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WHAT DO PRE-SERVICE PHYSICS TEACHERS THINK OF STUDY SHEETS?

Case Study

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Abstract

In this study, the aim is to take the views of pre-service teachers on study sheets and evaluate these views. Problem question of the study was determined to be "What are the views of pre-service physics teachers on study sheets?" In this study, which was realized in accordance with the aims of qualitative research, a case study model was utilized. The study group consists of 12 pre-service teachers who are seniors at the department of physics education at a state university during the spring semester. In the study, data were gathered via opinion forms and semi-constructed interviews. The obtained data were analyzed through content analysis. At the end of the study, the following themes came to the fore: “Appropriateness of study sheets for teaching,” “The effect of study sheets on learning,” “and “The applicability of the study sheets." It was determined that concerning study sheets, pre-service teachers think that study sheets can decrease misconceptions, enable meaningful learning, increase interest and attitude, determine the level of readiness, and can be used to relate topics with daily life. Moreover, pre-service teachers indicated that preparing study sheets and applying them takes too much time. At this point, it can be suggested that pre-service teachers make use of computer-aided study sheets to save time.

Keywords: Study sheet, pre-service physics teacher, teaching material.

1. Introduction

Contemporary life expects individuals to have the skills of identifying a problem, researching on and solving it. Instead of memorizing information, individuals today are required to reach information through appropriate means, to use this information, and to be able to provide different solutions to the problems they face (Karamustafaoğlu, 2006). It is why constructive learning is on the fore in the teaching programs that have been developed in the last decade. With the constructive learning approach, the aim is to enable individuals to construct their own knowledge and construct new knowledge by using their pre-existing knowledge. At this stage, it is believed that using different methods, strategies, and materials along with a constructivist approach would enrich the learning environments (Aydın & Balım, 2005). Using teaching materials specifically help students construct knowledge and it supports the realization of a meaningful learning, because teaching materials make it possible for abstract concepts to be concretized and for teaching to be realized more effectively (Gürbüz, 2007). Study sheets have become more important as a visual and written tool within the constructivist understanding. In addition to functioning as a guide during learning, they are also considered to be a material or evaluation tool that would enable active class participation, a guide through topics and concepts, and reveal previous knowledge (Yağdıran, 2005; Tan,

2008). When study sheets are prepared, three parts are taken into consideration (Çakır & Cerrah, 2006). In the first part, there are stimulants related to the topic or the concept such as a picture, a question or a caricature so that students may be steered towards the concept or the topic. In the second part, there are activities, and students are expected to work on a mental and physical level and arrange findings. Last part is the evaluation part, and there are evaluation questions related to the concept or the topic (Karamustafaoğlu, 2006). Students are asked to pass from one step to the other having comprehended each knowledge step with the study sheets. Thus, each part should be connected to one another. Therefore, students will be able to reach the solution by easily comprehending the problem they face (Bozdoğan, 2007). There are certain points to pay attention to when preparing study sheets. For instance, it is important to follow the regulations in the preparation phase, to use colors in content, to give succinct information, to provide proper space for students to do the exercise, and to take into consideration students' level. Verbal aspects, such as the font, size of letters, color of the writing, and the space between sentences or paragraphs, should be prepared diligently and they should be formally appropriate (Yanpar, 2005). Study sheets that are prepared in this respect are expected to enrich students' learning experience. When studies were examined, it was seen that they focus primarily on the process and outcome of the study sheets prepared by pre-service students. In this respect, study results indicate that study sheets have positive effect on success, meaningful learning, motivation, interest and attitude, they enable students to acquire necessary behaviors, they enable students to use their skills, and they can make class environment more fun (Çelikler, 2009; Coştu & Ünal, 2004; Dede, 2010). At the same time, some studies express that students' misconceptions can be eliminated by using study sheets (Demircioğlu, Demircioğlu & Ayas, 2004). In the field of physics education, Coştu, Karataş and Ayas (2003) made use of study sheets in the learning of the effect of pressure over boiling heat of liquids. Similarly, Atasoy (2008) used study sheets in the learning of Newton's laws of motion. Both studies reveal that study sheets that are prepared in accordance with constructivist learning theory are helpful in getting rid of misconceptions on a given topic. Scherr and Hammer (2009) decided to use pre-service physics teachers enrolled at a university as their study group, and they made use of study sheets within collaborative learning activities. It was revealed at the end of the study that students talked about study sheets as a tool that is helpful in their learning by doing and experiencing. Saka and Yilmaz (2005) also indicated that students' success increased when they developed study sheets on electrostatics. In light of these studies, it can be seen that study sheets can be used in every level of learning, and that they can be a guiding material for various topics. As was expressed in Şaşmaz Ören and Ormancı (2012), there are not enough studies in the literature on the views of pre-service teachers on study sheets who will be applying the constructivist approach in their professional lives. Thus, the aim of this study is to get pre-service physics teachers' views on study sheets and to evaluate them. It is believed that taking the views of pre-service teachers, who have received information about study sheets throughout the semester and who have used them in applications during this process, will contribute literature. To this end, the problem sentence of this study was determined as "What are the views of pre-service physics teachers on study sheets?".

