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Preservice teachers' motivations for choosing science teaching as a career and their epistemological beliefs: Is there a relationship?

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ABSTRACT

The purpose of this research is to investigate motivations behind pre-service teachers' science teaching career choice by adopting a relatively new approach. Apart from uncovering the motivations behind the teaching career choice, we have also determined epistemological beliefs that are potentially relevant to these motivations. Our sample included 393 first year pre-service science teachers (PSTs) in a Turkish context. We administered questionnaires about epistemological beliefs and motivations for choosing science teaching. The results show that social utility values and job security are the top motivations. In addition, epistemological beliefs, particularly beliefs in omniscient authority and innate learning, predict particular motivations.

Key Words: Motivations for Choosing Teaching, Epistemological Beliefs, Science Teaching, Turkey.

INTRODUCTION

Currently, many countries worldwide are trying to develop new science education policies to join the global economic competition by raising a talented workforce in science-based areas (Osborne & Dillon, 2008). However, the trends in career choice show that current school students do not necessarily choose science-based jobs. This trend indicates that the economic development of many countries may experience a crisis in the near future (OECD, 2006).

The pedagogy of science is a fundamental reason for the lack of interest in science-based areas (EC, 2007). Many students struggle to relate science to daily life. These students often try to memorize scientific concepts without further reasoning due to the traditional science teaching methods, which are based on the items in national examinations and the teacher's authority (EC, 2007). Therefore, policy makers and researchers have directed their attention toward the quantity and the quality of science teachers, who are the main factor in any educational reform (Harris & Farrel, 2007). In terms of quantity, many countries such as the US, UK and Australia are experiencing science teacher shortages (Watt & Richardson, 2007). A survey of urban school districts in the US indicated that 95 % of the responding districts had an immediate demand for high school science and math teachers (Urban Teacher

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Collaborative, 2000). The problem with teacher supply is also likely to be exacerbated by the aging profile of science teachers. In Norway, for example, half of the physics teachers are over 57, and a similar situation exists in Denmark, England and the Netherlands (Osborne & Dillon, 2008). Teacher retention is another crucial aspect to maintaining quantity. Harris and Farrel (2007) note that there is a high level of uncertainty among younger and early-career science teachers in Australia whether to remain in the teaching profession.

The quality of science teachers is also crucial for the pedagogy of science, considering the significant relationship between teacher quality and the students' engagement with science (Lawrence et al., 2006). At this point, three interrelated questions are particularly important: 'Who chooses science teaching?' 'How are science teachers educated?' and 'What do science teachers do in real classrooms?' We conceived of the present study to answer the first question. We believe that answering this question will not only provide reliable information about the quality of science teaching but also about the quantity of future science teachers in any country. In terms of quality, we are aware that having a strong motivation to choose teaching is crucial for the development of high teaching efficacy, strong pedagogical knowledge and good teaching practices (König & Rothland, 2012; Ramey-Gassert, Shroyer & Staver, 1996). In terms of quantity, we know that particular factors such as the intrinsic value of the career and the social utility values are important motivations because those who choose to teach with these motivations persist in teaching and do not change their careers (Watt & Richardson, 2008).

To better understand the motivations behind science teaching, we use another psychometric factor, epistemological beliefs, which are potentially relevant to career choice (Buehl, Alexander & Murphy, 2002). These beliefs relate to the nature of knowledge and are developed over the long term through the effects of education and the culture (Hofer, 2001). We know that people develop conceptions of learning and teaching based on their epistemological beliefs (Hofer & Pintrich, 1997). They then use these beliefs to evaluate evidence and make decisions about ill-structured problems (King & Kitchener, 1994). Considering the choice of a teaching career is an ill-structured problem (Watt & Richardson, 2012); we consider that those who choose science teaching may evaluate the knowledge and evidence regarding the teaching profession using knowledge beliefs that were developed for long term schooling. In other words, particular epistemological beliefs may lead to particular reasons and motivations for choosing teaching.

Finally, in a Turkish context, we study to see the influences of context specific factors on a science teaching career choice. Turkey has ambitious plans including joining the list of the top 10 economically strongest countries by 2023. Therefore, Turkey is trying to enhance its developing economy by investing money into new scientific technologies; in turn, this means that many new job opportunities will be created in science-based jobs such as engineering. At this point, science teachers are a particularly important need, to raise a generation who will be interested in science and fill workforce vacancies. Unlike many other countries, Turkey is not experiencing either a science teacher shortage or retention problems. Rather, there is limited space in state schools, even though there are many science teacher candidates who are waiting to become a teacher (Kilinc et al., 2012). For instance, in 2012, there were 16,547 applicants to become a science teacher; however, only 3148 science teachers were appointed. In terms of science teacher quality, we can argue that Turkey has problems similar to those of many other countries, especially considering its relatively low scores in the PISA and TIMSS. Under these conditions, in the present study, we investigate the profiles of the future science teachers in Turkey using three parameters: the motivations behind their career choice, their epistemological beliefs and the relationships between the two.

