

Comparison of the Chemistry Learning Motivations of the Science and Primary School Teacher Candidates

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ABSTRACT The aim of this study is to compare the chemistry learning motivations of the science and primary school teacher candidates. Participants of the study are composed of 98 science teacher candidates (71 female and 27 male) and 62 primary school teacher candidates (44 female and 18 male) studying at the departments of Science and Elementary teaching of the Education Faculty at Pamukkale University in the Spring Semester of the academic year 2012/2013. Totally, 160 Science and primary school teacher candidates studying at the first grade participated in the study. Chemistry Motivation Questionnaire (CMQ) composed of 22 five-point likert type scale questions were applied to the participants. Cronbach's alpha internal consistency coefficient of the Chemistry Motivation Questionnaire was found to be 0.86. Gathered data was analyzed by using SPSS-15 software program. The results of the study showed meaningful differences between intrinsic motivation levels, personal appropriateness, self-determination and self-ability, extrinsic motivation and sub-dimension motivation levels of science and primary school teacher candidates. Motivations of Science teacher candidates were found to be higher than primary school teacher candidates in terms of these three sub-dimensions of motivation. However, anxiety level of being evaluated wasn't found to be significant. While the results of CMQ based on the item of gender variety did not show significant differences in terms of participants' intrinsic motivation, personal appropriateness, self determination and extrinsic motivation levels, the anxiety level of being evaluated was found to be significant and this difference was in favour of male candidates. (Anxiety level of males was found to be lower than female candidates). According to the gender difference variety, there wasn't found to be significant difference among primary school teacher candidates.

INTRODUCTION

Natural Science is a science that includes activities as examination, research, digest and understand the things in our lives. With the help of natural sciences people try to gain the information and abilities that will help them to adapt to the nature and environment they are living in and thus people can receive some certain comfort and eases (Cohen et al. 2007; Soylu 2004). To illustrate, with the help of science developing countries and communities invent instruments and materials as computers for better communication, information sharing or even for shopping and they also invent technological devices as planes, automobiles, trains that make our lives much easier and quicker (Topsakal 2006). Science provides us with opportunities to investigate the biological, chemical and physical structures of the incidents and events in and out of the earth. Students participate in community life with science education. When such facts are considered, learning, teaching and understanding science becomes more essential (Gokce 2009; Ozdemir 2011; Taylor 2003; Cook and Quigley 2013). According to Kaptan, sci-

ence can be defined as predetermination studies about the incidents and events that haven't been investigated, researched, understood or observed, yet. In Turkey, there are some problems in terms of teaching, learning and understanding the Science subjects. In order to solve these problems, it is necessary to develop and utilize appropriate alternative techniques, methods and strategies for individuals' understanding abilities, taking individual differences into consideration (Kaptan 1999). Motivation has an important role in increasing the students' successes in education. It becomes even more important for the lessons that include difficult and abstract subjects and notions, which are difficult to teach and learn (Eren 1998; Guzel 2011).

Intrinsic motivations of gifted and skilled individuals are particularly high. Therefore, providing appropriate education to individuals based on their needs is necessary not only for the country and the community they are living in but also for the whole world (Kanli and Emir 2009). According to Tuan et al. (2005), students' interests, needs, task perceptions as well as their success and failures affect their motivations

(Tuan et al. 2005; Transfer Uzun and Keles 2010). In order for the primary school teachers to raise appropriate individuals for the determined targets, their learning motivations are also essential, as well as their knowledge of the field (Karaman and Emrahoglu 2011). Science and Primary School teachers have very important place in increasing students' motivations in learning chemistry. It is very important for these teachers to find out students' feelings and their individual proper learning styles during the learning process (Glynn and Koballa 2006, Glynn et al. 2009).

