An Application about Pre-Service Teachers’ Development and Use of Worksheets and an Evaluation of their Opinions about the Application

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Abstract
The present study aimed to investigate pre-service elementary teachers’ development and use of worksheets for science and technology course, and to obtain their opinions about these applications. To fulfill this end, in the study, it was employed the case study model as a qualitative research model. The applications were conducted during the fall and spring semesters of the academic year 2008-2009 in the Faculty of Education at Celal Bayar University. The study data were collected through the worksheets prepared by the pre-service teachers as a result of the applications, an opinion form, and semi-structured interviews. The presentation files prepared by the pre-service elementary teachers were examined through document analysis. Furthermore, the data obtained through the opinion form were examined by content analysis, while the data from the semi-structured interviews were analyzed by the descriptive analysis method. The results of the study revealed that the pre-service teachers usually prepared and used worksheets for the purposes of assessment, identification of previous knowledge, activity development and in the form of experiment/activity reports. As for the acquisitions of the use of worksheets, the pre-service teachers mentioned their contributions such as identifying learning levels, revealing previous knowledge, providing experience, teaching preparation and increasing interest in the course. Moreover, most of the participants stated that they had certain problems about choosing suitable questions, and developing questions appropriate for students’ levels while developing worksheets. In the light of these results, certain suggestions are made about the preparation and use of worksheets.

Key Words

In today’s changing and advancing information technology, individuals are expected to exhibit their skills to identify problems, researching and arriving at solutions and to attain knowledge by themselves instead of accepting a piece of information as given. As argued by Karamustafaoğlu (2006), individuals are expected not to draw information from a single source and memorize it; in contrast, the aim is to raise individuals who know how to access and use information, and can develop solution methods using such information in face of problems. For this reason, as suggested by Aydm and Balm (2005), educational curricula should employ methods suitable for the constructivist approach, whereby individuals can learn better by constructing their knowledge themselves. One such method involves teaching materials, which are defined by Gürbüz (2007) as the instruments used to concretize abstract concepts in teaching environments, and to ensure more effective teaching. As a supportive teaching material, worksheets (Kösa, Karakuş, & Çakıroğlu, 2008) are among the written and visual tools that have gained importance under constructivist approach.

Worksheets are written and visual materials that ensure more active student participation and consist of operational stages to be followed to attain...
knowledge as well as instructions that explain the activities to be performed at these stages (Tan, 2008). Güneş and Asan (2005) argue that such teaching materials provide guiding explanations for students. In general, worksheets consist of three sections which are ‘capturing attention’ which includes stimulants such as conceptual images, questions and cartoons; ‘activity’ through which students mentally-physically work for an activity and organize their observational or experimental findings; and ‘assessment’ which involves various evaluative questions about a concept (Karamustafaoğlu, Yaman, & Karamustafaoğlu, 2005, p. 217). Since these instruments usually involve stages, it is easier for students to fully grasp every knowledge stage to proceed with the next one, and as transitions from one step to another are interconnected, students can more easily perceive the problems they are faced with, and can more easily arrive at the solution (Bozdoğan, 2007). Tutak and Birgin (2008a; 2008b) developed and used worksheets so that they would guide students in the application of computer-assisted teaching activities. In their study, Bak-Kibar and Ayas (2010a; 2010b) treated worksheets as one of various materials used to ensure students’ learning in learning-teaching environments. The researchers developed a worksheet about the concepts of physical and chemical change in one their studies (2010b), and developed another worksheet based on the theory of multiple intelligences about the above concepts with the pre-service teachers studying at the department of elementary science teaching in another study (2010a).

A literature review reveals various studies examining the use of worksheets for various purposes and their effects on different variables (success, retention of information, motivation etc.). Çelikler (2009) examined the impact of worksheets developed about chemical compounds upon academic success and retention of information in a study, and found a significant difference in favor of the use of worksheets. Coştu and Ünal (2004) conducted a study in order to develop a worksheet for 2nd-grade high school students to grasp Le-Chatelier’s principle and to evaluate its effectiveness in teaching. In a study, Kösa (2010) developed worksheets about perpendicular projection as a subject in space geometry and examined the applicability of these worksheets for high school students (12th grade). The author concluded that such instruments facilitate the teaching of subjects, are found enjoyable by students, motivate them and enhance their interest in the course. In a study carried out with university students to determine the relationship between self-efficacy and statistical performance; Lane, Hall and Lane (2004) used worksheets as a self-assessment tool for performance in the statistics module developed. Krombaß and Harms (2008) investigated the impact of worksheets upon knowledge acquisition about bio-diversity in a museum of natural history with grammar school students in the 11-15 age group. Mortensen and Smart (2007) examined the use of worksheets in museum trips with elementary students. In their study Johnson, Wardlow and Franklin (1997) compared the effects of hands-on activities and of worksheets upon 9th-grade students’ cognitive achievements and attitudes in teaching physical science principles. Their results revealed no significant difference between the two groups with regard to cognitive achievement, while a significant difference was found in favor of the group taught by using hands-on activities with regard to the attitudes towards science.

