

The Science and Technology Pre-Service Teachers' Self-Efficacy Levels and Opinions about Alternative Assessment and Evaluation Approaches

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Abstract

The present study aims to determine the science and technology pre-service teachers' self-efficacy levels and their opinions about alternative assessment and evaluation approaches. The study was carried out with the participation of 53 science and technology pre-service teachers studying in the Faculty of Education at Celal Bayar University. As the data collection instruments, a self-efficacy scale about alternative assessment and evaluation approaches, a questionnaire form which was composed of open-ended questions about alternative assessment and evaluation approaches, and a semi-structured interview were used. It was found out that most of the pre-service teachers had high self-efficacy levels about alternative assessment and evaluation approaches. The results obtained from the questionnaire form and the interviews revealed that the pre-service teachers wanted to use these approaches in their future careers for different purposes, but they believed they might experience some problems while implementing these approaches. Furthermore, the study also offers some suggestions based on the pre-service teachers' self-efficacy levels and opinions about alternative assessment and evaluation approaches.

Key Words

Alternative Assessment and Evaluation, Self-Efficacy, Students' Views, Science And Technology Pre-Service Teachers.

Certain fundamental changes have been carried out in the learning-teaching notion on the basis of the new curricular reform which has been gradually implemented in Turkey starting from the academic year 2005–2006. These changes have brought to the foreground the constructivist approach, which maintains that individuals construct information upon their previous knowledge using cognitive and social processes. As stated by Kılıç, Karadeniz and Karataş (2003), constructivist approach requires that whole learning occurs as a result of mental construction and that individuals

take greater responsibility and be more active during their learning process. Kanatlı (2008) argues that every novel approach in the field of education influences the teaching methods and techniques used, as well as the assessment and evaluation techniques. In this context, as constructivist approach was introduced in the curriculum, changes were made in the learning-teaching methods, techniques, and strategies used, as well as in the assessment and evaluation notion.

In the process of assessing an individual's knowledge, the focus had for long been on assessing factual knowledge, after which assessment of procedural knowledge gained prominence; however, today metacognitive knowledge has become the focal point in assessment (Fourie & Van Niekerk, 2001). Gülbahar and Büyüköztürk (2008) suggest that the assessment method selected for learning and teaching process is effective in helping students acquire higher order thinking skills. Conventional

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assessment and evaluation approaches usually employ classical tests. As a traditional assessment strategy, summative assessment is a conventional method of only assessing learning outcomes at the end of a teaching process, while formative assessment as a part of performance assessment tracks progress during the semester and regularly collects feedback from students by way of responses (Born, 2003, p. 169). Since formative assessment mainly aims to gain insight into what students know and do not know for changes to be made in the learning-teaching process, techniques such as teacher observations and classroom discussions as well as homework and test analyses play a crucial role in this assessment approach (Boston, 2002).

Dikli (2003) considers multiple choice tests, true-false tests and short-answer questions as the commonly used traditional assessment and evaluation instruments. Such tests employed by these approaches include a limited number of options suggested by teachers (DeMauro, Helphrey, Schram, & Spiekermann, 2001) and focus on superficial knowledge assessing lower order skills and removed away from the real source of success (Miesels, 1995). In a similar view, Zessoules and Gardner (1991) note that classical tests do not provide detailed information about students' development and are inadequate in helping students' works be understood. Nevertheless, in alternative assessment and evaluation approaches, which are more realistic and student-centered when compared to conventional assessment and evaluation (Naser, 2008), various techniques used include open-ended questions, exhibition, demonstration, experimental practices based on hand skills, computer simulations, concept maps, performance evaluation, self-peer assessment and portfolios (Dietel, Herman, & Knuth, 1991; İnger, 1995; Struyven, Dochy, Janssens, Schelfhout, & Gielen, 2006). As revealed by an examination of the literature, some studies (Dietel et al., 1991; Lawrenz, Huffman, & Welch, 2001) categorize open-ended questions as one of such techniques under alternative assessment approaches, while others (Gelbal & Kelecioğlu, 2007; Nazlıççek & Akarsu, 2008; Yaman, 2011) classify them among traditional assessment approaches. Law and Eckes (1995) argue that alternative assessment and evaluation approaches make use of higher order thinking skills and focus on students' performance and development. Furthermore, alternative assessment and evaluation approaches allow monitoring students' improvement throughout the learning process and regard assessment as a part of learning (Acar & Anıl, 2009). Therefore, it could