THEORETICAL FRAMEWORK

Motivations for Choosing Science Teaching as a Career

Choosing teaching as a career is a complex decision that includes not only rational reasoning but also depends on affective factors such as beliefs and motivations (Watt & Richardson, 2012). In terms of motivations, scholars agree that extrinsic (e.g., salary), altruistic (e.g., desire to shape future generations) and intrinsic (e.g., love of teaching) factors are components behind the selection of a teaching career. However, Watt and Richardson (2007) did not feel that this trio explained the factors behind the choice to a sufficient extent because there was a lack of theoretical background. Using *expectancy-value theory* (e.g. Eccless et al., 1983), these authors suggested that expectancies (ability beliefs) and the values attached to teaching are the primary motivators for choosing teaching as a career. They emphasized the importance of 12 motivations and six perceptions in their Factors Influencing Teaching Choice (FIT-Choice) framework. The motivations include social utility values, personal utility values, intrinsic values, perceived teaching ability, prior teaching experience, social influences and fallback career. The perceptions are related to task demand, task return, experiences of social dissuasion and satisfaction with choice.

In the case of the motivations behind choosing to teach science, we can argue that there is rather limited literature, including only a few studies. In one of these studies, Dawson (1997) scrutinized the factors influencing Australian preservice teachers' decisions to become secondary science and math teachers. The top reasons for teaching in this group were the desire to make a difference, good job conditions, a liking for young people and a love of math/science. In another Australian context, Watt, Richardson and Pietsch (2007) investigated the motivators for STEM teachers using the FIT-Choice framework. The highest rated motivations were their perceived teaching abilities, the desire to make a social contribution, the opportunity to shape the futures of their students and the intrinsic value of teaching. Wang (2004) studied graduate science students' motivations for choosing teaching as career in Taiwan. The results showed that students were attracted to teaching due to an early exposure to science teaching in informal environments and their perceptions regarding the promising material rewards, good working conditions and the high social status of teaching. In addition, Eick (2002) studied secondary science education graduates' career choice and the perception of retention in an US sample. The main motivator for science education majors was the potential to influence youths and shaping their futures.

In the case of Turkey, Kilinc, Watt and Richardson (2012) compared science (STEM) and non-science preservice teachers' motivations in a large sample (N=1577) using the FIT-Choice framework. They found that significant others close to the preservice science (STEM) teachers had tried to dissuade them from teaching because there were other 'better' job possibilities in science-based areas. In a complementary manner, the participants in the science (STEM) teaching group were less motivated by job security than their counterparts in the non-science group. In addition, Kilinc and Mahiroglu (2009) found that enjoying working with children, the love of biology and the light workload were the primary attractors for those who teach biology. Turkish preservice biology teachers also emphasized that their top barrier in the future would be the limited number of appointments.

Epistemological Beliefs

Although there is no agreed upon definition, the psychologists and educators address beliefs about the nature of knowledge and knowing in epistemological research (Hofer & Pintrich, 1997). We can argue that there are two main trends that the researchers follow in this tradition: the development of epistemological beliefs and the effects of epistemologies on learning and teaching (Hofer, 2001).

In first trend, the scholars agree that education and culture shape and/or influence epistemological beliefs (e.g., Hofer, 2001). Perry (1970), for example, believes that students enter universities with immature epistemologies; however, as they experience complex courses, they move through more sophisticated epistemologies. In terms of culture, recent research shows that different cultures lead to different traditions in epistemologies (Hofer & Pintrich, 1997). Schommer (1994) noted that the motivation behind American schools is individual achievement, whereas in other contexts based on collective cultural goals, the motivation is group achievement. In the Chinese culture, the effort spent in learning is crucial. In addition, the authority figures in society, such as politicians, teachers and, most importantly, parents, receive high respect, so people most commonly depend on authority in their decisions (Chan & Elliott, 2004).

Scholars have also developed theoretical assumptions about the developmental characteristics of epistemological beliefs. In the first tradition, scholars (e.g., Perry, 1970) consider epistemologies to be unidimensional and developed by stage-like trajectories. In the second tradition, Schommer (1990) believes that epistemologies are multidimensional and that an individual might possess different levels of beliefs about different structures of knowledge (source, certainty, etc.) at same stage. A review of the developmental models in first tradition suggests that each of the primary models posit developmental trajectories that parallel each other (Hofer & Pintrich, 1997). In these models, immature epistemological beliefs represent knowledge as certain and derived from an external authority. Mature epistemological beliefs emphasize that people should be skeptical about knowledge sources and that knowledge structures are judgments that can be evaluated based on the arguments supporting them.

Schommer (1990) suggested that a personal epistemology is a multidimensional belief system including five more or less independent dimensions: the structure, stability and source of knowledge and the control and speed of learning. The structure of knowledge ranges from isolated bits to integrated concepts. The stability of knowledge is considered to be tentative or unchanging. The source of knowledge is considered to be handed down by authority or gleaned from observation and reason. The control of knowledge acquisition ranges from fixed at birth to life-long improvement. The speed of knowledge relates to quick all-or-none learning or gradual learning. She considers these beliefs to be better characterized as frequency distributions rather than dichotomies or continuums. For example, a mature learner may believe that a certain small proportion of knowledge is unchanging and the remaining proportion is evolving.

