



# New Trends and Issues Proceedings on Humanities and Social Sciences



Issue 1 (2017) 265-272

ISSN 2421-8030

[www.prosoc.eu](http://www.prosoc.eu)

Selected paper of 8th World Conference on Educational Sciences (WCES-2016), 4-8, February 2016, University of Alcalá, Madrid, Spain

## Investigation of mental models for science teaching and primary school teacher candidates' self-efficacy beliefs

**Sibel Acisli<sup>a</sup>\*, Department of Elementary Education, Educational Faculty, Artvin Coruh University, Artvin 08000, Turkey.**

### Suggested Citation:

Acisli, S. (2017). Investigation of mental models for science teaching and primary school teacher candidates' self-efficacy beliefs. *New Trends and Issues Proceedings on Humanities and Social Sciences*. [Online]. 01, pp 265-272. Available from: [www.prosoc.eu](http://www.prosoc.eu)

Selection and peer review under responsibility of Jesus Garcia Laborda, University of Alcalá, Spain

©2017 SciencePark Research, Organization & Counseling. All rights reserved.

---

### Abstract

This study aims to explore mental models for science teaching and primary school teacher candidates' self-efficacy beliefs. The sample of this research study is composed of 108 students who are studying at the department of Primary School Teaching of Artvin Coruh University during the 2014-2015 academic year. Self-Efficacy Beliefs Inventory for Prospective Primary School Teachers in teaching science developed by Riggs and Enochs (1990) and adapted in Turkish by Bıkmaz (2002) and 'Science Teacher Illustration Form' (DASTT-C) developed by Thomas, Pedersen and Finson (2001) have been used as data collection tools. The data obtained were analyzed using SPSS. The obtained data were analyzed using, frequency, percentage, mean, standard deviation, t-test, correlation and one-way analysis of variance (ANOVA) in accordance with the purpose. Various differences in variables have been identified in self-efficacy beliefs of prospective primary school teachers for science teaching and mental models for teacher candidates' for science education were examined

Keywords: Primary school teacher candidates, self-efficacy, belief about science teaching.

---

\* ADDRESS FOR CORRESPONDENCE: **Sibel Acisli**, Department of Elementary Education, Educational Faculty, , Artvin Coruh University, Artvin 08000, Turkey.

E-mail address: [sacisli26@hotmail.com](mailto:sacisli26@hotmail.com) / Tel.: +0-466-215-1043

## 1. Introduction

Self-efficacy is one of the central concepts highlighted in Bandura's Social Learning Theory for the first time (Berkant & Ekici, 2007). According to Chaplain, (2000) and Zusho, and Pintrich, (2003), self-sufficiency is one of the factors helping students to be motivated to learn. Self-efficacy is defined as being aware of the abilities and believing in them to do a job (Cited by Altuncekic, Yaman and Koray, 2005).

One of the concepts associated with the concept of self-efficacy is the concept of self-efficacy beliefs of teachers. Teacher self-efficacy is the thoughts of the teachers believing that even students with learning difficulties and low motivation has the capacity that may affect their learning products (Tschannen-Moran & Woolfolk-Hoy, 2001). Teacher self-efficacy beliefs affect their efforts spent for teaching, level of professional goals and objectives created accordingly (Kucukyilmaz & Duban, 2006). Science teachers with high levels of self-efficacy are quite successful on using student-centered approaches, spending more time for teaching science and performing a research based teaching. Teachers with low level of self-efficacy choose to use teacher-centered approaches such as giving information by reading from books or teaching orally (Yaman, Cansungu Koray & Altuncekic, 2004).

In the literature, there are some studies tried to determine how self-efficacy beliefs of pre-service teachers were affected by various variables (Akbas & Celikkaleli, 2006; Avci, 2008; Ekinci Vural & Hamurcu, 2008; Gercek, Yilmaz, Koseoglu & Soran, 2006; Kahyaoglu & Yangin, 2007; Morgil et al. 2004; Saracaloglu & Yenice, 2009; Yaman, Cansungu Koray & Altuncekic, 2004)

Self-efficacy beliefs relating to the science, which is one of the particular areas of self-efficacy, can be defined as beliefs and judgments of teachers about their own abilities to perform science teaching more effectively and efficiently and increase achievement of their students (Avci, 2008). Pre-service teachers should be well-trained from first year until the last year of the college in terms of teaching profession and knowledge. In this context, it is possible to train qualified teachers in science teaching by determining their self-efficacy levels and presenting factors affecting this achievement (Yaman et al., 2004). Determination of these self-efficacies will shed light on practices in teacher training. Investigating science teaching self-efficacy of especially classroom teachers is needed to train pre-service teachers with high self-efficacy for teaching science (Avci, 2008).