Motivation is a driving force pushing the individual to act and it is a process that initiates, leads and sustains this spiritual and/or physical action in order to reach a certain goal or an object. In other words, performing behaviors of individuals due to their needs and impulses for a certain goal is called motivation. (Budak 2000). Students perform their actions based on intrinsic and extrinsic motivations. For example, while carrying out a project students might enjoy themselves and they can approach to the project from different aspects. Moreover, their enthusiasm and willingness might even get higher along with the idea of having promotion and getting awarded. While having a job, proceeding their job, making good money and being appreciated are external factors that effect the students, willing to understand the real world, to have a better life and to be a good citizen are considered to be internal factors (Glynn and Koballa 2006). Motivational beliefs consist of items such as goal orientation, test anxiety, and perception of self-efficacy of individuals. Motivational variables interact with behavioral, and cognitive factors (Ocak and Yamaç 2013). Motivation is can be referred to the way urges aspirations, need of human beings control and directs their behavior (Oredein and Awodun 2013).

Since motivation changes from person to person, motivating students with different individual characteristics in the teaching and learning process shows significant differences. When these differences are considered, motivation becomes an important variable in the teaching and learning process. Teaching approaches effect students' learning motivations (Sharma et al. 2013). Motivation can be integrated with the lessons proceeded with various teaching and learning approaches and strategies. Possible environments in which they might experience their success and failures, put their values conform to

their abilities, which stimulate and urge their wonders might affect their motivations during their education process (Unsal 2012). Students show differences in terms of their parents' educational situations, their genders and their social and economical status, which might also affect their motivation level in learning science (Uzun and Keles 2010).

The Purpose of the Study

As Science and primary school teacher candidates, students need to have high motivation not only in learning science but they also need to be highly motivated in teaching process (Cakmak 2008; Munby and Russel 2003). Therefore, the study aimed to investigate the Chemistry learning motivation levels of the Science and primary school teacher candidates. The research question of the study is: "is there a meaningful difference between the chemistry learning motivation levels of the science and primary school teacher candidates based on their departments and gender differences?"

Sub – research questions of the study are:

"Is there a meaningful difference between the chemistry motivation levels of the science and primary school teacher candidates?"

"Is there a meaningful difference between the chemistry motivation levels of the science teacher candidates according to their gender differences?"

"Is there a meaningful difference between the chemistry motivation levels of the primary school teacher candidates according to their gender differences?"

MATERIAL AND METHODS

In the study, since the purpose of the study is to define the current situation and accordingly to find out the differences based on the departmental and gender variables, descriptive research model was used. The screening model is based on reflecting the existing situation as it is. This model includes screening arrangements carried out on a group, sample group or whole universe in order to draw conclusion about the universe composed of a good many of elements (Karasar 1994; Balci 2004). A statistical evaluation of the gathered quantitative data through questionnaires was used to draw general conclusions. 160 (female: 115, male: 45) science and

primary school teacher candidates studying in the departments of Science and Elementary teaching of the Education Faculty at Pamukkale University in the Spring Semester of the academic year 2012/2013 participated in the study. 98 science teacher candidates (71 female and 27 male) and 62 primary school teacher candidates (44 female and 18 male) participated in the study.

Data Collection Tools

Science Motivation Questionnaire (SMQ) developed by Glynn and Koballa (2006) and Glynn et al. (2009) was translated into Turkish and adapted as "Chemistry Motivation Questionnaire" (CMQ) by İlhan et al. (2012) and Cronbach Alpha reliability coefficient was found to be 0.82. There are four sub-divisions of CMQ. These are:

Intrinsic Motivation and Personal Convenience: This factor includes 9 items all of which are related to intrinsic motivation (1, 12, 16 and 22) and personal convenience (2, 9, 14, 17 and 19)

Evaluation Anxiety: This factor includes 4 negative words (4, 5, 10 and 13). These items aimed to measure candidates' anxiety levels through CMQ.

Self-determination and Self-efficacy: This factor includes 6 items, which are about the dimensions of self-determination (7, 8 and 20) and self-efficacy (15, 18 and 21).

Extrinsic Motivation: This factor includes the items 3, 6, and 11.