Epistemological beliefs influence teachers' conceptions about learning and teaching science (Chan & Elliott, 2004). On the one hand, science teachers with sophisticated epistemologies believe that knowledge is complex and uncertain, can be learned gradually through long-term experience and can be constructed by the students. On the other hand, a science teacher who holds immature epistemologies believes that knowledge should be transmitted from authorities and views students as passive recipients of pre-established knowledge (e.g., Olafson & Schraw, 2006).

In the case of Turkey, even though there is limited research on science teachers' epistemological beliefs (Yilmaz-Tuzun & Topcu, 2008), we can see that Turkish preservice science teachers (PSTs) consider learning to be a gradually developing process rather than a quick practice. They do not believe that learning is innate. However, they do relatively believe that knowledge is certain and unchanging. In addition, they place importance on omniscient authority, and they mostly agree that knowledge consists of isolated bits and pieces rather than integrated concepts and multiple meanings (Topcu, 2011). Regarding the reasons for the immature epistemological beliefs of PSTs, Yilmaz-Tuzun and Topcu (2008) suggested that for many of the PSTs, their teachers applied traditional teaching strategies and these strategies

led them to comprehend the concepts. In addition, teachers are still authority figures despite recent reforms based on the constructivist approach in Turkey. Certain cultural points such as collective culture might also lead to certain epistemologies, such as the development of respect for authority and giving importance to certain and simple knowledge.

RESEARCH RATIONALE and PURPOSE

Apart from the goal of investigating the profiles of future science teachers in Turkey, we also have the important goal of adopting a relatively new approach for investigating teaching career choice. We believe that certain epistemologies may be crucial in the development of particular motivations to become a science teacher. In rather limited literature about the relationships between epistemological beliefs and career choice, Baxter Magolda (1998) considered that *self-authorship* is crucial in adult decision making including career choice decision making. It is the internal capacity to define one's belief system about nature of knowledge (epistemologies), identity and relationships. Epistemological component of self-authorship is based on complex assumptions about the nature of knowledge (e.g., knowledge is constructed in a context based on relevant evidence and evidence is necessary to make informed decisions) (Baxter Magolda, 1998). Self-authorship plays a role in career decision making because it influences how people evaluate the advice they receive from others and how susceptible they are about feedbacks and knowledge about careers (Creamer & Laughlin, 2005). Epistemological beliefs in this case relate to views about nature of knowledge and the criteria that are used to judge the credibility of information about the career. By using Baxter Magolda's assumptions, Creamer and her colleagues have tried to understand the relationships between self-authorship and career decision making. They (Creamer and Laughlin, 2005) have found that trust and respect for authorities such as parents and a need for approval are important epistemological orientations that women use in their career decisions. In another research, they (Meszaros, Creamer & Lee, 2009) have argued that women are significantly more likely than men to seek information about IT careers, but encountered developmental (epistemological) dissonance when the advices are inconsistent with the advices provided by trusted others. In addition, parental support have had a direct and positive impact on IT career interest and choice. They interpreted their findings in both of these studies using developmental perspectives in self-authorship. They believe that most people who make career decisions are at early stages of *self-authorship*. In these stages, "people view knowledge as certain and are lack of an internal basis for evaluating knowledge. They rely heavily on authority figures for the right answers" (Creamer & Laughlin, 2005, p.9). In the other extreme, "the full development of self-authorship includes an internally generated sense of self that guides interpretation of experience and choices, accompanied by the ability to evaluate and interpret knowledge claims in light of the available evidence and the capacity to genuinely consider others' perspectives without being overshadowed by them"(Creamer & Laughlin, 2005, p.9).

Inspiring by Baxter Magolda's and her followers' works, we believe that epistemological beliefs are core beliefs (Rokeach, 1968) about knowledge and are developed through a range of experiences during schooling (Hofer, 2001). They are also used for the interpretation of ill-structured problems and decision making processes (King & Kitchener, 1994). In addition, whether to choose teaching as a career is a complex decision that not only includes rational reasoning but that is also affected by motivational factors (Watt & Richardson, 2012). Considering the filter nature of beliefs (Pajares, 1992), we believe that epistemological beliefs may be used to interpret and evaluate the knowledge and evidence about teaching career choice that depends on a complex decision making process. In addition, apart from Baxter Magolda's and a few other researchers' (Creamer and Laughlin, 2005, Meszaros, Creamer & Lee, 2009) works, there have been limited efforts to understand the

relationships between epistemologies and career choice. In Creamer's and other colleagues' works, we see that they have dealt only with 'source of knowledge' that is one of the dimensions in epistemological beliefs. However, in addition to source of knowledge, the epistemological beliefs are related to the simplicity of knowledge, certainty of knowledge and justification for knowing (Hofer & Pintrich, 1997). At this point, in order to better understand the relationships between epistemologies and career motivators, it is necessary to create a better coverage for both of these parameters. Therefore, our purpose is to investigate Turkish PSTs' reasoning about choosing science teaching as a career by using a range of motivations, epistemologies and the relationships between these parameters. Accordingly, we used three research questions in the present study:

1. What types of epistemological beliefs do Turkish PSTs have?
2. What types of motivators are influential in the decisions of Turkish PSTs about choosing science teaching as a career?
3. Are there relationships between the epistemologies and the motivations behind a science teaching career choice and how can these relationships be used in the interpretation of PST's reasoning about career choice?