The purpose of this study is to determine the relationship between science teaching self-efficacy beliefs of prospective classroom teachers and their mental models for science teaching and the following questions are tried to be answered for this purpose. The sub-problems of the research were defined as follows:

1. Is there a significant difference between science teaching self-efficacy beliefs of prospective classroom teachers according to their gender?
2. Is there a significant difference between science teaching self-efficacy beliefs of prospective classroom teachers according to their level of grade?
3. Is there a significant difference between science teaching self-efficacy beliefs of prospective classroom teachers according to their age?
4. Is there a significant difference between perceptions of prospective classroom teachers towards teaching science by using their own drawings depending on their gender?
5. Is there a significant difference between perceptions of prospective classroom teachers towards teaching science by using their own drawings depending on the type of high school they graduated from?
6. Is there a significant difference between perceptions of prospective classroom teachers towards teaching science by using their own drawings depending on their level of grade?

7. Is there a significant difference between perceptions of prospective classroom teachers towards teaching science by using their own drawings depending on their age?

8. Is there a significant relationship between science teaching self-efficacy beliefs and perceptions of prospective classroom teachers towards teaching science by using their own drawings?

## **2. Method**

In this study, relational screening model, which is one of the general screening models, was used. Screening models aim to describe a past or present situation as it is. The subject of the research is tried to be described as it is. No effort is spent to modify or change the events, objects or individuals considered as the subject of the research" (Karasar, 2009).

### **2.1. Participants**

This study was conducted with a total of 96 students studying at Artvin Coruh University Department of Primary Teaching in the academic year of 2014-2015. 62 of the students participated in the study were female, while the remaining 34 students are male, respectively.

### **2.2. Research instrument and procedure**

In this study, "Self-efficacy beliefs of prospective classroom teachers towards teaching science scale" was used to determine self-efficacy beliefs of prospective classroom teachers towards teaching science. This scale was developed by Riggs and Enochs (1990) and its adaptation to Turkish and reliability studies were conducted by Bikmaz (2002). In this Likert-type measurement tool consists of 21 items, there are two sub-factors as "self-efficacy belief in teaching science" and "outcome expectancy in science teaching". Self-efficacy belief in teaching science factor was developed with 12 items (2,3,5,6,8,12,17,18,19,20,21,23), whereas outcome expectancy in science teaching factor was developed with 9 factors (1,4,7,9,10,11,14,15,16), respectively. The reliability coefficient was calculated as 0.89 for self-efficacy belief in teaching science factor and 0.69 for outcome expectancy factor and 0.85 for the entire scale, respectively (Bikmaz, 2002). In the study, "Draw a science teacher test" developed by Pedersen and Finson (2001) was used to determine the images of science teachers.

### **2.3. Data analysis**

The obtained data were analyzed using SPSS. The data obtained was analyzed by using frequency, percentage, mean, standard deviation, t-test, correlation and one-way analysis of variance (ANOVA) in accordance with the purpose of the study. Multiple regression analysis was used to determine to see whether perceptions of prospective classroom teachers towards teaching science is predicted by subscales of Self-Efficacy Beliefs of Prospective Science Teachers in Science Teaching scale (self-efficacy belief in teaching science and outcome expectancy in science teaching).

## **3. Results**

In this section, statistical operations were performed on findings obtained from the data collection instruments used in the study and results are given in the tables.

Independent t-test analysis was used to see whether self-efficacy beliefs and outcome expectancy of prospective teachers in science teaching subscales and their DASTT-C scores are differentiated depending on their gender. Analysis results are shown in Table 1.

**Table 1. T-test results of self-efficacy beliefs in science teaching and DASTT-C scores according to the gender**

	Gender	N	Mean	Ss	t	p
Personal science teaching efficacy belief	Female	62	41,71	7,05	-	0
	Male	34	43,71	7,57	1,29	,20
Science teaching outcome expectancy	Female	62	34,10	4,62	-	0
	Male	34	34,53	4,19	0,45	,65
DASTT-C	Female	62	6,10	3,51		0
	Male	34	5,94	3,68	0,20	,84

Considering the data given in Table 1, there is no significant difference between self-efficacy beliefs and outcome expectancy of prospective teachers in science teaching subscales and DASTT-C scores according to the gender ( $p > 0.05$ ).