2. Method

In this part of the study, information about the pattern of the study, study group, data collection and application, and data analysis are given.

2.1. The pattern of the Study

Aiming to collect pre-service physics teachers' views on study sheets, this study is qualitative research. Qualitative researches aim to directly represent the viewpoints of

participants and to have an inductive analysis by focusing on the process through rich descriptions (Büyüköztürk, Kılıç-Çakmak, Akgün, Karadeniz & Demirel, 2008). This study, too, was realized in accordance with the aims of qualitative research. Case study model was employed in this study. Case study model was defined as a survey model by Karasar (2009); however, the case study model provides more detailed information compared to general survey models. Yıldırım and Şimşek (2006) define a case study as a research method that enables a thorough examination of a phenomenon or event within the frame of "how" and "why." A case study is a strong research method that helps observe the effects of cause-effect along with the real context (Cohen, Manion & Marrison, 2007). Similarly, in this study case study was employed because the aim is to determine pre-service physics teachers' views on study sheets, to get collect qualitative data and to get thorough information in this respect.

2.2. Study Group

The study was realized with the participation of 12 pre-service teachers enrolled at the department of physics education at a state university in Ankara during the Spring semester. Pre-service teachers were selected based on criterion sampling, which is part of purposeful sampling. To this end, the criterion was determined to be pre-service teachers with some school experience who can prepare study sheets and those who have taken the teaching practice class because these are what are expected of pre-service teachers if their views on study sheets are to be collected.

2.3. Data Collection and Application

Pre-service teachers were given information about study sheets for a class hour before application, and then they were asked to prepare a sample study sheet. Pre-service teachers' views were collected through opinion forms and one-to-one interviews during the three-week process. Application of the opinion forms took 20-25 minutes, and the semi-constructed interviews took 20 minutes. Opinion form was completed during the class hour, and the semi-constructed interviews were realized during the time that was free both for the pre-service teacher and the researcher. This whole process was voluntarily. There were four questions on the opinion form which was used as the data collection tool in the study:

Do you think teaching that is realized by using study sheets can be appropriate for the topics of physics? Explain.

What could be the effects on the students of teaching that is realized by using study sheets?

What can you say about the applicability of study sheets taking into consideration the level of students and the classroom sizes?

At which stage of the course should the study sheets be used if they are going to be used in the teaching of a course? Explain.

Pre-service teachers were asked to answer the four questions given in the opinion form. These four questions also formed the basis for the semi-constructed interviews, and pre-service teachers were asked different questions related to the answers they have given. With the application of the opinion form and the following semi-constructed interviews, the aim was to present data that support one another (Yıldırım & Şimşek, 2006). It can be argued that collecting different data on the same thing can be said to indicate the correctness of the decisions.

2.4. Data Analysis

In the analysis of data obtained in the study, content analysis was used. The content analysis which is frequently used in qualitative studies enables categories to be developed and comparisons on the topic can be made (Büyüköztürk et al., 2008). In this study, the aim was to thoroughly examine the data obtained through content analysis. To this end, data were coded by the researchers. Then common traits of these coded were found, and codes were collected under themes. Codes collected under themes were turned into a table by indicating their frequency and percentages. Codes, themes, frequency, and percentages can be found in the findings section. To have reliability, consistency between coders was calculated. Conformity percentage formula of Miles and Huberman (1994) was used in the calculation of the consistency between the two researchers who have PhDs in the field. Data were analyzed separately by the researchers, and their conformity was calculated to be 0,84. Then, researchers came together and reached a consensus on the places were conformity is low. In this respect, codes and themes expressed in the findings came about, and data reached its final version.