be argued that along with traditional assessment and evaluation approaches, alternative assessment and evaluation approaches should also be employed in classroom environment in learning process (Duban & Küçükylmaz, 2008). As seen in the literature, Tatar and Şaşmaz-Ören (2009) focused in their study on the alternative assessment and evaluation techniques used by elementary school teachers and Bay et al. (2010) attempted to determine the opinions of education faculty members and pre-service teachers about the assessment and evaluation system. On the other hand, Herman, Klein and Wakai (1997) took students' opinions about alternative assessment approaches in their study, while Flowers, Ahlgrim-Delzell, Browder and Spooner (2005) identified in their study what teachers from five different countries think about alternative assessment approaches.

As noted by Compeau and Higgins (1995), the concept of self-efficacy denoting an individual's belief about the level of his/her ability level to perform a certain behavior is defined by Khodarahimi (2010) as a person's perceived capacity to execute a particular action. An examination of the literature on self-efficacy shows that the studies often focus on determining pre-service teachers' perceptions of self-efficacy toward teaching profession (Derman, 2007; Veznedaroğlu, 2005) and self-efficacy toward teaching (Atılboz, 2007; Ercan, 2007; Şahinkaya, 2008). Şahin and Ersoy (2009), on the other hand, identified the self-efficacy perceptions of pre-service elementary teachers about assessment and evaluation in the new elementary curriculum. In a study, Rackley (2004, p. 12) presents the study results arguing for a strong relationship between teacher efficacy and students' success, motivation and self-efficacy perceptions. At this point, it could be suggested that teacher efficacy may also positively influence student performance. Chung's (2000) study reveals that self-efficacy among elementary school students was significantly enhanced following the use of self-assessment, an alternative assessment tool. Similarly, in a study by Zimbicki (2007) that investigated the impact of alternative assessment approaches upon students' motivation and self-efficacy levels, students taught by using alternative assessment approaches attain higher self-efficacy levels. Therefore, a strong relationship is suggested between pre-service teachers' self-efficacy levels in alternative assessment approaches and the extent to which they use these approaches in their professional careers and their students' self-efficacy in a subject area.

The study aimed to determine pre-service science and technology teachers' self-efficiency levels towards and views about alternative assessment and evaluation approaches. For this purpose, the study's main problem was stated as follows: "How are Senior Pre-service Science and Technology Teachers' Self-Efficiency toward and Views about Alternative Assessment and Evaluation Approaches?"

Method

Aiming to reveal pre-service science and technology teachers' self-efficiency levels towards and views about alternative assessment and evaluation approaches, the present research is a descriptive study that makes a combined use of quantitative and qualitative data. The study was carried out in the fall semester of academic year 2009–2010 with senior students ($n=53$) studying in the department of Elementary Science and Technology Teacher Education in Demirci Education Faculty at Celal Bayar University.

The study employed the 'scale on self-efficiency toward alternative assessment and evaluation approaches', an 'opinion form', and 'semi-structured interview form' as data collection instruments. The 'Scale on Self-Efficiency toward Alternative Assessment and Evaluation Approaches' developed by Buldur (2009) was used to identify the self-efficiency beliefs in alternative assessment and evaluation approaches among the pre-service teachers studying in the department of science and technology teacher education. So as to identify the views of pre-service teachers in the sample group toward alternative assessment and evaluation approaches, the pre-service teachers ($n=40$) were administered the opinion form containing six open-questions in written form. Moreover, semi-structured interviews were made with six pre-service teachers. As argued by Yıldırım and Şimşek (2006), interviewing is one of the data collection instruments most commonly used in qualitative research.