Independent t-test analysis was used to see whether self-efficacy beliefs and outcome expectancy of prospective teachers in science teaching subscales and their DASTT-C scores are differentiated depending on the type of high school they have graduated. Analysis results are shown in Table 2.

**Table 2. t-test results of self-efficacy beliefs in science teaching and DASTT-C scores according to the type of high school graduated**

	High school types	N	Mean	Ss	t	p
Personal science teaching efficacy belief	General High School	67	42,72	7,53		
	Anatolian High School	29	41,72	6,68	0,61	0,54
Science teaching outcome expectancy	General High School	67	34,13	4,63		
	Anatolian High School	29	34,52	4,09	-0,39	0,70
DASTT-C	General High School	67	6,10	3,79		
	Anatolian High School	29	5,90	2,99	0,26	0,79

Considering the data given in Table 2, there is no significant difference between self-efficacy beliefs and outcome expectancy of prospective teachers in science teaching subscales and DASTT-C scores according to the type of high school graduated ( $p > 0.05$ ).

One Way ANOVA analysis was performed to see whether self-efficacy beliefs and outcome expectancy of prospective teachers in science teaching subscales and their DASTT-C scores are differentiated depending on the level of grade. Analysis results are shown in Table 3.

**Table 3. ANOVA results of self-efficacy beliefs in science teaching and DASTT-C scores according to the level of grade**

	Source of variance	Sum of squares	Sd	Mean square	F	p	Sd
Personal science teaching efficacy belief	Between Groups	1993,83	2	996,92			
	Between Groups	3017,50	93	32,45	30,73	0,00	2-3 and 2-4
	Total	5011,33	95				
Science teaching outcome expectancy	Between Groups	62,70	2	31,35			
	Between Groups	1819,30	93	19,56	1,60	0,21	
	Total	1882,00	95				

DASTT-C	Between Groups	61,99	2	30,99		
	Between Groups	1135,85	93	12,21	2,54	0,09
	Total	1197,83	95			

As it can be seen in Table 3, there is a significant difference between self-efficacy beliefs in science teaching subscale scores of the prospective teachers  $F_{(2-95)}= 30.73$ ;  $p<0.05$ ]. According to the results of Scheffe Test performed to determine these groups, the average score of 2<sup>nd</sup> grade students ( $\bar{x}=35.07$ ) was found to be lower than average scores of 3<sup>rd</sup> ( $\bar{x}=43.89$ ) and 4<sup>th</sup> ( $\bar{x}=43.89$ ), grade students. No significant difference was found between averages scores of other variables by the level of grade ( $p>0.05$ ).

One Way ANOVA analysis was used to see whether self-efficacy beliefs and outcome expectancy of prospective teachers in science teaching subscales and their DASTT-C scores are differentiated depending their age. Analysis results are shown in Table 4.

**Table 4. One Way ANOVA results of self-efficacy beliefs in science teaching and DASTT-C scores according to the age variable**

	Source of variance	Sum of squares	Sd	Mean square	F	p	Sd
Personal science teaching efficacy belief	Between Groups	662,73	2,00	331,36	7,09	0,00	19-20 aged and 23- and older
	Within Groups	4348,61	93,00	46,76			
	Total	5011,33	95,00				
Science teaching outcome expectancy	Between Groups	102,45	2,00	51,22	2,68	0,07	-
	Within Groups	1779,55	93,00	19,14			
	Total	1882,00	95,00				
DASTT-C	Between Groups	58,74	2,00	29,37	2,40	0,10	-
	Within Groups	1139,09	93,00	12,25			
	Total	1197,83	95,00				

As it can be seen in Table 4, there is a significant difference between self-efficacy beliefs in science teaching subscale scores of the prospective teachers [ $F_{(2-95)}= 7.09$ ;  $p<0.05$ ]. According to the results of Scheffe Test performed to determine these groups, the average score of the students aged 19-20 ( $\bar{x}=36.47$ ) was found to be lower than the average scores of the students aged 21-22 ( $\bar{x}=43.00$ ) and those aged 23 and older ( $\bar{x}=44.31$ ). No significant difference was found between averages scores of other variables by the age variable ( $p>0.05$ ).

Regression analysis was used to see whether DASTT-C scores of prospective teachers predict their self-efficacy beliefs and outcome expectancy in science teaching subscales. Analysis results are given in Table 5.