METHODOLOGY

a) Context and Sample

We believe that a few context-specific issues are crucial to understanding science teaching carrer in our Turkish sample. If someone wants to become a science teacher in Turkey, she first needs to complete 12 years of precollege education, which includes primary and secondary education. At the final year of secondary school (Grade 12), she needs to take an Exam of Accessing University (EAU), which is a high stakes examination, to access one of the universities that offers a science teaching program. After the results of the EAU are announced, she has only one month to select the programs that are compatible with her university access score. At this stage, she can select from 30 different programs such as medicine, engineering and science teaching. After getting the applications, the Council of Higher Education (CHE) appoints the student to one of the universities that offers a science teaching program. In this program, she must complete a four-year education including general culture, science, education and science education courses. Because teachers in Turkey are considered to be government officials, she needs to complete the Selection Examination for Professional Posts in Public Organizations (SEPPO), which is administered annually by the CHE. She takes this examination after finishing her science teacher education. Each year, the Ministry of National Education (MNE) determines the number of science teachers to be recruited in state schools, and appointments are made according to the teachers' SEPPO scores. In general, there is an oversupply of intending teachers (Kilinc et al., 2012).

In the present study, we distributed 458 questionnaires to first year PSTs from seven universities in different locations in Turkey shortly after (within two months) they enrolled in the science teaching program. A total of 393 questionnaires were returned, representing a 86% response rate. The participants ranged in age from 17 to 26 (X=18.87, SD=1.12). The monthly household income was selected using one of 17 options: 20 (5.1%) participants selected 0-500 TL, 104 (26.5%) selected 500-1000 TL, 107 (27.3%) selected 1000-1500 TL, 61 (15.6 %) selected 1500-2000 TL, 38 (9.7 %) selected 2000-2500 TL, 32 (8.2 %) selected 2500-3000 TL, 12 (3.1 %) selected 3000-3500 and the remaining 18 (4.7%) selected options over 3500 TL (1 US dollar is currently equal to 1.84 TL).

The participants' fathers were more educated than their mothers; three (0.8%) of the fathers were 'uneducated', 147 (37.5 %) graduated from primary part 1, 63 (16.1%) from primary part 2, 100 (25.5%) from secondary school, 78 (19.9%) from university and 1(0.3%) had a Master's degree. For the mothers, 15 (3.8%) were illiterate, 225 (57.5%) had graduated

from primary part 1, 65 (16.6) from primary part 2, 63 (16.1%) from secondary school and 23 (5.9%) graduated from university.

Regarding when the respondents started seriously thinking about the science teaching choice, 226 (58.5 %) participants stated that they first considered science teaching after seeing their EAU score. A total of 88 (22.8%) said that they started thinking about science teaching during high school; and 72 participants (18.7%) made this decision during primary school.

b) The Nature of the Questionnaires

Schommer's epistemological belief (SEB) questionnaire: Because many researchers use quantitative instruments to assess epistemological beliefs in (science) education research (Yang & Tsai, 2012), we selected Schommer's (1990) epistemological beliefs (SEB) questionnaire for the present study. There are five primary dimensions with 12 subsets in the questionnaire. These dimensions are 'simple knowledge' (subsets: seek single answers, avoid integration), 'certain knowledge' (subsets: avoid ambiguity, knowledge is certain), 'omniscent authority' (subsets: do not critize authority, depend on authority, can not learn how to learn), 'innate ability' (subsets: success is unrelated to hard work, ability to learn is innate, learning is quick) and 'quick learning' (subsets: learn first time, concentrated effort is a waste of time) (for further information about items please see Schommer (1990)). The PSTs selected one of the five options (strongly agree, disagree, undecided, agree and strongly agree). The SEB was translated into Turkish and validated earlier (Topcu & Yilmaz-Tuzun, 2006). This translated form was used in the present study.

Watt's and Richardson's FIT-Choice questionnaire: We used the FIT-Choice scale developed by Watt and Richardson (2007) to determine the motivations of PSTs regarding choosing science teaching as a career. These authors developed the items in the questionnaire using the expectancy-value theory. There are 12 motivations and 6 perception factors in the questionnaire. Motivation factors are 'ability', 'intrinsic career value', 'fallback career', 'job security', 'time for family', 'job transferability', 'shape future of children', 'enhance social equity', 'make social contribution', 'work with children', 'prior teaching/learning ecperiences' and 'social influences'. Perception factors are 'expert career', 'high demand', 'social status', 'salary', 'social dissuasion' and 'satisfaction with choice'. The FIT-Choice questionnaire was back translated into Turkish by Author 1 et al. (2012). We used this Turkish form, including 61 items in the present study. The PSTs selected one of the numbers from 1 through 7 representing their agreement with each item (for further information about items please see Author 1 et al., 2012).