An examination of the literature on worksheets shows that these instruments are usually used along with different approaches, methods or techniques. In a study about geography subjects, Başbüyükk and Çikılı (2002) investigated the effects of the use of elementary level worksheets and outline maps upon student success and motivation. Atasoy (2008) investigated the impact of worksheets about Newtonian laws of motion appropriate for the constructivist learning theory in eliminating misconceptions, and obtained favorable results. In a study she examined the impact of a constructivist learning environment on undergraduate mathematics students’ learning of the limit concept, Bukova-Güzel (2007) used worksheets to assess students’ learning about the subject. In a study presenting an extra-curricular observational activity for elementary schools, Su, Hung, Hwang and Lin (2010) used worksheets in an automated scoring system developed to evaluate ecological observations in mobile learning activities. Moreover, Scherr and Hammer (2009) employed worksheets in the cooperative active learning activities in their study conducted in an undergraduate physics course. In their study Perkins and Saris (2001) used worksheets as an assistive instrument to ensure active learning by practice involving problem sets within the process of applying the jigsaw technique as a cooperative learning method. Vries, Meij, and Lazonder (2008) used worksheets at elementary level to support reflective internet search in a computer lab course. The literature review revealed a lack of long-term applied research about worksheets and studies for taking in-service or pre-service teachers’ opinions about such applications.
Study Objective and Problem

In the study, pre-service elementary teachers were asked to develop worksheets for the science and technology course; to use them in their presentations for the course, and thus, gain experience about worksheets, and to take their opinions about worksheets used in these applications. Thus, the study involves two main problems which are “How well can pre-service elementary teachers develop and use worksheets for the science and technology course?” and “What are the opinions of pre-service elementary teachers about the worksheets developed for the science and technology course?”

Method

The case study model as a qualitative research model was selected and employed in the study. Yıldırım and Şimşek (2006) define case study as a research method that allows in-depth examination of a phenomenon or event mainly by asking ‘how’ and ‘why’. In other words, case study is described as a powerful method in observing effects and determining the impacts of causes and effects in real contexts (Cohen, Manion, & Morrison, 2007, p. 253).

The study was conducted with junior students studying in the Department of Elementary Teacher Training in the Education faculty at Celal Bayar University during the academic year 2008-2009. Worksheet applications took place in the courses ‘Science and Technology Teaching I’ and ‘Science and Technology Teaching II’ for two semesters (28 weeks). 97 students participated in the fall semester applications, while 159 pre-service teachers participated in the applications held during the spring semester. 115 pre-service elementary teachers selected from among the participants using the cluster sampling method as a result of the applications were administered an opinion form consisting of open-ended questions. Furthermore, semi-structured interviews were held with a total of 9 individuals selected from among the pre-service teachers filling in the opinion form on the basis of the principle of voluntariness (focus group interviews with 4 and personal interviews with 5 individuals).

The study data were collected through the worksheets prepared by the pre-service teachers as a result of the applications, as well as by an opinion form and semi-structured interviews. To enhance validity, the study aimed for data variation by using multiple data collection instruments. Accordingly, Jick (1979) argues that researchers can enhance the validity of their decisions by compiling various data about the same event/phenomenon. Using multiple methods or sources to present a more correct and realistic picture of the investigated structure or phenomenon could be termed as data variation (triplification) (Şencan, 2005, p. 858). In the study, the data were first obtained from the worksheets developed and used in the applications by the pre-service teachers for two semesters. The pre-service teachers also prepared files about their presentations, in which they included the worksheets they used for these presentations. At the end of the process, these worksheets that the pre-service teachers used in classes and attached to their files were used as one of the data collection instruments. The opinion form is another data collection instrument used in the study. It consists of five open-ended opinion questions formulated by the researchers. As defined by Balcı (2007), opinion questions are intended to identify what an individual thinks about a certain subject at a given moment. Another data collection instrument used in the study was the semi-structured interviews. Interviews are used as shortcuts to learning about individuals’ knowledge, ideas, attitudes and behaviors about any subject along with their underlying reasons (Karasar, 2009, p. 166).