**Table 5. Regression analysis results of self-efficacy beliefs in science teaching and DASTT-C scores**

Dependent variable	independent variable	B	Std. Err.	Beta	t	Sig.	
Personal science teaching efficacy belief	(Constant)	46,183	1,406		32,842	0,000	R =0,305 R <sup>2</sup> =0,09
	DASTT-C	-0,623	0,201	-0,305	-3,102	0,003	F =9,62 P =0,03
Science teaching outcome expectancy	(Constant)	34,729	0,903		38,46	0,000	R =0,063 R <sup>2</sup> =0,004
	DASTT-C	-0,079	0,129	-0,063	-0,615	0,570	F =0,378 p =0,54

Considering the analysis results, DASTT-C scores are found to be significant predictors of self-efficacy beliefs in science teaching subscale ( $R=0.305$ ,  $R^2=0.09$  and  $p<.00$ ). Thus, DASTT-C scores of prospective teachers decrease as their scores received from self-efficacy beliefs in science teaching subscale increase.

However, DASTT-C scores don't significantly predict outcome expectancy subscale scores of prospective teachers in science teaching ( $R=0.06$ ,  $R^2=0.00$  and  $p>0.05$ ).

#### Conclusions and Recommendations

T-test was used for unrelated samples to determine whether there is a significant difference between self-efficacy beliefs of prospective classroom teachers in science teaching by their genders. According to the results, no significant difference was found between self-efficacy beliefs ( $p=0.20$ ) and outcome expectancy ( $p=0.65$ ) subscales of prospective teachers by their gender differences. Accordingly, we can suggest that gender is not an important variable in the science teaching. This conclusion is consistent with the results of some studies in the literature (Yaman, Cansungu Koray and Altuncekic, 2004; Altuncekic, Yaman and Koray, 2005; Avci, 2008; Saracaloglu and Yenice, 2009), while it conflicts with some other studies (Akbas and Celikkaleli, 2006; Yalcin, 2011; Uredi and Uredi, 2006; Hamurcu, 2006).

According to the t-test results performed for unrelated samples to determine whether there is a significant difference between self-efficacy beliefs of prospective classroom teachers in science teaching by the type of the high school graduated; no significant difference was found between self-efficacy beliefs ( $p=0.54$ ) and outcome expectancy ( $p=0.70$ ) subscales of prospective teachers by the type of high school they have graduated from. This result is consistent with the results of the studies in the literature (Yaman et al., 2004; Avci, 2008; Altuncekic, Yaman and Koray, 2005).

According to the ANOVA results performed to determine whether there is a significant difference between self-efficacy beliefs of prospective classroom teachers in science teaching by their level of grade; there is a significant difference between self-efficacy beliefs in science teaching subscale scores of the prospective teachers  $F_{(2-95)}= 30.73$ ;  $p<0.05$ ]. According to the results of Scheffe Test performed to determine these groups, the average score of 2<sup>nd</sup> grade students ( $\bar{x}=35.07$ ) was found to be lower than average scores of 3<sup>rd</sup> ( $\bar{x}=43.89$ ) and 4<sup>th</sup> ( $\bar{x}=43.89$ ), grade students. The increased self-efficacy beliefs of prospective classroom teachers by their level of grade can be explained by increased self-confidence as they become more educated in science. This result is consistent with the results of some studies in the literature (Altuncekic, Yaman & Koray, 2005; Ambusaidi & Al-Balushi 2012; Ekinci Vural & Hamurcu, 2008; Feyzioglu, Feyzioglu and Kucukcingi, 2014; Yalcin, 2011; Yaman et al., 2004). No significant difference was found between outcome expectancies of the students by their level of grade ( $p=0.21$ ).

There is a significant difference between self-efficacy beliefs in science teaching subscale scores of the prospective teachers [ $F_{(2-95)}= 7.09$ ;  $p<0.05$ ]. According to the results of Scheffe Test performed to

determine these groups, the average score of the students aged 19-20 ( $\bar{x}=36.47$ ) was found to be lower than the average scores of the students aged 21-22 ( $\bar{x}=43.00$ ) and those aged 23 and older ( $\bar{x}=44.31$ ). In addition, no significant difference was found between outcome expectancy scores of prospective classroom teachers by their age ( $p = 0.07$ ).

The data obtained from the study was analyzed to determine whether there is a significant difference between perceptions of prospective teachers towards teaching science from their own drawings by their gender ( $p=0.84$ ), between perceptions of prospective teachers towards teaching science from their own drawings by the type of high school graduated ( $p=0.79$ ) and perceptions of prospective teachers towards teaching science from their own drawings by their level of grade ( $p=0.09$ ), respectively. According to the analysis of the data obtained, there is no significant difference between perceptions ( $p=0.1$ ) of prospective teachers towards teaching science from their own drawings by their age.

