the knowledge that they learned into practice. This finding agreed with the studies of Unrau and Beck (2004), who found that learning about research methods for the pre-service teachers were a major constraint in their preparation. The difficulty of forming a research question for pre-service teachers is due to their shorter experience in teaching (Ross, 1987; Smith & Sela, 2005). Often, they encounter many problems in education, so they do not know which problem they should select for their research project. Price (2001) mentioned that one of the greatest challenges that pre-service teachers encounter is finding the time for working on educational research projects.

### **Conclusion and Implications**

The Research Methods Education Program indicates that pre-service teachers may have an active role in improving their own teaching. As stated by Lammers (2011), research is like a treasure hunt. Pre-service teachers need to be engaged in this treasure hunt to feel its excitement, by practicing the skills that provide the clues and actually experience the excitement of finding a clue. He states that “It is nice to read a story about a treasure hunt, but it is so much more fun to participate in one!” This is important in order to have teachers who feel themselves responsible in their professional development.

The study showed that taking courses on research methods and statistics and carrying out a research study has an effect on the attitudes and anxieties of the participants. Pre-service teachers’ attitudes toward undertaking educational research changed in a statistically significant positive direction

during the study. Their anxiety level did not change after the theoretical courses related with educational research methods and statistics, but there was a statistically significant decrease in the anxiety level of participants after they carried out an educational research project by themselves. As stated by some of the pre-service teachers, the educational research process was perceived as long and difficult and carrying out the research project made the research processes clearer. Active learning was also stated as an important method that enabled learning (Johnson, Johnson, & Smith, 1998), and having pre-service teachers carry out research by themselves was effective in improving their understanding of the research process and in reducing their anxiety level. To overcome the obstacles to conducting research projects, pre-service teachers mentioned the importance of supervision. The teacher educator can play an important role in supervising groups of student teachers by directing their engagement in decision making process for identifying the research problem, planning and carrying out the research. Additionally, it is important to note that the pre-service teachers should be encouraged to improve their second language, especially English. Owing to the challenging nature of research methods courses, it is also important for teacher educators to use different teaching strategies and to include many practical examples in research methods courses.

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