3. Findings

Data obtained from the views of pre-service physics teachers on study sheets were examined in this study. Views of pre-service teachers were gathered under four themes. These four themes have 21 codes under them. Findings obtained through views of pre-service teachers are given in detail below (Table 1).

Table 1. *Views of pre-service physics teachers on study sheets (N=12)*

Themes		Codes	f	%
Appropriateness of study sheets for teaching		Appropriate for all topics of physics classes	11	91,66
		More appropriate for thermodynamics, electricity, mechanics, and optics	5	41,66
		Not appropriate for the topics of physics classes	1	8,33
Effect of study sheets on learning	*Positive expressions*	Decreases misconceptions	12	100
		Provides meaningful learning	10	83,33
		Increases success	9	75
		Increases interest	7	58,33
		Increases positive attitude	7	58,33
		Helps determine readiness	4	33,33

		Enables students to relate topics to daily life	3	25
		Provides diversity in teaching through group studies	1	8,33
		Increases critical thinking skills	1	8,33
	Negative expressions	Takes too much time to prepare and apply	4	33,33
		Can cause misconceptions	1	8,33
		Decreases the development of abstract, creative, and critical thinking skills.	1	8,33
Applicability of study sheets		Can be applied more effectively at 9th and 10th grades	11	91,66
		Class size should be small	6	50
		Class size should be big	6	50
		Can be applied at every class level	1	8,33
Place of study sheets within the running of the class		At the end of the class	11	91,66
		At the beginning of the class	8	66,66

As can be seen in the Table, under the theme "Appropriateness of study sheets for teaching" are three codes, namely, "Appropriate for all topics of physics classes," "More appropriate for thermodynamics, electricity, mechanics, and optics," and "Not appropriate for Not appropriate for the topics of physics classes." Within the frame of the first theme, pre-service teachers, in general, think that study sheets can be appropriate for all topics of the physics class (11, 91,66%). However, 5 pre-service teachers (41,55%) express that using study sheets would be more appropriate for thermodynamics, electricity, mechanics, and optics. 1 pre-service teacher (8,33%) thinks that study sheets are not appropriate for topics such as modern physics as they include abstract concepts. Some of the explanations given by pre-service teachers on the first theme can be seen below:

Maria: Study sheets can be used for all topics of physics. However, they need to be adjusted for each topic. Study sheets have the quality to realize multi-faceted objectives.

Jack: I think study sheets are more appropriate for thermodynamics, electricity, mechanics, and optics. Misconceptions related to these topics can be eliminated by study sheets.

Henry: Visuality is on the fore with study sheets, and they would not have any effect on topics such as modern physics that include abstract concepts; on the contrary, they may cause misconceptions. Thus, I think they should not be applied to physics in general.

There are a total of 12 codes – three in negative expressions and nine in positive expressions – under the theme titled "Effect of study sheets on learning." Concerning the second theme, the majority of pre-service teachers think that study sheets have a positive effect on learning. The most frequently expressed positive opinion is that study sheets can decrease misconceptions (12, 100%), and this is followed by "ensures meaningful learning" (10, 83,33%), "increases success (9,75%), interest (7, 58,33%), and attitude (7, 58,33%); meanwhile, the pre-service teachers indicate as a negative opinion that preparing and applying study sheets take too long (4, 33,33%). Expressions of pre-service teachers are given below:

Susan: Visuals within the study sheets attract students' attention and they increase students' interest in the class. Moreover, students get to chance to explore an entertaining side of physics, thus their attitude as well as success increases. By checking the answers students give t study sheets, one can see their mistakes and deficiencies. Therefore, their misconceptions can easily be recognized, and this can direct us in how to eliminate such misconceptions. Likewise, study sheets used at the beginning of the class can be used to measure students' levels of readiness.