c) Administration of the questionnaires

After obtaining permission from the university councils, the second author contacted a lecturer in the science teaching department at each university. She and the lecturer were present during the administration of the questionnaires. Due to the high number of items in the questionnaires, the SEB was administered first. After one course of instruction, the FIT-Choice questionnaire was administered. In addition, because the present study is a part of a longitudinal project, personal information such as name, surname, telephone number and e-mail addresses were collected in the first part of the SEB. The completion of SEB took approximately 20 minutes, whereas the FIT-Choice was completed in 15 minutes.

d) Data Analyses

Both descriptive and inferential analyses were used in the present study. The scores of mean, percentage and standard deviation were used to explain the differences in epistemological beliefs and in motivations. Explanatory Factor Analysis was used to

determine the factorial structure of the SEB. A Confirmatory Factor Analysis (CFA) was performed on the FIT-Choice. Two maximum likelihood CFAs assessed the model fit for motivation factors and perception factors. To investigate the relationships between epistemological beliefs and motivations/perceptions, we used Multiple Regression Analysis (MRA). In the MRA, epistemological beliefs were predictor variables whereas motivations/perceptions were dependent variables.

FINDINGS

a) Motivations for Choosing Science Teaching as a Career

Kilinc and others (2012) adapted and applied the FIT-Choice scale to the Turkish context. In their factor analyses (exploratory and confirmatory), they found that the items were distributed to hypothesized factors suggested by Watt and Richardson (2007). Therefore, we used a Confirmatory Factor Analysis to test the factor structures and assess the model fit in the present study. Using CFA, the items were assigned to load only on their respective factors, error variances were estimated, no error covariances were specified, and the latent correlations were freely estimated. Close attention was paid to the incremental fit indices (Tabachnick & Fidell, 2007). The CFA for the 12 factors for motivations yielded acceptable global fit indices: normal theory weighted the least squares chi-square = 1334.634, df = 528, RMSEA = .062, NFI = .82, NNFI / TLI = .85, CFI = .88. Similarly, the CFA for the six factors of perceptions showed acceptable fit indices: normal theory weighted the least squares chi-square = 342.025, df = 155, RMSEA = .055, NFI = .89, NNFI / TLI = .92, CFI = .94. These results confirmed that the items correctly distributed to the hypothesized factors.

Table 1. *Descriptive Results and Final Cronbach's Alpha Reliabilities for the FIT-Choice Factors*

	X	SD	Alpha
Motivations			
Make social contribution	6.12	1.12	.76
Shape future of children/adolescents	5.90	1.23	.78
Enhance social equity	5.57	1.22	.78
Job security	5.44	1.52	.79
Ability	5.17	1.27	.79
Prior teaching experiences	5.11	1.80	.73
Work with children/adolescents	5.02	1.62	.91
Time for family	5.00	1.48	.70
Intrinsic career value	4.67	1.51	.83
Fallback career	4.42	1.50	.52
Social influences	4.30	1.65	.74
Job transferability	4.05	1.90	.62
Perceptions			
Expert	5.05	1.28	.79
High Demand	4.92	1.35	.67
Satisfaction	4.76	1.52	.88
Social dissuasion	4.51	1.63	.58
Social Status	4.39	1.37	.87
Salary	3.64	1.38	.64

According to Table 1, the social utility values (to make a social contribution, to shape the future of children and adolescents, to enhance social equity) followed by job security were the strongest motivations for choosing science teaching as a career. Ability, prior teaching experience, work with children/adolescents, time for family and intrinsic career values were the other motivations that had mean scores over the scales' midpoint. Fallback career, social influence and job transferability were not considered to be as important as the other motivations because their mean scores are close to the midpoint.

In terms of perceptions, many PSTs considered science teachers to be experts and science teaching to be a high demand profession. The satisfaction with the choice was over the midpoint but still relatively low. In addition, it is likely that social dissuasion, status and salary were not as important as the other perceptions about science teaching.

b) Epistemological Beliefs

We used the procedures of Schommer (1990) for a factor analysis of the SEB. The mean scores of the 12 subsets were used as variables in the factor analysis. A principal factoring extraction with orthogonal varimax rotation and an eigenvalue greater than 1.0 produced three factors accounting for 45.6 % of the variance. Taking a closer look at the analysis results, four factors could also account for the data. The fourth factors' eigenvalue was .967. Therefore, as Schommer, Chrouse and Rhodes (1992) did, we conducted a second factor analysis using .96 as the cutoff eigenvalue. The results of our second factor analysis yielded a four-factor structure accounting for 53.6% of the variance. Table 2 displays the distributions of the factor loadings of the subsets by four factors. Using Schommer's procedures, the first factor was designated 'innate ability'. Apart from the subset 'ability to learn is innate', the other subsets ('can't learn how to learn' and 'success is unrelated to hard work') were included in the innate ability factor. The second factor was designated 'quick learning'. All of the theoretically assumed subsets ('learning is quick', 'learning first time' and 'concentrated effort is a waste of time') (Schommer, 1990) were included in quick learning. The third factor was designated 'omniscient authority'. Only the subset of 'depends on authority' was represented this factor. The final factor was designated 'certain knowledge'. These factor structures are similar to those in Yılmaz-Tüzün and Topcu's (2008) research, wherein they used a sample of Turkish PSTs.

