Research on Humanities and Social Sciences
ISSN (Paper)2224-5766 ISSN (Online)2225-0484 (Online)
Vol.5, No.11, 2015

Evaluation of Critical Thinking Skills and Self-Efficacy Levels among Science Teacher Candidates

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Abstract

The aim of this study was to evaluate and determine the critical thinking skills and the general self-efficacy of science teacher candidates. The study was performed with the participation of 32 teacher candidates from the science teaching department of a university in Turkey. Scales administered during the study included the California Critical Thinking Scale and the General Self-Efficacy Scale. Frequency distributions were calculated for data obtained from both scales. Based on the study results, it was determined that while the teacher candidates generally provided responses that illustrated effective critical thinking skills and self-efficacy, the frequency of the responses for some of the scale items lacked a clear distribution in terms of illustrating the teacher candidates' stance towards these abilities.

Key words: Critical thinking, Self-efficacy, Science teaching, Teacher candidate

1. Introduction

We live in a rapidly globalizing and constantly developing world, with development around the world steadily occurring in many areas such as technology, general knowledge, production, and education. In this context, societies that can create changes are better able to assume leading positions, with other societies being compelled to follow their lead. As result, advanced thinking skills, as well as self-efficacy in individuals, are gradually acquiring greater importance and influence in all societies. Within the scope of these developments, it becomes important to nurture teacher candidates who are capable of critical thinking and aware of their self-efficacy, since they will play an essential role in the education of individuals in future societies.

According to Çetin (2009), one of the implicit goals of new elementary education programs is to increase the self-efficacy levels of students. To solve problems and create knowledge, individuals must be able to use their skills and capacities effectively; in this context, self-efficacy has an important influence on student's ability to access and use information (Çetin, 2009). For many years in Turkey, educational programs have aimed to nurture modern, scientifically knowledgeable, critical, and creative individuals with high self-confidence and good problem-solving skills. In this context, various activities are being conducted for the preparation of new educational programs that are based on constructivist approach (Epçaçan and Erçen, 2008). Critical thinking involves both a process and a product (Garrison, Anderson, and Archer, 2001). During the acquisition of critical thinking skills and processes, the minds and bodies of students must be active and open to learning through scientific research. This enables individuals to open to new horizons, and to thereby develop an interest in different areas of research (Dökme, 2005). In addition to their families, school and teachers also play an important role in the development of thinking skills in individuals. Thinking skills such as critical thinking, creative thinking, and problem solving develop as a result of the education provided both by the family and in school (Özdemir, 2005). Applications in science especially, involve processes such as problem finding, problem solving, critical thinking, exploration, and investigation (Gomes, 2005). Tümkaya (2011) described critical thinking as the ability to obtain, compare, evaluate, and use information effectively. According to Aizikovitsh-Udi and Amit (2011), critical thinking encompasses questioning the reliability of information, and on accepting, rejecting, or questioning examples and knowledge from daily life. Education can be described as a process in which, parallel to their integration into society, individuals also gain the ability to think critically (Dutoğlu and Tuncel, 2008). As such, education occupies a very important place in the development of advanced thinking skills and self-efficacy. Consequently, the quality of the education provided to teacher candidates in education faculties in undeniably important.

Determining the critical thinking skills and self-efficacy of science teacher candidates is fairly important for

identifying the areas and abilities that need to be emphasized during their education in faculties of education. Ensuing that teacher candidates (i.e. the teachers of the future) gain the necessary critical thinking skills and self-efficacy is likely to have a significant positive impact on their training. For this reason, it is important to identify and utilize effective means for assessing critical thinking skills and self-efficacy among teacher candidates. In this context, the aim of this study was to determine the critical thinking skills and self-efficacy of science teacher candidates.

2. Methods

The study was conducted with 32 second-year university students receiving education at the science teaching department of an education faculty in a Turkish university. The aim of this study was to determine the current critical thinking skills and self-efficacy of science teacher candidates.

2.1. Data Collection Tools

Two main assessment tools were employed in this study, which were the California Critical Thinking Scale and the General Self-Efficacy Scale. The original California Critical Thinking Scale was developed by Facione, Facione, and Giancarlo in 1998, and adapted to Turkish by Kökdemir in 2003. This six-point Likert-type scale consists of the answers: "Strongly Disagree (SD), Disagree (DG), Partly Disagree (PD), Partly Agree (PA), Agree (AG), and Strong Agree (SA)," and the Cronbach's Alpha value of the scale was previously determined as 0.88. The General Self-Efficacy Scale, on the other hand, was developed by Sherer et al. in 1982; the Turkish adaptation as well as the validity and reliability study of the scale was performed by Yıldırım and İlhan (2010). The said scale is a five-point Likert-type scale with a calculated Cronbach's Alpha value of 0.80.

3. Results

The results obtained from the research are given in table1 and table2.

Table 1. The frequency distribution of critical thinking skills among science teacher candidates.