Archie: On a positive note, study sheets may enable students to better understand concepts, and ensure that they relate these concepts to daily life. I also think they can increase success as they can get students' attention. On a negative note, they may hinder the development of abstract, critical, and creative thinking as they concretize topics.

Chuck: I think they would increase student success. However, preparing study sheets takes time.

The theme "Applicability of study sheets" were expressed through four codes. Pre-service teachers indicated in the third theme that applying the study sheets at the 9^{th} and 10^{th} grades would be more effective (11, 91,66%) because it is said that learning at this level is realized more within the frame of concepts related to daily life than through mathematical operations. They claim that meaningful learning can be realized through teaching based on this because they think study sheets can easily be related to daily life. One pre-service teacher (8,33%) thinks that study sheets can be used at every level of education. Moreover, while pre-service teachers indicate that using study sheets in large classes can be helpful in order to reach every single student, to make learning environment fun, and to enable brainstorming in-class environment (6, 50%), they also think that the use of study sheets in small classes can make it possible for the teachers to pay attention to the students more (6, 50%). Views of pre-service teachers on the third theme are given below:

Veronica: It may be more appropriate to apply study sheets in the 9^{th} and 10^{th} grades because these classes are more about comprehension than about doing operations, and I think study sheets would be more effective at these levels. Moreover, through a lecturing with study sheets that are based on problems and visuals related to daily life, meaningful learning will take place. In large classes, it is difficult to reach each and every student, so study sheets play an important role for students to internalize the topic.

Cherly: They can be applied in large classes. Brainstorming can be done, and applying study sheets can make the class environment become more fun.

Betty: They can be applied in small classes so that one can have better control in class, and can pay attention to each and every one of students.

The last theme, "Place of study sheets within the running of the class," was explained through two codes. In this theme, pre-service teachers mostly think that study sheets should be used at the end of the class (11, 91,66%). They argue that by doing so they could note students' misconceptions and their level of learning. Pre-service teachers who think that they should be used at the beginning of the class (8, 66,66%) indicate that students' level of readiness can be determined by applying study sheets at the beginning of the class. Views of the pre-service teachers are given below:

Lili: They should be used at the end of the class so that we can determine to what extent students have learned the topic, and what they have not understood, and what their misconceptions are.

Casey: They should be used at the beginning of the class so that we can determine students' level of readiness.

4. Discussion, Result and Suggestions

As a result of the study, views of pre-service physics teachers on study sheets were examined under the following themes: "Appropriateness of study sheets for teaching," "Effect of study sheets on learning," "Applicability of study sheets," and "Place of study sheets within the running of the class." Looking at the expressions of pre-service teachers, it can be seen that their views are usually positive concerning study sheets. For instance, most of the pre-service teachers indicated that study sheets are appropriate for all topics of physics and that they are more effective in such topics as thermodynamics, electricity, mechanics, and optics. Pre-service teachers indicated that study sheets are not really appropriate for topics such as modern physics which contains abstract concepts. In Bozdoğan's (2007) study on study sheets, it was determined that the use of study sheets enabled students to actively participate in class and that students would answer questions more willingly with more motivation. Moreover, it was put forth that pre-service teachers gained experience by preparing study sheets on each and every topic and their proficiency on the topics increased as a result. Indeed, it is believed that pre-service teachers, who have enough experience with study sheets, would increase students' levels of readiness (Bozdoğan, 2007). Those pre-service teachers who think that study sheets are appropriate generally for each and every topic of physics also believe that they could increase their mastery on topics by preparing study sheets for the topics included in the physics education program, and that they could provide a more effective teaching. Meanwhile, it was determined that the pre-service teachers who think that study sheets have a positive effect on learning believe that study sheets decreases misconceptions, enables meaningful learning, increases success, attitude, and interest, determine students' levels of readiness, and can be used to relate topics with daily life. Moreover, it was voiced by the pre-service teachers that study sheets increase critical thinking skills, and provide diversity in teaching by encouraging group study. Indeed, it is known that study sheets are designed based on different teachings, approaches, methods, and techniques. Thus, it can be seen in literature that study sheets, which are designed as such within the frame of constructivist approach, provide positive improvement in students (Akgün, Gönen & Yılmaz, 2009; Burhan, 2008). Literature specifically puts forth that study sheets are effective in detecting students' previous knowledge, determine and eliminate their misconceptions (Akgün & Gönen, 2004; Coştu et al., 2003). In addition to talking about the positive aspects of study sheets, pre-service teachers also mentioned negative points about study sheets, namely, that they take too much time to prepare and to apply. At this point, it can be said that preparing study sheets is not easy and it takes time. However, it should be kept in mind that study sheets contribute to learning as they can strengthen students' knowledge of topics, teachers can give feedback to students thanks to them, and they can help summarize the topic (Kurt & Akdeniz, 2002). It can be suggested that teachers use computer-