Consistent with Schommer's (1990) assumptions, the four-factor structure in the present study showed that Turkish PSTs possessed epistemological beliefs as a set of more or less independent beliefs. The inter-item reliabilities of the items for the factors range from .46 to .68. Yilmaz-Tuzun and Topcu (2008) found that these scores ranged from .20 to .60. Schommer's research yielded scores between .51 and .78.

Considering the mean scores of each factor that we found in the present study, we can argue that PSTs moderately give importance to omniscient authority (X= 3.26, SD=.49, Range = 1-5). They also moderately believe that knowledge is certain (X= 2.99, SD=.39, Range = 1-5). However, their beliefs regarding quick (X= 2.41, SD=.49, Range = 1-5) and innate (X= 2.04, SD=.49, Range = 1-5) learning are relatively low compared to the other epistemological beliefs. These results show that PSTs possess relatively immature beliefs about the certainty of knowledge and dependence on authority. However, they also hold relatively mature beliefs about learning in terms of speed and innate ability.

Table 2. *Factor Loadings of the Epistemological Subsets*

	Factor 1	Factor 1	Factor 3	Factor 4
Cannot learn how to learn	**.756**	.164	-.237	.000
Success is unrelated to hard work	**.501**	.355	-.074	.055
Dont critize authority	.433	.185	-.027	.207
Avoid integration	.372	.264	.054	.147
Concentrated effort is a waste of time	.395	**.599**	.031	-.195
Learning is quick	.245	**.533**	-.029	.135
Ability to learn is innate	.107	.468*	.170	.145
Learning first time	.159	**.384**	-.164	.034
Depend on authority	.020	-.008	**.520**	-.076
Seek single answers	-.114	-.129	.308	.124
Avoid ambiguity	-.049	.107	.254	**.214**
Knowledge is certain	.159	.085	.098	**.519**
% of variance	25.07	11.59	8.93	8.06
Eigenvalue	3.009	1.391	1.072	.967

*Factor loading of the subset that does not fit in with hypothesized factor.

The Relationships between Epistemological Beliefs and Career Choice Motivations

Multiple regression analysis was used to understand how motivations/perceptions are predicted by the epistemological beliefs. The assumptions of the multiple regression such as a normal distribution, multicollinearity, linearity and sample size were scrutinized for each regression analysis (Tabachnick & Fidell, 2007). We found that these assumptions were met in all of the analysis.

Table 3 shows that epistemological beliefs, particularly ‘omniscient authority’ and ‘learning is innate’ are significant predictors of particular motivations and perceptions regarding choosing science teaching as a career. Those who primarily depend upon authority and who hold less of a belief that learning is innate are likely to develop social utility motivations and to be satisfied with their choice. Similarly, those who hold less of a belief that learning is innate consider science teaching to be an expert career and ability and prior experiences are to be crucial. Those who give importance to authority believe that social status and science teaching salaries are satisfying. The participants who believe that knowledge is certain suggest that time for family is an important motivation. Those who depend on authority and believe that knowledge is certain attach importance to job security. The participants who hold less of a belief that knowledge is certain but depend on authority believe that science teaching is a highly demanding profession. Those who hold less of a belief that learning is a quick process consider science teaching to be a fallback career.

Similarly, the participants who hold less of a belief that learning is quick and depend on authority develop intrinsic career values (e.g. love of science teaching).

Table 3. *Beta Scores and Adjusted R^2 Scores for Each Regression Analysis*

	Certain Knowledge (Beta)	Omniscent Authority (Beta)	Quick Learning (Beta)	Innate (Beta)	Adjusted R^2
Motivations					
Make social contribution		.17**		-.22***	.08
Shape future of children/adolescents		.11*		-.18***	.05
Enhance social equity		.13*		-.22***	.07
Job security	.12*	.17**			.05
Ability				-.16**	.03
Prior teaching experiences				-.11*	.01
Work with children/adolescents		.15**		-.11*	.04
Time for family	.12*				.01
Intrinsic career value		.15**	-.11*		.04
Fallback career			-.11*		.01
Social influences					
Job transferability					
Perceptions					
Expert				-.33***	.11
High Demand	-.11*	.12*			.03
Satisfaction		.17**		-.12*	.05
Social dissuasion					
Social Status		.16**			.03
Salary		.12*			.02

*p< .05, **p< .01, ***p< .001

DISCUSSION

a) Motivations for Choosing Science Teaching as a Career

In terms of the PST's motivations, social utility values (e.g., make a social contribution, shape the future of children and adolescents, enhance social equity) followed by job security, ability, prior teaching experience, the opportunity to work with children/adolescents, time for family and intrinsic career value were the top motivations. Fallback career, social influences and job transferability were not considered to be as important as the other motivations. In terms of perceptions, many PSTs considered science teaching to be difficult and requiring expertise. The satisfaction with the choice was over the midpoint but still relatively low. In addition, social dissuasion, status and salary were not strong perceptions.