The items (4, 5, 10 and 13) used to determine the evaluation anxiety in the CMQ were composed of negative statements. The evaluation of these negative items was conducted by reversing the points (5 points instead of 1) (İlhan et al. 2012). Pilot study of the CMQ was applied to 98

Science teacher candidates and 62 Primary school teacher candidates studying at the departments of Science and Primary School Teaching at the Education Faculty of Pamukkale University. Cronbach Alpha reliability Coefficient was found to be 0.86.

Data Analysis

The teacher candidates were given 5 different choices of selection in the survey. Items were scored on a five point likert type scale (5= always, 4=usually, 3= sometimes, 2=rarely, 1= never). The data gathered through the survey was analyzed by using SPSS 15 software program. The *independent t-test analysis* was used to compare the statistical significance of the difference between the average points of the two groups.

FINDINGS

In this section of the study, the findings and the interpretation of the findings obtained as a result of the analysis of the collected data are presented. While analyzing the data gathered from the CMQ, the participants' gender and departmental differences was compared.

Findings for the First Sub-problem

As stated above, the first sub-problem was to find out if there is a significant difference between chemistry motivation levels of the science and primary school teacher candidates.

In Table 1, the t-test results of the survey about the Chemistry motivation levels of the teacher candidates based on their departments are presented. Statistically, a significant difference between the motivation levels of the candi-

Table 1: Chemistry motivation levels of the science and primary school teacher candidates

Sub-Dimension	Department	N	x	ss	t	p
Intrinsic motivation and personal convenience	Science	98	3.64	0.71	2.84	0.00
	Primary School	62	3.27	0.97		
Evaluation anxiety	Science	98	2.76	0.84	0.21	0.21
	Primary School	62	2.73	0.95		
Self-determination and Self efficacy	Science	98	3.71	0.73	3.54	0.00
	Primary School	62	3.23	1.01		
Extrinsic motivation	Science	98	4.15	0.65	2.14	0.02
	Primary School	62	3.89	0.84		

p<0.05 (significance level)

dates was found in terms of their intrinsic motivation and personal convenience, self-determination and self-efficacy according to the results of CMQ ($p < 0.05$). However, there was not found statistically significant difference ($p > 0.05$) between two groups in terms of their anxiety levels.

Findings of the Second Sub-question

As stated before, second sub-question of the study was to determine "if there is a meaningful difference between the chemistry motivation levels of the science teacher candidates according to their gender differences".

As can be seen in the Table 2, there is a statistically significant difference among the science teacher candidates in terms of their evaluation anxiety levels based on their gender differences.

Table 3 shows that there is not a statistically significant difference among primary school teacher candidates in terms of their gender differences according to the results of the CMQ.

DISCUSSION

According to the results of the CMQ, the study have indicated that there is a significant difference between Science and Primary school

teacher candidates on the items about their intrinsic motivation levels and personal conveniences ($p < 0.05$). A motivation level of Science teacher candidates ($x = 3.64$) was found to be higher than those of primary school teacher candidates ($x = 3.27$). It was also found that there is a meaningful difference between Science and Primary school teacher candidates on the items of CMQ about self-determination and self-efficacy ($p < 0.05$). While the chemistry motivation levels of Science teacher candidates was found to be $X = 3.71$, it was $x = 3.23$ for the primary school teacher candidates. The results of the CMQ showed that there is a meaningful difference between Science and primary school teacher candidates in terms of their extrinsic motivation levels ($p < 0.05$). A motivation level of Science teacher candidates ($x = 4.15$) for this item was found to be higher than those of primary school teacher candidates ($x = 3.89$). There might be some certain factors that lead to receive such results. Because of the fact that Science teacher candidates choose to study in the field of science when they are at high school, their motivation, desire and interest in learning chemistry is higher. In addition, due to the requirements of their department at the universities, they study Chemistry more intensely and comprehensively than Primary school teacher candidates. And this, natu-