In the study, 15 files randomly selected from among the presentation files prepared by the pre-service elementary teachers were first examined through document analysis. As noted by Çepni (2007, p. 79), document analysis is the process of gathering together any available records and documents about a planned study and coding them according to a certain norm or system. Similarly, in this study, the worksheets attached to the files were analyzed in accordance with their purposes of use and were expressed in quantitative terms. While examining the worksheets, the researchers reviewed some resources about the characteristics of teaching materials (Kaya, 2006; Seferoğlu, 2006; Yanpar, 2005) and the theses conducted about worksheets (Çınkır, 2007; Kaymakçı, 2006; Yaşgırdan, 2005) to determine the variables and selected them as ‘instruction’, ‘coloring’, ‘page setup’, ‘content’, ‘ID information’, ‘writing font/style’. These variables were examined at three different levels for each file analyzed, which are high, moderate and low levels. For the analysis of the data obtained from the opinion form in the study, content analysis was used as a commonly employed method in qualitative research. In content analysis which is often used in social sciences and to analyze the data obtained from observations and interviews, researchers can make comparisons about the subject of study by developing appropriate categories, classifications or signs (Büyüköztürk, Kilç-Çalımkaya, Akgün, Karadeniz, & Demirel, 2008, p. 263). In the
study, the ‘agreement percentage’ formula developed by Miles and Huberman (1994) was used to calculate inter-rater agreement and the overall agreement percentage for all questions was computed to be 0.83. The data obtained from the semi-structured interviews as another data collection instrument used in the study were subjected to the descriptive analysis method, the results of which are presented in the results section. Ekiz (2007, p. 195) argues that descriptive analysis can be preferred if research aims to support the subject of study with direct citations and in line with previously-formulated questions, subjects or themes.

Results

Results about the Worksheets developed and used by the Pre-Service Teachers

With regard to the purposes of use of the worksheets developed and used by the pre-service teachers, they can be commonly categorized as evaluation, identifying previous knowledge, activity and experiment/activity reports. The analyses revealed that worksheets prepared for evaluative purposes were attached to all of the 15 files selected. Instruction in the worksheets was covered at a high level in 7 files, and at a moderate level in 8 files. In the worksheets prepared, ID information (information such as first name, last name, group number etc.) were available at a low level in 10 files, at a moderate level in 3 files and at a high level in 2 files. This part of the results section also includes examples of the worksheets developed and used by the pre-service elementary teachers for different purposes (identifying previous knowledge, activity, experiment/activity report, evaluation) in accordance with different teaching methods, techniques and strategies employed in science and technology education (research-based learning, cooperative learning, analogies etc).

Results Obtained from the Opinion Form

As shown by an examination of the student responses concerning their acquisitions from the use of worksheets, the pre-service teachers stated that such materials help identifying the learning levels of students (f=32, 11.4%), revealing their previous knowledge (f=17, 6.1%) and gaining experience (f=14, 5.0%). On the other hand, 16 (5.6%) pre-service teachers mentioned that the applications taught how to prepare worksheets while 13 (4.7%) pre-service teachers claimed that it promoted interest in the course. Apart from all these, some pre-service teachers believed that worksheets were effective in teaching how to formulate questions (f=17, 6.1%). The participants stated that they often used worksheets at the beginning of a course session (30.5%, f=78), during a course session (23.0%, f=59) and at the end of a course session (46.5%, f=119). Those who used worksheets at the beginning of a course session often employed them to identify previous knowledge (f=54, 21.0%); those who preferred using them during a course session aimed to reinforce the subjects taught (f=18, 7.0%); and those who used it at the end of a course session aimed for evaluation (f=105, 41.0%).