These results show that there are certain general predispositions and context-specific tendencies regarding the motivations behind science teaching career. Considering similar results in US (Eick, 2002), Australia (Dawson,1997) and Taiwan (Wang, 2004), we can argue that social utility values are a crucial top factor in choosing science teaching as a career, regardless of the culture and the context. However, their importance is particularly apparent in the Turkish context, perhaps because of the collective nature of the culture (Kilinc et al., 2012). In the case of job security, we believe that a science teaching career in Turkey is very sensitive to the job opportunities in governmental and private sectors (Kilinc et al., 2012). Due to the uncertainties in particular science-based jobs and the influence of parents with

limited socio-economic background, Turkish students may be directed toward a science teaching career, which offers better security options. When we compare our results with the Australian sample (Watt, Richardson & Pietsch, 2007), the low level of ability motivations and intrinsic value in our sample may partly be due to the high fallback career motivations (Kilinc et al., 2012). Those choosing science teaching in Turkey may attribute importance to more basic needs such as job security over personal interests and abilities (Watt & Richardson, 2012). In terms of perceptions, perhaps because the PSTs could not achieve the score in the EAU that is required to access better, 'demanding' job alternatives such as medicine and dentistry, they did not find science teaching to be a demanding profession. In addition, their satisfaction level was relatively low, perhaps because most of them did not come to science teaching intrinsically.

b) Epistemological Beliefs

The results of present study show that PSTs possess relatively immature beliefs about the certainty of knowledge and dependence on authority. However, they also held relatively mature beliefs about learning in terms of speed and innate nature. This combination is consistent with the previous Turkish studies of PSTs (Topcu, 2011, Yilmaz-Tuzun & Topcu, 2008).

We believe that education and culture are crucial factors that may help us to explain these results. As the scholars suggest, preservice teachers are education insiders and they develop many beliefs during their schooling, starting at the kindergarten level (Pajares, 1992). The Turkish school environment (both in college and at the precollege level) where the PSTs in our sample are educated are full of traditional teaching approaches based on memorization and the rehearsal of concepts (Yilmaz-Tuzun & Topcu, 2008). Perhaps because of the high stakes national examinations, most of the stakeholders (students, parents, teachers, principals, etc.) in the educational sector believe that excellence in education means obtaining high scores in these examinations. The questions include multiple choice items based on only one right answer. Due to the nature of these national examinations, the knowledge required for these questions should be certain and not permit skepticism. We can argue that textbooks, which are the main teaching materials in Turkish classrooms, are full of certain knowledge structures and that there is no window for discussion of the limits of knowledge and its sources (Irez, 2008). In regard to teachers, they assume the role of the transmitter of knowledge, which fits best into this competitive examination-driven environment. Through this role, the teachers become an authority on knowledge rather than the collegial developer of it (Kilinc et al., 2013). These conditions may explain immature epistemologies of PSTs about certainty of knowledge and dependence on authority. In addition, we believe that PSTs' relatively sophisticated scores for innate and quick learning are an expected result. Rather than constructivist worldviews, we believe that the national examinations in Turkey and in other contexts are the primary reasons for these mature beliefs. Perhaps the PSTs come to think that the memorization of knowledge is not an easy task and that it requires significant practice and a gradual process.

In terms of culture, Turkish society is based on a collective culture that places importance on family relationships. Despite the visible impact of Western values on metropolitan cities such as Istanbul, we can argue that most of the population still relies on collective goals. Elders, parents and teachers are still respected and youngsters usually depend upon their authority when they make significant decisions about their lives (Karakitapoglu-Aygun & Imamoglu, 2002). This nature of Turkish culture might provide some explanation for the result regarding the PST's dependence on authority. Another explanation may be from the tendency to avoid uncertainty in Turkish culture. Hoftsede's (1980) research shows that Turkey has high scores in the dimension of 'uncertainty avoidance'. Uncertainty avoiding

cultures strive to minimize the possibility of unstructured situations. This characteristic may also be responsible for the high scores of PSTs regarding the certainty of knowledge.

c) The Relationship between the Epistemologies and the Motivations for Choosing Science Teaching

As we assumed, we found that there were significant relationships between epistemological beliefs and motivations. The epistemological beliefs, particularly as regards omniscient authority and innate learning, were significant predictors of particular motivations about choosing science teaching as a career.

Those who depend upon authority and hold less of a belief that learning is innate are likely to develop social utility motivations and to be satisfied with their choice. Perhaps PSTs give importance to significant authorities such as parents, teachers and leaders in their culture who have particular group goals, thereby guaranteeing the maintenance of society. Additionally, because the educational environment is dominated by the teachers' authority, these PSTs may develop a belief that meeting the expectations of authority will bring satisfaction. In addition, those who depend on authority and believe that knowledge is certain attach importance to job security. Perhaps less affluent parents with limited educational background in our sample ask their children to select reliable jobs such as teaching science. In addition, PSTs may not want to face the uncertainties in science-based job sector that are most likely being experienced by their parents (Kilinc et al., 2012).