For the analyses of the quantitative data in the study, percentage and frequency values were analyzed at item level and total scores were calculated for the items under each factor. As for the analysis of qualitative data, content analysis was used, as is usually done in quantitative research. The data obtained from the opinion form in the study were analyzed and coded by three field experts, who also identified the percentage–frequency values. Reliability calculations for expert examination of the opinion form were performed by using "agreement percentage",

which had been developed by Miles and Huberman (1994). The agreement percentage of the coding in the study were computed as 0.66 for the first question, 0.78 for the second question, 0.74 for the third question, 0.81 for the fourth question, 0.57 for the fifth question, while the overall agreement percentage for all questions was found to be 0.74.

Results

The study's results are discussed under two main sections, which are the results obtained from the 'Scale on Self-Efficiency toward Alternative Assessment and Evaluation Approaches' and the results obtained from the opinion form and semi-structured interviews.

Results Obtained from the Self-Efficiency Scale

In the examination of the scale's first sub-factor (Practical Self-efficiency), the pre-service teachers' mean score for this factor was found to be 45.30. The mean score per item was calculated to be 4.12. In five-point scales, mean value per item can be calculated by dividing total score by the number of items. In such calculations, score range between 1.00–1.80 can be interpreted as "totally disagree", score range between 1.80–2.60 as "disagree", score range between 2.60–3.40 as "undecided", score range between 3.40–4.20 as "agree" and score range between 4.20–5.00 as "totally agree". Given the scale's five-point rating characteristic, the mean value of 4.12 corresponds to the 'agree' range. Thus, the pre-service teachers can be said to have high practical self-efficiency levels. As for the examination of the second sub-factor of the scale (Self-Efficiency toward Coping with Difficulties), the pre-service teachers had a mean score of 36.53 for this factor, while the mean score per item was 3.32. Given the scale's five-point rating characteristic, the mean value of 3.32 corresponds to the 'undecided' range. So the pre-service teachers can be said to have a medium level of "self-efficiency toward coping with difficulties". Examinations on the scale's third sub-factor (Self-Efficiency toward Resource Utilization) revealed that the pre-service teachers had a mean score of 15.85 for this factor, while the mean score per item was 3.96. Given the scale's five-point rating characteristic, the mean value of 3.96 corresponds to the 'agree' range. Therefore, the pre-service teachers can be said to have a high level of "self-efficiency toward resource utilization" in alternative assessment and evaluation approach.

Results Obtained from the Opinion Form and Interviews

All of the participants in the study group stated their desire to use alternative assessment and evaluation approaches in their teaching careers. As for the motives of the science and technology pre-service teachers to use alternative assessment and evaluation approaches, 29.6% (f=13) stated their belief that these approaches will help enhance retention and activeness in learning. 15.9% (f=7) of the pre-service teachers stated that alternative assessment and evaluation approaches will help them evaluate the process, while a group of them argued that they will provide multidimensional information, thus offer multifaceted evaluation, will allow getting to know students, and are objective, valid and reliable. These opinions were also confirmed by the interviews. For instance, pre-service teacher A stated that *"I would like to use alternative assessment and evaluation because in conventional approaches, students are asked questions and they answer them. However, it is impossible to make the right decision about a student simply on the basis of such little information. In order to obtain information about students, evaluation should be continued for the entire term, rather than relying on examinations administered for a class hour. I mean, process-based evaluation is required."*, while pre-service teacher D said, *"I certainly want to use it because then you have all the work and activities performed by students for the whole year. So you have a student's all activities, not just the information s/he writes on a piece of paper. This way, students are assessed not simply by their knowledge, but also by their abilities. So it is a more valid and reliable method."* Furthermore, the pre-service teachers believe that alternative assessment and evaluation approaches are suitable for modern learning and teaching approaches, will contribute to the development of research skills, and are effective in revealing previous knowledge.