aided study sheets in order to save time (Saka & Yılmaz, 2005). Here, a great responsibility befalls academic staff in introducing computer-aided study sheets and in helping pre-service teachers design them through applied examples. It is believed that the academic staff should have a specific focus on the preparation of study sheets in their teaching technologies and material design classes. Moreover, as a negative aspect of study sheets, pre-service teachers contend that study sheets can create misconceptions and can decrease students' abstract, creative, and critical thinking skills. However, as is known, study sheets help concretize abstract concepts and enable more effective learning to take place (Gürbüz, 2007). At this point, it can be suggested that pre-service teachers can be advised to pay attention to the content of the topic and to check at which part of the topic they can make use of study sheets. In terms of the applicability of study sheets, pre-service teachers indicated that study sheets are more effective on students if they are applied at 9th and 10th grades because pre-service teachers see that concepts related to daily life and visuality are more on the fore instead of mathematical operations in the 9th and 10th-grade curriculum. At this point, pre-service teachers contended that study sheets are more appropriate at these levels. Indeed, they expressed that meaningful learning would take place especially in the 9th and 10th graders and student-centered teaching can be realized as such (Demircioğlu & Atasoy, 2006). In addition to this, half of the pre-service teachers argued that study sheets would be more effective in small classes because teachers could be more attentive to every single student in a small class by using study sheets. This brings to mind as is also indicated by Demircioğlu and Atasoy (2006) that study sheets would be effective in students consolidating and constructing their knowledge. Pre-service teachers who argued that study sheets would be more effective in large classes indicate that using study sheets would enable them to reach more students, do brainstorming in class, and to turn the class environment into a more fun place. It can be argued that students' motivation towards the topic and their interest could be increased in large classes through the activities given at the introduction part of study sheets, which are designed to draw students' attention. Finally, pre-service teachers indicated that study sheets should be used at the end of the class. They argued that by doing so the teachers could detect what students did not understand, what their misconceptions are, and what their learning levels are. In literature, too, it is argued that study sheets are used as an evaluation tool at the end of the class. At this point, using study sheets at the end of the class as an evaluation tool is thought to stem from adopting a traditional teaching and evaluation approach. However, if seen in a positive light, as was also indicated by the pre-service teachers, study sheets used at the end of the class would reveal students level and learning (Bozdoğan, 2007). Pre-service teachers who expressed that study sheets should be used at the beginning of the class argued that by doing so students' level of readiness would be determined. Literature supports this assumption and shows that students' level of learning and their misconceptions can be detected as such (Şaşmaz Ören & Ormancı, 2012).

In light of all these, it can be argued that study sheets have a positive effect on students and that they provide a more successful result compared to traditional teaching methods. This study was limited to pre-service physics teachers, but future studies may select pre-service teachers from different fields as their study group. At the same time, study sheet design and application process of pre-service physics can be researched. It is believed that studies to be realized for pre-service teachers to prepare study sheets would contribute to the field in terms of designing and developing study sheets, because study sheets, which consist of three parts, enable students to see a subject in its totality and consolidate it, and they also make them realize their mistakes or misconceptions. From a broader perspective, a study that focuses on eliminating misconceptions by combining study sheets with different teaching methods and techniques can be suggested. Finally, it is thought that student engagement would be ensured with studies in which concept caricatures are used at the introduction part of study sheets, and also students' misconceptions can be easily detected, because it is believed that study sheets that are prepared

in accordance with constructivist learning approach would contribute to meaningful learning by enabling students to draw relations between concepts.

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