Scale Items	SD	DG	PD	PA	AG	SA
It would be great to learn new things throughout my entire life.	6.3	3.1	0.0	25.0	40.6	25.0
It bothers me when people rely on weak arguments to defend good opinions.	6.3	6.3	0.0	12.5	62.5	12.5
Before giving an answer, I always focus on the question first.	0.0	12.5	0.0	12.5	43.8	21.9
I value my ability to think with great clarity.	0.0	0.0	12.5	21.9	53.1	12.5
If there are four views in favor of, and one view against an argument, I would tend to side with the four favorable opinions.	3.1	31.3	9.4	50.0	6.3	0.0
Many university courses are uninteresting and not worth understanding.	9.4	15.6	25.0	21.9	15.6	12.5
I prefer exams where one needs to apply thinking rather than memorizing information.	0.0	0.0	0.0	12.5	53.1	34.4
Other individuals appreciate my intellectual inquisitiveness and research-oriented personality.	3.1	12.5	12.5	34.4	37.5	0.0
I act as if I were rational, while in fact I am not.	43.8	37.5	3.1	9.4	0.0	6.3
I find it easy to organize my thoughts.	3.1	6.3	6.3	28.1	46.9	9.4
Everyone, including myself, generally engages in debates and arguments out of self-interest.	3.1	28.1	18.8	21.9	25.0	3.1
Keeping records of my personal expenditures is very important for me.	3.1	3.1	9.4	25.0	53.1	6.3
When confronted with a big and important decision, I first try to collect as much information as I can.	0.0	0.0	12.5	21.9	50.0	15.6

Since I make decisions judiciously by properly taking the "rules" into account, my friends generally consult and trust me with their own decisions.	0.0	12.5	9.4	31.3	40.6	6.3
Being open-minded means not knowing what is right and what is wrong.	37.5	40.6	0.0	9.4	6.3	6.3
It is important for me to understand what other people think on various subjects.	0.0	0.0	9.4	12.5	56.3	21.9
All my beliefs must have a solid and tangible basis.	0.0	12.5	3.1	12.5	65.6	6.3
Reading is something I avoid whenever I can.	40.6	28.1	12.5	3.1	3.1	12.5
People generally say that I am too hasty when taking decisions.	21.9	43.8	6.3	21.9	6.3	0.0
Elective courses in university are a waste of time.	18.8	37.5	6.3	21.9	9.4	6.3
I panic whenever I have to deal with something truly and excessively complex.	3.1	15.6	18.8	40.6	15.6	6.3
Rather than describing their culture to us, foreigners should try to understand our culture.	9.4	25.0	12.5	18.8	25.0	9.4
People generally think that I procrastinate when it comes to making decisions.	25.0	34.4	18.8	12.5	9.4	0.0
When people oppose the opinions of others, they must do so based on concrete reasons.	0.0	0.0	3.1	3.1	65.6	28.1
It is impossible for me to be impartial when discussing my own opinions.	9.4	12.5	12.5	28.1	31.3	6.3
I admire my own ability to present creative choices and solutions.	0.0	0.0	3.1	18.8	53.1	25.0
I believe whatever I want to.	0.0	9.4	21.9	25.0	18.8	25.0
Spending a lot of effort for solving complex problems is really not all that important.	6.3	62.5	9.4	15.6	0.0	6.3
Other people often consult me to determine reasonable standards concerning the implementation of their decisions.	3.1	9.4	12.5	31.3	40.6	3.1
I am always willing to learn things that are challenging.	0.0	9.4	18.8	28.1	31.3	12.5
It is important to try to understand the thoughts/opinions of foreigners.	0.0	18.8	12.5	31.3	18.8	18.8
My curiosity is one of my greatest strengths.	0.0	6.3	12.5	40.6	31.3	9.4
I always seek information that supports my views, while avoiding those that contradict my views.	3.1	25.0	6.3	34.4	31.3	0.0
Solving complex problems is fun.	0.0	6.3	9.4	37.5	40.6	6.3
People admire my ability to understand the thoughts of others.	3.1	3.1	6.3	28.1	50.0	9.4
Analogies and metaphors are only as useful as boats on a highway.	15.6	46.9	12.5	6.3	18.8	0.0
I can be described as a reasonable person.	0.0	3.1	3.1	34.4	46.9	12.5
I really enjoy trying to understand how everything works.	0.0	0.0	6.3	25.0	46.9	15.6
When a problem get complicated and challenging, others often ask me to keep working on it.	0.0	15.6	9.4	28.1	34.4	3.1
Developing an open view about a problem at hand should always be a first priority.	0.0	15.6	0.0	12.5	50.0	15.6
My opinion of controversial subjects is generally shaped by the last speaker.	25.0	34.4	6.3	25.0	3.1	0.0