Table 2: Chemistry motivation levels of the science teacher candidates based on their gender differences

Sub-dimension	Department	N	$\bar{x}$	ss	t	p
Intrinsic motivation and personal convenience	Female	71	3.72	0.74	1.90	0.26
	Male	27	3.42	0.60		
Evaluation anxiety	Female	71	2.68	0.90	-1.61	0.01
	Male	27	2.98	0.62		
Self-determination and self efficacy	Female	71	3.79	0.75	1.70	0.28
	Male	27	3.51	0.64		
Extrinsic motivation	Female	71	4.27	0.60	3.14	0.65
	Male	27	3.83	0.66		

p < 0.05 (significance)

Table 3: Chemistry motivation levels of primary school teacher candidates according to their gender

Sub-Dimension	Department	N	$\bar{x}$	ss	t	p
Intrinsic motivation and personal convenience	Female	44	3.27	0.97	0.06	0.83
	Male	18	3.25	0.99		
Evaluation anxiety	Female	44	2.73	0.89	-0.03	0.19
	Male	18	2.74	1.10		
Self-determination and self efficacy	Female	44	3.22	0.10	-0.12	0.85
	Male	18	3.25	1.07		
Extrinsic motivation	Female	44	3.94	0.88	0.68	0.65
	Male	18	3.78	0.75		

p < 0.05 (significance level)

rally, makes their interests and desires; namely, their motivation levels in learning chemistry become higher. On the other hand, there has not been found meaningful difference among the participants about their evaluation anxiety levels between the Science and primary school teacher candidates according to the results of the CMQ. That is, a motivation level of the two groups for this item was found to be similar to each other. Among the reasons that decrease the students' motivations might be lack of experiments and activities, insufficient background knowledge and inappropriate teaching methods and techniques that the teachers used (Bayrakci and Demirbas 2011). While there was not found a significant difference among science teacher candidates in terms of their intrinsic motivation and personal convenience, self determination, self efficacy and extrinsic motivation based on the gender variable, a significant difference was found about the evaluation anxiety and motivation levels of the male candidates was found to be higher than female candidates. However, according to gender variable in the CMQ, there was not found significant difference among primary school teacher candidates on the items about their intrinsic motivation and personal convenience, self determination, self efficacy and extrinsic motivation. Considering these results, it can be concluded that gender differences do not have much effect on the chemistry learning motivation level of the participants. Teacher candidates need to carry out different activities to increase the students' motivations by seeking out answers to the questions as: "How do the students learn subjects of science best? How do they feel and why do they get bored and become less interested when studying these subjects?" (Glynn and Koballa 2006). According to a study carried out by Uzun and Keles (2010) on 531 primary school children from 6th, 7th and 8th grades, at eleven primary schools located in the city center, Aksaray, it was found that there was not a significant difference between motivation levels of the students based on gender variable (Uzun and Keles 2010). It is essential to train teacher candidates who will teach in such an important field of study as Science. Recognition of students' motivations is quite important in terms of both motivating and letting them take their own responsibilities (Ilhan et al. 2012). According to Geban and Eimur (2011), Chemistry Teacher candidates' motivations, particularly their intrinsic

motivations, have positive impact on their academic successes (Geban and Eimur 2011). Teaching methods and techniques can also play important role in increasing students' motivation. For example, according to Tosun and Taskesenligil (2012), problem based learning (PBL) method had a positive effect on sub-dimensions of motivation such as goal orientation of motivational beliefs, subject value and self-efficacy (Tosun and Taskesenligil 2012). In order to let the students or teacher candidates be successful in the science subjects, it is necessary to increase their interest and desire, namely their motivation, in the field. And it is only possible by application of alternative strategies, methods and techniques, being aware of their readiness level, needs, attitudes and their ability to learn Science. In addition, education environment (in terms of physical structure of the classroom environment and the materials to be used in the class) should be designed appropriately to increase their motivation. It is also significant that the science and primary teachers, who will teach science, must be highly motivated in the field of science.

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