A majority of the pre-service teachers argued for the advantages of worksheets. The opinions of participants revealed that they regarded the most important features of worksheets as ensuring reinforcement of the subjects taught (f=15, 6.6%), feedback (f=12, 5.2%) and subject review/summary (f=10, 4.4%). In addition, the pre-service teachers also consider testing the previous knowledge of students (f=16, 6.8%), identifying their shortcomings (f=12, 5.2%) and their suitability for students’ levels (f=10, 4.4%) among the most important characteristics of worksheets. Furthermore, 39 participants (17.0%) argued that worksheets were important in that they allowed evaluating students’ knowledge. A majority of the pre-service teachers (f=176, 95.6%) were found to experience some difficulty in preparing worksheets. In the study, the pre-service teachers stated that they had difficulty while preparing worksheets in finding/selecting/formulating suitable questions (f=23, 12.5%) and formulating questions that are suitable for acquisitions (f=18, 9.8%). In addition, the participants also had troubles in preparing worksheets that are suitable for the level of students (f=36, 19.5%) and grade levels (f=12, 6.5%). Furthermore, the results made clear that the pre-service teachers had financial problems (f=15, 8.2%) and problems relating to time (f=9, 4.9%). The participants stated that when applying worksheets, they particularly considered their suitability for student/grade level (f=17, 8.4%), at what point of teaching they should be applied (f=12, 5.9%) and their suitability for the subject taught (f=12, 5.9%). On the other hand, 27 (13.3%) pre-service teachers stated that they took care to grant sufficient time to administer worksheets.

Results Obtained from Semi-Structured Interviews

The participants of the study believed that worksheets were effective in addressing students with different characteristics and learning styles. One
A pre-service teacher explained her opinion as follows: “Since we used worksheets in many different areas, I believe we could appeal to a lot of students, so including various activities allowed us to reach a greater number of students.” (Focus Group Interview: Pre-service teacher A). Nearly all pre-service teachers interviewed as the focus group argued that worksheets used in science courses were effective in attracting student attention and interest in the course; yet, they had different ideas as to why. For instance, one pre-service teacher expressed his opinion as follows: “I think it increased student interest in the course since it attracted their attention and encouraged them more.” (Focus Group Interview: Pre-service Teacher C), while another said: “...we used worksheets in combination with different instruments and we ensured diversity, which was enjoyable and attractive for them...” The participants interviewed personally or as the focus group think that worksheets should be used to identify or eliminate the previous knowledge and misconceptions of students. In addition, the participants believe that using worksheets in science courses will be effective in establishing links or ensuring integration with other courses. One participant’s idea about the subject is as follows: “At first links are established with the Turkish course. With the sentences we form, words we write, and the sentences they form. For example, we ask them to write a story. They use their imagination to write a story, and we can observe both their skills to form sentences and to use punctuation marks.” (Focus Group Interview: Pre-service teacher C). The pre-service teachers stated in the semi-structured interviews that worksheets were influential in associating science courses with daily life, a point which they illustrated with various examples: “We have already used worksheets in the form of experiment reports. For instance, with regard to chemistry, addition of salt in water delays boiling. How can a child apply this to his/her daily life? S/he is cooking pasta, for which s/he first boils the water and then adds salt. If s/he learns it through an experiment given in a worksheet, his/her learning will be retained, and for this s/he must use the knowledge in his/her daily life.” (Focus Group Interview: Pre-service teacher A), “For example, we could prepare a worksheet by using a visual aid about the formation of rain. Students could be asked to analyze this activity. Children can guess that it might rain cloudy weather.” (Personal Interview: pre-service teacher I).

The pre-service elementary teachers interviewed argue that worksheets are appropriate for the constructivist learning approach as well as for different learning-teaching approaches. As a response to the last question in the semi-structured interviews, the pre-service teachers stated that if they had the opportunity to prepare and present again the worksheets they used in their applications, they would have corrected some of their errors. The opinions of some pre-service teachers about the subject are given below: “I noticed that I made some mistakes in forming sentences, asking questions as well as in instructions. I would change them if I could.” (Focus Group Interview: Pre-service teacher B).

Discussion
From an examination of the presentation files including the results of the applications made by the pre-service teachers in the study, it is observed that worksheets were most commonly prepared and used for evaluative purposes, which is attributed to the fact that even though the pre-service teachers had been taught about the theoretical information and had been exposed to applications about the constructivist approach, they may still have adopted traditional teaching and evaluation approaches more, or to the fact that it is easier to present different assessment techniques using worksheets. Furthermore, an examination of the worksheets attached to the presentation files concerning the applications performed during the science and technology teaching course in the study revealed that instruction, page setup, content and font/style were usually satisfactory, while coloring was used at a high level in some files and at lower level in others. The greatest problem with the worksheets attached to the files examined is that they lack sufficient ID information, a fact which is confirmed by the examples from the pre-service teachers’ presentation files. Nevertheless, there was a reduction over time (particularly toward the final weeks) in this shortcoming in the pre-service teachers’ worksheets they used during the applications in the teaching course and attached to their presentation files. As shown by a review of literature on worksheets, different researchers developed worksheets about different subjects: Saka, Akdeniz and Enginar (2002) and Özay-KÖse (2010) about our senses; CoŞtu, KarataŞ, and Ayas (2003) about the granular structure of matter; Özdemir (2006) about reproduction; and Dede (2010) about atoms. Some research used worksheets along with other methods. For instance, Burhan (2008)
used worksheets enriched with concept cartoons. In their study carried out with elementary students to determine the effects on mathematics achievement and attitudes, Tarım and Akdeniz (2007) used worksheets within the process of applying two different techniques based on cooperative learning. Akgün, Gönen, and Yılmaz (2009) used worksheets as their data collection instrument in their study aiming to identify students’ lack of knowledge and misconceptions about the relationship between vapor pressure and boiling point. In Bulu and Pedersen’s (2010) research, worksheets were employed to present problem-solving activities in constructing a problem-based learning environment. Obviously, the literature includes studies that examine the development and use of worksheets, and their effects upon students with regard to different variables; however, there is a lack of research examining the characteristics of worksheets.