Regardless of the circumstances, I am always interested in learning more about a subject.	0.0	6.3	21.9	40.6	21.9	3.1
The best way to solve a problem is to ask for the answer from someone else.	37.5	43.8	0.0	3.1	3.1	6.3
I am described as having an orderly and systematic approach towards complex problems.	3.1	9.4	21.9	34.4	18.8	6.3
Having an open mind towards different world views is less important than what people actually think.	21.9	37.5	3.1	12.5	18.8	0.0
Learn everything you can, since you never know when you might need it.	0.0	0.0	0.0	6.3	59.4	28.1
Nothing is ever as it seems.	21.9	56.3	3.1	3.1	9.4	0.0
Other people let me decide how a problem should be solved.	3.1	18.8	9.4	37.5	21.9	3.1
I know what I think; so why should I pretend that I am considering other views and options?	3.1	28.1	35.0	18.8	12.5	6.3
Others express their opinions, but I am not interested in listening to them.	31.3	31.3	15.6	0.0	9.4	6.3
I am good at developing orderly plans for resolving complex problems.	3.1	3.1	12.5	37.5	31.3	6.3

An evaluation of the data in Table 1 indicates that many of the teacher candidates provided responses that showed a strong inclination for critical thinking. However, in certain items, the frequencies of the responses were distributed both in favor of and against critical thinking. Examples of this include the percentage distribution of the responses to the following items: “If there are four views in favor of, and one view against an argument, I would tend to side with the four favorable opinions,” “Many university courses are uninteresting and not worth understanding,” “Rather than describing us their culture, foreigners should try to understand our culture,” and “Everyone, including myself, generally engage in debates and arguments out of self-interest.” In addition, the responses of the science teacher candidates to several of the questions indicated attitudes incompatible with critical thinking.

Table 2. The frequency distribution of self-efficacy scale items among the science teacher candidates.

Scale Items	Not at all	Very little	Moderately	Fairly	Absolutely
When making plans, I am certain that I can implement them.	0.0	6.3	6.3	84.4	3.1
One of my problems is the inability to begin tasks on time.	12.5	21.9	34.0	25.0	6.3
If I fail at a task the first time, I will work on it until I succeed.	0.0	0.0	21.9	65.6	12.5
I am not very successful at reaching important objectives that I set for myself.	9.4	46.9	37.5	6.3	0.0
I always leave tasks half-done.	37.5	43.8	15.6	3.1	0.0
I avoid confronting difficulties.	21.9	46.9	31.3	0.0	0.0
If a tasks seems to complex, I will not even try doing it.	28.1	34.4	34.4	3.1	0.0
When I have to do something I do not like, I will still force myself to complete it.	6.3	6.3	21.9	56.3	9.4
When I decide to do something, I will start doing it immediately.	0.0	6.3	21.9	62.5	9.4
If I am not successful at first when trying something new, I will quit soon afterwards.	21.0	40.6	28.1	6.3	3.1
When confronted with unexpected problems, I have difficulties in	3.1	28.1	43.8	21.9	3.1

overcoming them.					
I avoid learning new things that seem complicated.	21.9	40.6	21.9	12.5	0.0
Failure increases my resolve.	6.3	18.8	34.4	40.6	0.0
I do not always trust my skills.	9.4	34.4	31.3	21.9	3.1
I have confidence in myself.	3.1	3.1	18.8	43.8	31.3
I give up easily.	31.3	40.6	25.0	3.1	0.0
I don't believe I have the resolve to handle the problems I encounter in life.	34.4	40.6	9.4	12.5	3.1

An evaluation of the data in Table 2 indicates that many of the teacher candidates provided responses reflecting strong self-efficacy. However, in certain items, the frequency distribution of the responses were ambiguous, with responses indicating both low and high self-efficacy. Examples of this include the percentage distributions for the responses to the following items: "Failure increases my resolve," "I do not always trust my skills," and "When confronted with unexpected problems, I have difficulties in overcoming them."

4. Conclusions and Discussion

Korkmaz and Yeşil's (2009) study previously determined that students enrolled in higher education institutions exhibit a moderate level of critical thinking. Ural's (2015) study determined that among teacher candidates, the perception of self-efficacy had a significant moderate effect on their concerns towards teaching. In another study, Andrew and Wialle (1998) identified significant relationships between nursing students' academic self-efficacy, science self-efficacy, learning self-efficacy, critical thinking, self-organization of metacognition, and academic performance (as cited by Üredi and Üredi, 2005).

The findings of the present study indicated that teacher candidates generally had a favorable perception of themselves with regards to their critical thinking skills and self-efficacy. However, in both scales, it was noted that the frequency distribution of responses to certain items were somewhat ambiguous. An evaluation of these ambiguous items showed that the science teacher candidates' responses lacked a clear and particular distribution with regards to agreeing with the opinion of the majority; believing in the necessity of courses taken in university; believing that opinions expressed in debates are based on self-interest; thinking that failure increases their resolve; lacking confidence in their own skills; and overcoming unexpected problems. These results indicate that these science teacher candidates need to further improve their critical thinking skills and self-efficacy. Critical thinking skills and self-efficacy are two dynamic factors that support and reinforce one another. For this reason, to ensure that science teachers develop their perspectives and gain the ability to think differently, it is necessary that they first consider themselves as adequate/sufficient (i.e. that they have good self-efficacy). In this context, we believe that this study will contribute significantly to the nurturing – as well as the development of critical thinking skills and self-efficacy levels – among science teacher candidates, who will assume an essential role in the shaping of society in the future.

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