Those who hold less of a belief that learning is innate consider science teaching to be an expert career and abilities and prior experiences to be crucial. Perhaps the PSTs who believe that learning is about life-long improvement consider that they will use their abilities and prior experiences in a science teaching career and will continue to develop them. In addition, the PSTs who believe that knowledge is certain suggested that time for family is an important motivation. Perhaps they avoid ambiguities once the family is under consideration. The participants who hold less of a belief that knowledge is certain but who depend upon authority consider science teaching to be a highly demanding profession. Perhaps there is a general agreement in the close environment of certain PSTs regarding the demanding nature of teaching. In terms of the certainty of knowledge, PSTs might think that science teaching does not have a structured framework regarding its responsibilities; sometimes it is an enjoyable job, whereas other times it can be highly demanding. This ambiguity may influence the PSTs' preferences.

The PSTs who hold less of a belief that learning is quick and who depend on authority develop intrinsic career values. This result may mean that the PSTs who believe in gradual learning develop an intrinsic motivation to select teaching. These PSTs may also persist despite learning problems of students and spend more time in science teaching. In addition, they may intrinsically want to become an authority in the future. Finally, those who give importance to authority believe that the social status and salary from science teaching are important. This result was an expected considering the relatively low socio-economic background of the respondents' parents. Perhaps the parents emphasize that a teaching salary and status are more satisfactory relative to their own occupations.

CONCLUSIONS and SUGGESTIONS

The results of the present study show that choosing science teaching as a career in the Turkish context is a complex and multidimensional decision. The policies around education, the economy (job sector) and the culture are the fundamental components influencing this decision. These components produce epistemologies and motivations that have close relationships. Traditional classrooms based on the memorization of information and on

teachers' authority as well as the collective culture develop particular epistemologies such as omniscient authority, certain knowledge and life-long learning. These epistemologies may be used to interpret the motivations behind the teaching career choice that are related to cultural priorities and economy-based situations.

Considering that approximately two-third of PSTs chose science teaching after seeing their EAU score, we can argue that most of the PSTs may use their core epistemologies in the interpretation of the science teaching choice in as short a time as one month. In other words, they consult their epistemologies to make an informed decision among a limited variety of options.

In terms of motivations, Turkish PSTs will most likely persist in teaching, because we know that social utility values are high for highly persistent groups in teaching (Watt & Richardson, 2007). Perhaps they will not change their career once they are appointed by MNE because job security is a vital factor for them. These results might signal a positive future for science teaching in the Turkish context; however, particular motivations such as job security and immature epistemologies under teaching motivations give us pause in terms of the *quality* of their future science teaching. The extrinsic and survival nature of job security may be a barrier to future science teaching quality. The teacher candidates who have limited intrinsic motivation and strong materialistic values may not develop a strong motivation and commitment to teaching science, which is already found to be problematic by Turkish scholars (e.g., Yilmaz-Tuzun & Topcu, 2008).

In terms of epistemologies, we believe that the PSTs in our sample will continue to memorize the information and attach importance to the knowledge authorities around them in their teacher training. The traditional practices of teacher educators in the Turkish context support this assumption (Kilinc et al., 2013). They may want to make a social change via science teaching, but may not sure about the nature of this change. Developing a new generation that is well-informed in terms of conceptual background rather than illiterate individuals might be a social goal for these teachers. Considering the nature of the epistemologies and motivations of PSTs, raising scientifically literate individuals who make informed decisions about current socioscientific issues, who address uncertainties and who are skeptical about authorities appears to be a distant goal given the current conditions in Turkey.

In terms of the relationships between epistemologies and science teaching career motivations, we can argue that epistemological development of PSTs has affected their evaluations regarding science teaching career. We believe that most of PSTs are at early stages of *self-authorship* in Baxter Magolda (1998)'s terms. They have developed immature epistemologies about certainty of knowledge and dependence on knowledge sources. Perhaps they have used these epistemologies in finding answers for the questions in their minds such as 'Will science teaching provide job security?', 'Can I make social contribution via science teaching?', 'Does science teaching have a high social status?' and so on. For a more qualified and dedicated science-teaching workforce and an informed career decision-making, we believe that the candidates need to be able to evaluate their abilities, intrinsic values and the inputs about science teaching by using a mature epistemological framework. At this point, science educators, advisers and teacher recruitment units at pre-college level in Turkish and other contexts may develop real and/or vicarious learning environments such as internships and service learning programs that will expose students to ill-structured problems and multiple perspectives about science teaching career (Creamer & Laughlin, 2005; Hofer & Pintrich, 1997; Howard et al., 2000). In this way, students will make their epistemologies explicit and reflect on them in real contexts. Also, the educators may challenge certain immature epistemologies such as dependence on authority by better alternatives. We believe that the quantity and quality of science teacher workforce in any country may positively be

affected by these types of implications, because they may enable 'right' students to choose science teaching without epistemological barriers.

Another implication may be related to the indicator role of epistemologies. Particularly in the countries such as US, UK and Australia where the quantity of science teachers is an urgent priority (rather than the quality of them) (OECD, 2006), teacher recruitment units can produce different policies in which they will advertise particular motivations that are compatible with epistemologies. For instance, a slogan such as 'your country expects you to raise top scientists, engineers and doctors' may be used for those with social utility values and with dependence on authority. Secondly, the cultural components regarding the nature of knowledge, teaching, learning and the teaching profession should be scrutinized in detail. The authorities in these countries can use these components to make the science teaching profession more attractive to school students.

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