Investigation of Pre-service Science Teachers’ Self-efficacy Beliefs of Science Teaching

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Abstract

The scope of the study is to investigate the pre-service science teachers’ self-efficacy beliefs of science teaching with respect to gender and grade level. Using the survey approach, the data of the study were gathered from 114 pre-service science teachers enrolled in the Faculty of Education at two universities in Turkey. The data was collected using a likert type scale, “science teaching self-efficacy belief scale” with 23 items, originally developed by Enochs-Riggs (1990). Variance analyses (two-way ANOVA) was performed on the collected data to reveal whether there are significant differences in science teacher candidates’ self-efficacy beliefs of science teaching according to grade level and gender. The results of analysis showed that there was no statistically significant difference in pre-service science teachers’ self-efficacy beliefs of science teaching with respect to both gender and grade level.

Keywords: Self-efficacy of science teaching, science education, teacher training

Introduction

Self-efficacy belief, first introduced by Bandura as a part of his social cognitive theory, is defined as “people’s judgments of their capabilities to organize and execute courses of action required to attain designated types of
Self-efficacy is not essentially a function of individuals’ skills. It is the product of individual judgments about what could be done using one’s own ability. In other words, self-efficacy is a person's judgment about being able to perform a particular activity (Dede, 2008). It is claimed that persons who possess a high degree of self-efficacy are more willing to undertake difficult tasks, to persist longer at them, and to spend more effort in the process (Witt-Rose, 2003). For example, a person with high self-efficacy beliefs for math is less likely to give up on a challenging problem, because person believes that he or she can solve it. A person with low self-efficacy beliefs may give up on the same problem because he or she thinks it is beyond his or her capability (Allan, 2010).

The concept of self-efficacy recently has become focus of many studies (Morgil, Seçken & Yücel, 2004), since a teacher with high self-efficacy belief is one of the most fundamental elements for an effective teaching. Because teachers’ self-efficacy has been associated with student motivation, teachers’ adoption of innovations, and teachers’ competence as rated by superintendents, effective classroom management strategies of the teacher, time spent on different subjects, and teachers’ referrals of students to special education (Woolfolk Hoy, 2000). Chan (2003) suggested that teachers with a strong sense of self-efficacy experience less stress and are more successful in creating an effective teaching setting. In contrast to this, teachers with low self-efficacy do not feel personally responsibility for the failure of students, and want to be the sole authority in their classroom (Yaman et al., 2004).

In the literature, there are numerous papers related to the self-efficacy beliefs of both pre-service and in-service teachers, for instance, the relationship between changes in teachers’ self-efficacy beliefs and the science teaching environment (Andersen et al., 2004), the comparison of self-efficacy beliefs of pre-service teachers in different countries (Cakiroglu, Cakiroglu & Boone, 2005), and the relationship between teachers’ self-efficacy and their perceived job performance (Khurshid, Qasmi & Ashraf, 2012). However, one of the most widely studied topics related to self-efficacy of pre-service teachers is the factors influencing self-efficacy beliefs (Azar, 2010; Yalcın, 2011; Yaman et al., 2004).

It is important to determine the self-efficacy beliefs of pre-service teachers – who will become teachers in the future – because it is difficult to change their beliefs once self-efficacy beliefs are formed (Yalçın, 2011; Bandura, 1997). Therefore, the present study aims to investigate pre-service teachers’ self-efficacy beliefs of science teaching according to gender and grade level.

2. Method

A survey research method was employed in this article. Surveys are used to learn about peoples’ attitudes, beliefs, values, demographics, behavior, opinions, habits desires, ideas and other types of information (McMillian & Schumacher, 2004 p. 304).

2.1. Sample

The sample of the study consisted of 114 pre-service science teachers who enrolled in the department of Science Teacher Training in the Faculty of Education at two different universities in Turkey. Of these pre-service teachers, 89.2 percent were females and 11.8 percent were males. In terms of year of study, 38.6 percent of the participants were freshmen and the remaining 61.4 percent were junior.

2.2. Instrument

In determining pre-service science teachers’ self-efficacy beliefs of science teaching, “Self-efficacy scale in Science Teaching”, with 23 items, originally developed by Enochs and Riggs (1990) was used (cited in: Denizzoğlu, 2008). Cronbach's alpha coefficient for the scale was 0.73.

2.3. Data Analysis

The data was analysed through SPSS software version 19.0. First, in order to determine whether the data was normally distributed, skewness and kurtosis values were computed. In addition, Levene’s test was used in determining homogeneity of variances. After the required assumptions were met, variance analysis (two-way ANOVA) was performed.

3. Findings
The statistics of pre-service teachers’ self-efficacy beliefs are given in Tables 1, 2 and 3. The results showed that regardless of varying values of grade level and gender, the overall mean value turns out to be 88.75. The highest possible score of measure was 115. In other words, pre-service science teachers’ self-efficacy beliefs of science teaching were rather high.

The calculated skewness and kurtosis values turned out to be between 1.0 and -1.0 and therefore it was assumed that the data satisfied the normality assumption with respect to grade level and gender. However, Levene’s test indicated that the assumption of homogeneity of variances has been met (F(3.110)=1.390; p=0.25).