Among the pre-service teachers, 52.3% (f=11) state their wish to use alternative assessment and evaluation approaches at the end of the class, 30.2% (f=19) would like to use them during class, and 17.5% (f=33) want to use them at the beginning of lessons. Although there are differences among the stages at which the participants would like to use alternative assessment and evaluation approaches, most of them want to use these approaches at the end of lessons to assess students' learning (38.9%) and to perform extracurricular activities such as projects and research (13.9%). During lesson teaching, as stated by the pre-service teachers, they

plan to use alternative assessment and evaluation approaches to increase the interest and participation in the course (11.1%) and to obtain effective learning and retention of information (8.3%). The science and technology pre-service teachers would like to use alternative assessment and evaluation approaches at the beginning of lessons for the same motive, which is to determine students' previous knowledge and readiness levels (13.9%). On the other hand, some of the pre-service teachers interviewed stated that they want to use alternative assessment and evaluation approaches at all stages of the course for different purposes. For example, pre-service teacher F stated that *"I'd like to use them at all stages of the course. I will use them to test their previous knowledge and to determine their readiness levels during course introduction, to see how much and how they learned the subjects during the course, and to identify what they have learnt or whether they learnt during the teaching of a unit at the end of the course."*, while pre-service teacher E mentioned his opinion as follows: *"I use them during the class to keep the students interested and before the class to see what they know about the subject. And I use it at the end of the class either to reveal what they know about the subject or to see fruits of their studies. They could also be employed before starting the lesson so as to encourage students to do research."*

Given the science and technology pre-service teachers' opinions, they believe that using alternative assessment and evaluation approaches will contribute much to students in many respects. As revealed by the participants' views, the most significant contributions of alternative assessment and evaluation approaches for students include providing students with self-awareness about their own progress and allowing them to easily monitor such progress (29.4%), and ensuring learning through activity and by experience (25.5%). Moreover, the pre-service teachers also think that alternative assessment and evaluation approaches allow students to learn more effectively and retain their learning (15.7%), their research (9.8%), higher order and creative thinking (5.9%) skills will develop, and they will be more interested in the course (5.9%). As a confirmation of this view, pre-service teacher A said, *"Students will learn better and meaningfully as they actively participate in classes. Higher order learning occurs in students. For instance, creativity... Students will learn better since they themselves recognize their mistakes."*, while pre-service teacher D noted that *"They improve students' higher order thinking skills. They improve students' ability both to criticize themselves and others. In addition, they*

will be more motivated for the course as they are in charge of their own learning.” Furthermore, 3.9% of the participants ($f=2$) stated that the cooperation between teachers-students-parents and school will be enhanced.

A great majority of the students in the sample group (37.7%) stated that they would like to use portfolios among alternative assessment and evaluation approaches. Besides, particularly rubric (18.8%), attitude scale (7.1%), science journal (7.1%) and performance assessment (7.1%) are other alternative assessment and evaluation approaches that the elementary pre-service teachers want to use.

Among the most important problems they might encounter while using alternative assessment and evaluation approaches at elementary level, the pre-service teachers participating in the study mentioned the lack of information about these approaches on the part of teachers or students (26.6%), the time problem (23.3%) and in particular, the inability to be adequately objective in certain assessment approaches like self/peer assessment (20.0%). Most of the pre-service teachers interviewed see the time issue as the greatest problem. Pre-service teacher A explained her opinion about the issue by stating that *“I believe the greatest problem is the lack of time. Apart from that, both students and the teacher exert great efforts, which mean spending a lot of time. In addition, it is difficult to all these in financial terms.”*, while pre-service teacher C stated that *“Since students do not know about these assessment methods, they will have difficulties or problems regarding time.”* In addition, the pre-service teachers in the sample group believe that sufficient objectivity may not be possible in certain alternative assessment and evaluation approaches like self/peer assessment in particular.