A significant relationship was found between DASTT-C scores of prospective teachers and their self-efficacy beliefs subscale in science teaching ( $R=0.305$ ,  $R^2=0.09$  and  $p<.00$ ). Thus, DASTT-C scores of prospective teachers decrease as their scores received from self-efficacy beliefs in science teaching subscale increase. However, no significant relationship was found between DASTT-C scores and outcome expectancy of prospective classroom teachers ( $R=0.06$ ,  $R^2=0.00$  and  $p>.05$ ). This result conflicts with the study of Feyzioglu et al. (2014) in the literature.

In line with the results obtained from the study, the importance of investigating science teaching beliefs of prospective classroom teachers has emerged and it is suggested to conduct studies to improve their self-efficacy beliefs.

## References

- Akbas, A. & Celikkaleli, O. (2006). Sınıf ogretmeni adaylarının fen ogretimi oz-yeterlik inanclarinin cinsiyet, ogrenim turu ve universitelerine gore incelenmesi. *Mersin Universitesi Egitim Fakultesi Dergisi*, 2(1), 98-110.
- Altuncelik, A., Yaman, ve Koray, O. (2005). Ogretmen adaylarının oz-yeterlik inanc duzeyleri ve problem cozme becerileri uzerine bir arastirma (Kastamonu Ili Ornegi), *Kastamonu Egitim Dergisi*, 13(1), 93-102.
- Ambusaidi, A. K. & Al-Balushi, S. M. (2012). A Longitudinal Study to Identify Prospective Science Teachers' Beliefs about Science Teaching Using the Draw-a-Science-Teacher-Test Checklist. *International Journal of Environmental and Science Education*, 7(2), 291-311.
- Avci, A. (2008). Sınıf ogretmenligi ogrencilerinin kendi cizimlerinden fen dersi ogretmenine yonelik algıları ile fen ogretimi oz yeterlik inancları arasındaki iliski. Ege Universitesi, Sosyal Bilimler Enstitusu, Y.L. Tezi.
- Ekinci Vural, D. & Hamurcu, H. (2008). Okul oncesi ogretmen adaylarının fen ogretimi dersine yonelik oz-yeterlik inancları ve gorusleri. *İlkogretim Online*, 7(2), 456-467.
- F, A. G. H. G., & Ekici, G. (2007). Sınıf ogretmeni adaylarının fen ogretiminde ogretmen oz yeterlik inanc duzeyleri ile zeka turleri arasındaki iliskinin degerlendirilmesi. *Cukurova Universitesi Sosyal Bilimler Enstitusu Dergisi*, 16(1).
- Feyzioglu, E. Y., Feyzioglu, B. & Kucukcingi, A. (2014). Fen bilgisi ogretmen adaylarının fen ogretimine yonelik zihinsel modelleri, oz yeterlik inancları ve ogrenme yaklasımları. *Ondokuz Mayıs Universitesi Egitim Fakultesi Dergisi*, 33(2), 404-423.
- Hamurcu, H. (2006). Sınıf ogretmeni adaylarının fen ogretimine yonelik oz yeterlik inancları. *Eurasian Journal of Educational Research (EJER)*, Issue 24, p112-122.
- Saracaloglu, A.S. & Yenice, N. (2009). Fen bilgisi ve sınıf ogretmenlerinin oz yeterlik inanclarının bazı degiskenler acısından incelenmesi. *Egitimde Kuram Ve Uygulama*, 5 (2), 244-260.
- Uredi, I. & Uredi L. (2006). Sınıf ogretmeni adaylarının cinsiyetlerine, buldukları sınıflara ve basarı duzeylerine gore fen ogretimine iliskin oz-yeterlik inanclarının karsılastırılması, *Yeditepe Universitesi Egitim Fakultesi Dergisi*. 1(2)



Acisli, S. (2017). Investigation of mental models for science teaching and primary school teacher candidates' self-efficacy beliefs. *New Trends and Issues Proceedings on Humanities and Social Sciences*. [Online]. 01, pp 265-272. Available from: [www.prosoc.eu](http://www.prosoc.eu)

Yalcin, A.F. (2011). Investigation of science teacher candidates' self-efficacy beliefs of science teaching with respect to some variables. *International Online Journal of Educational Sciences*, 3(3), 1046-1063.

Yaman, S., Cansungu Koray O. & Altuncekcic, A. (2004). Fen bilgisi ogretmen adaylarının oz-yeterlik inanc duzeylerini incelenmesi uzerine bir arastırma. *Turk Egitim Bilimleri Dergisi*, 2(3), 355-366.