As can be seen in Table 1, female and male pre-service teachers’ self-efficacy mean scores were 88.78 and 88.62, respectively. Standard deviation value of females was 7.65 and of males was 7.48.

| Gender | N  | Mean  | Std. Dev. |
|--------|----|-------|-----------|
| Female | 91 | 88.78 | 7.65      |
| Male   | 23 | 88.62 | 7.48      |
| Total  | 114| 88.75 | 7.79      |

It can be seen in Table 2 that while self-efficacy mean scores for the first year grade students were 88.78, for third year grade students they were 88.81. In addition, standard deviation value of freshmen and juniors was 9.10 and 6.91, respectively.

| Grade Level | N  | Mean  | Std. Dev. |
|-------------|----|-------|-----------|
| Freshmen    | 44 | 88.65 | 9.10      |
| Junior      | 70 | 88.81 | 6.91      |
| Total       | 114| 88.75 | 7.79      |

Two-way variance analysis was performed to determine whether there is any significant difference between pre-service science teachers’ self-efficacy beliefs scores in terms of gender and grade level. The results of analysis showed that there was no statistically significant difference in pre-service science teachers’ science teaching self-efficacy beliefs with respect to both gender and grade level. At the same time, no statistically significant interaction was observed between the variables (Table 3).

In terms of gender, the mean score for female pre-service teachers was 88.78, while for males it was 88.62. It can be clearly seen that mean scores of female and male pre-service teachers were similar.

| Source | Sum of squares | df | Mean square | F   | p     | Eta squared |
|--------|----------------|----|-------------|-----|-------|-------------|
| Grade level | 14.39         | 3  | 14.39       | 0.23| 0.63  | 0.002       |
| Gender  | 7.27           | 1  | 7.27        | 0.12| 0.73  | 0.001       |
| Grade level*gender | 21.63          | 1  | 21.63       | 0.35| 0.56  | 0.003*      |

When participants’ self-efficacy beliefs levels of science teaching were analyzed, it was seen that the mean score of freshmen (1st grade level) and juniors (3rd grade level) was 88.65 and 88.81, respectively. In other words, the average score of 1st grade students was close to average for 3rd grade level students. The results of variance analysis support this prediction.

### 4. Discussion and Conclusion

Teachers with high level self-efficacy beliefs is extremely important for a high quality education, because the level of self-efficacy beliefs may impact negatively or positively on teacher behaviors such as effort, giving feedback, choice of teaching methods and techniques, and tendency to use teaching material (Enochs & Riggs, 1990; Gibson & Dembo, 1984). For example, Allinder (1994) found that instructors who possess high teaching efficacy beliefs had a tendency to apply various teaching methods in their classroom. In the current study, it was found that pre-service science teachers’ self-efficacy beliefs were rather high (mean 88.75) in comparison to the maximum point total of 115.
The results of the study in which pre-service science teachers’ teaching efficacy beliefs was investigated with respect to some variables revealed that there were no gender differences between male and female participants in their self-efficacy beliefs of science teaching. Similar findings were also confirmed by some other researchers (Gerçek et al., 2006; Yaman et al., 2004). However, while it was found in some studies that male students have higher levels of self-efficacy than females (Morgil, Secken & Yücel, 2004; Cakiroglu & Isiksal, 2009; Riggs, 1991), the findings from some other studies were in favor of females (Yalcin, 2011).

In the current study, it was found that there was no statistically significant difference between pre-service teachers’ self-efficacy beliefs in terms of grade levels. A similar finding was also reported by Senemoglu et al., (2009). In a study by Aydin and Boz (2010), no statistically significant difference between freshmen and junior pre-service teachers’ self-efficacy scores was found. In contrast to these findings, some studies reported that self-efficacy beliefs increase with increasing grade level (Yaman et al., 2004). In particular, it was found that fourth year students’ scores on self-efficacy beliefs were higher than those of the first year students (Yalcin, 2011; Aydin & Boz, 2010). According to Aydin and Boz (2010), this situation may result from the teaching practice lessons taken in fourth grade.

Exploring and increasing teachers’ self-efficacy belief are important issues, as emphasized in studies so far published. Because instructors with high self-efficacy beliefs are open to innovations in teaching strategies and thus they play a critical role in enhancing the quality of training. For example, it was reported that teachers who possess high-level self-efficacy belief has an important influence on students’ achievement as well as on their motivation (Lewandowski, 2005; Woolfolk Hoy, 2000). Therefore it is important to explore the factors influencing self-efficacy belief of teachers, especially of pre-service teachers. For this purpose, many studies have been performed on both pre-service and in-service teachers for several years and various factors influencing their self-efficacy have been detected. For example, Schoon and Boone (1998) asserted that one of the causes of low self-efficacy among pre-service elementary teachers with regard to teaching science may be the holding of certain alternative conceptions of science. Thus the use of alternative teaching methods that will help eliminate misconceptions held by pre-service teachers may be an effective way in increasing their level of self-efficacy.

It is believed that the findings from this and similar studies may be useful for revision of the teacher training syllabus. In addition, it is hoped that the results of the study could shed light on future studies. However, due to budgetary and time constraints, the current study was limited to only 114 pre-service science teachers. It would therefore be beneficial to replicate this study on larger and different samples.

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