In the study, the participants stated that worksheets were effective in determining students’ learning levels. In addition, according to the examinations on the presentation files and analyses of the opinion forms, it was found that the pre-service teachers preferred to use worksheets most commonly for evaluative purposes. This was confirmed by the semi-structured interviews. Bozdoğan (2007) noted that worksheets prepared for assessment purposes were administered at the end of units or subjects to determine students’ learning levels. Hung, Lin and Hwang (2010) used computer and mobile technologies to develop a formative assessment design in their study, in which they found that worksheet activities successfully help students focus on extra-curricular learnings about targeted assignments. In the present study carried out with pre-service elementary teachers, the participants stated that they used worksheets in their applications to find out about students’ previous knowledge and identify their misconceptions at the beginning of a course session. Similarly, a literature review would reveal some research on the use of worksheets to identify previous knowledge and misconceptions. Akgün and Gönen (2004) conducted a study discussing the applicability and significance of worksheets to identify/eliminate students’ misconceptions and lack of knowledge about ‘the relationship between dissolution and physical change’ and found that such materials are important both in guiding students and in identifying/eliminating their misconceptions and lack of knowledge. Türkdöğan, Baki, and Tutak (2010), on the other hand, developed a computer-assisted material for teaching mathematics in their study in order to determine the misconceptions of pre-service elementary teachers and noted that worksheets allow students to make guesses about any concept or subject and thus to identify and discuss their misconceptions. Moreover, as claimed by Demircioğlu and Atasoy (2006), worksheets could arguably be used for various purposes such as making learning active and eliminating learners’ misconceptions.

In the present study, the pre-service elementary teachers stated that they used worksheets within the teaching process to reinforce a subject or as an activity, a result which is in parallel with the results of the document analysis. Similarly, in their study, Kurt and Akdeniz (2002) argued that a physics course taught by the use of worksheets allows students to learn by themselves instead of learning by heart, to think of phenomena with their underlying reasons, and to be able to update subjects. Kete, Avcu, and Aydın (2009) recommend that pre-service teachers should have sufficient acquisitions with regard to worksheets, which will enhance students’ readiness levels. In this context, it would be useful for instructors to make pre-service teachers engage in related applications and help them acquire experience in the teaching courses in higher education curricula such as special teaching methods, science and technology teaching, and social studies teaching.

As demonstrated by the study, the pre-service teachers believe that certain points require attention and care while preparing and administering worksheets. The participants stated that while administering worksheets, they particularly pay attention to ensure that they are suitable for student/grade level and relevant to the content/subject matter. In addition, the pre-service teachers in the study also took care to grant enough time to students when administering worksheets. In fact, the time problem was one of the difficulties experienced by pre-service teachers during the applications in the science and technology courses. In parallel with this result, the teachers in Atasoy and Akdeniz’s (2006) research stated that they could not use materials like worksheets in their classes due to reasons such as intensive curricula and lack of time. Worksheets are usually prepared individually for each student in applications and most often include colored images, which results in certain financial difficulties for pre-service teachers both in the development and copying processes. In this context, as is argued by Saka and Yılmaz (2005), worksheets prepared in computer environments are important in that they both reduce costs and save time.
In the light of the study’s results, it could be suggested that the applications about worksheets should be increased in the teaching courses in higher education curricula. In addition, it would be more appropriate for pre-service teachers to perform applications and to assess the worksheets they develop, rather than simply informing about worksheets. Furthermore, both for financial savings (copying and coloring worksheets) and also for time-saving purposes, it is suggested that computer-assisted worksheets could be introduced to pre-service teachers and exemplary applications could be provided.

References/Kaynakça