Discussion and Conclusion

In parallel with the outlook based on constructivist and active learning that developed within the learning-teaching process, understanding of assessment has also witnessed great changes. As noted by Anderson (1998), constructivism supports alternative assessment practices rather than traditional teaching and assessment methods. Since alternative assessment aims to reveal students’ knowledge and skills in cognitive, kinesthetic, and affective domains through various ways, individuals need to display their performance to show their capacity in these domains (Adanalı & Doğanay, 2010).

An examination of the elementary science and

technology pre-service teachers’ scores on the alternative assessment and evaluation self-efficacy scale reveals that they perceive themselves the best in practical self-efficacy, and the weakest in self-efficacy to cope with difficulties. Thus, the pre-service teachers think that they could easily implement alternative assessment and evaluation approaches, but believe that they may have certain problems with regard to use of sources, and particularly in coping with difficulties.

All of the science and technology pre-service teachers in the sample group stated their wish to employ alternative assessment and evaluation approaches in their careers, noting that these approaches will particularly help enhance effective learning and retaining of information. The pre-service teachers believe that they can perform process evaluation using alternative assessment and evaluation approaches. Milli Eğitim Bakanlığı [MEB] (2005) underlines the need to evaluate students’ learning processes along with products in the new curriculum. As argued in the elementary 6th-8th grades science and technology curriculum, alternative assessment and evaluation techniques assess not only learning products but also learning process, allowing students to feel responsibility for their own learning (MEB, 2006). A study by Mamlok-Naaman, Hofstein and Penick (2007) claims that students who actively engage in their own assessment processes develop a greater sense of responsibility for their own achievement.

The pre-service teachers’ opinions concerning the contributions of alternative assessment and evaluation approaches to students cover all areas including cognitive (higher-order thinking, creativity, learning how to learn etc.), affective (enhancing interest and motivation, awareness of self-development) and psychomotor (ensuring activeness, research etc.) areas. In a similar view, Korkmaz (2004) notes that conventional alternative assessment and evaluation approaches attempt to explain alternative assessment and evaluation of learners’ acquisitions in the cognitive domain in particular, while alternative assessment and evaluation approaches define learners’ capabilities in a much broader framework within the context of cognitive, affective and psychomotor characteristics. The science and technology pre-service teachers think that alternative assessment and evaluation approaches allow students to be aware of their own development and to learn through experience by actively engaging in the process. In parallel with the above results, Sağlam-Arslan, Avcı and

İyibil (2008) note that in alternative assessment and evaluation approaches, pre-service teachers actively participate in students' assessment process. In their study on elementary school teachers' views about alternative assessment and evaluation approaches, Şaşmaz-Ören and Tatar (2007) argue that teachers see significant advantages in these approaches, including multidimensional assessment of students, the ability to observe and know them better and ensure their activeness. In this context, the opinions of this study's participants are strongly parallel to the experiences of teachers who apply alternative assessment and evaluation approaches. The pre-service teachers think that alternative assessment and evaluation approaches contribute to the improvement of students' research skills. Öztürk and Ada (2006) argue that among alternative assessment and evaluation approaches, portfolios improve students' scientific research skills.

In the study, 32 of the 40 pre-service teachers to whom the interview form was administered mentioned their wish to use the portfolios termed as student product file in the curriculum. Portfolio evaluation process provides students with many advantages such as enjoying the learning process, spending sufficient time on the studies outside the classroom and reducing anxiety in learning (Slater, Ryan, & Samson, 1997), and facilitate students' conceptual understanding by providing the teacher with detailed information as to how students acquire knowledge (Lee, Chan, & Aalst, 2006). Apart from this, the pre-service teachers would like to use rubrics, (graded scoring key), attitude scales, science journals, performance, self and peer assessment and projects. In a study in which Ogan-Bekiroğlu (2009) examined the pre-service teachers' attitudes towards assessment approaches and the factors that affect these attitudes, pre-service physics teachers consider examinations, portfolios, performance evaluation and projects as the most effective assessment methods. Birgin and Gürbüz (2008) carried out a study with pre-service elementary teachers, which identified some of the alternative assessment and evaluation approaches that pre-service teachers knew about and could implement as puzzles, worksheets, concept maps, portfolios, mind maps and project work.

The pre-service teachers in the sample group believe that the most important two problems possibly encountered in using alternative assessment and evaluation approaches in elementary education are lack of knowledge and time. In Watt's (2005) study, teachers identified the most impor-

tant problems about alternative assessment and evaluation approaches as their high level of subjectivity, the difficulty to structure these approaches, ineffectiveness of certain methods in acquiring information about students, and problems regarding time. The teachers participating in a study by Sağlam-Arslan, Devcioğlu-Kaymakçı and Arslan (2009) attributed the negative influences on the implementation of the alternative assessment and evaluation methods in the curriculum mainly to lack of time, crowded classrooms and the inability to gain access to sufficient information about these methods. Alternative assessment and evaluation approaches require more time when compared to conventional assessment approaches, a fact which has been demonstrated by numerous studies (Lawrenz, Huffman, & Welch, 2000; Mintah, 2003; Ruiz-Primo & Shavelson, 1996; Şaşmaz-Ören, 2005; Thompson, Benson, Pachnowski, & Salzman, 2001; Wistedt, 1998). However, it could be argued that as more applications are carried out about alternative assessment and evaluation approaches, students can get accustomed to the assessment instruments and methods consisting the approach, thus, reducing the time spent.

The following suggestions are made by interpreting the study results:

- Yılmaz-Tüzün (2008) argue that teacher education programs, and chiefly methodology courses have great significance in preparing pre-service teachers for their professional careers. These courses aim to help pre-service teachers acquire the necessary professional skills such as teaching different teaching methods and assessing students' knowledge. Therefore, pre-service teachers should acquire information and perform applications regarding alternative assessment and evaluation approaches in courses such as 'Special teaching Methods I and II' and 'Assessment and Evaluation'. Furthermore, science and technology pre-service teachers can be suggested to be offered elective courses about alternative assessment and evaluation approaches.
- Bandura (2004) maintains that one of the four fundamental elements contributing to self-efficacy development is an individual's successful performances. Thus, there is a need to perform applications concerning these approaches during appropriate courses in order to enhance pre-service teachers' self-efficacy levels about alternative assessment and evaluation approaches (particularly in the dimension of self-efficacy to cope with difficulties). In this context, pre-service

teachers are suggested to perform alternative assessment and evaluation applications along with learning-teaching applications in courses such as 'School Experience' and 'Teaching Practice'.

- Recently, many studies in the literature (Sung, Lin, Lee, & Chang, 2003; Tseng & Tsai, 2007; Wen & Tsai, 2006; Zembal-Saul, Haefner, Avraamidou, Severs, & Dana, 2002) have brought to the fore internet-based or computer-based alternative assessment and evaluation studies (e.g. electronic portfolio applications, internet-based self/peer assessment, concept maps, science journals etc.). Such assessment approaches have attracted considerable attention due to their advantages such as saving time, improving skills regarding technology use and lower costs. According to the new science curriculum in which one of the most significant acquisitions is science-technology-society-environment relationship and which closely associates science and technology, pre-service teachers, as the teachers of the future, should be informed about these issues as well, and allowed to perform exemplary applications. In this context, it is suggested to add related courses to teacher education training programs at higher education level, and to exert efforts to inform in-service teachers on the subject.

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