ISRG Journal of Education, Humanities and Literature (ISRGJEHL)

ISRG PUBLISHERS
Abbreviated Key Title: ISRG J Edu Humanit Lit
ISSN: 2584-2544 (Online)
Journal homepage: https://isrgpublishers.com/isrgjehl/
Volume – I Issue-III (May – June) 2024
Frequency: Bimonthly

Determination of the subjects that students have difficulty in high school physics teaching with the opinions of high school physics teachers

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| **Received:** 26.04.2024 | **Accepted:** 02.05.2024 | **Published:** 08.05.2024

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Abstract

The aim of the study is to identify the issues that students have difficulty in teaching high school physics, in line with the opinions of high school physics teachers. In the study conducted using the cross-sectional survey design, which is one of the quantitative research methods, data were collected by applying a survey to high school physics teachers to determine the issues that students have difficulty in teaching physics, developed by the researchers. The data collected with the participation of 35 high school physics teachers teaching in a medium-sized province in Eastern Anatolia was analyzed with descriptive statistics and the percentage of each subject was determined. As a result of the procedures, it was determined that the subject that high school physics students had the most difficulty with was Electricity and Magnetism, and the subject that they had the least difficulty with was Introduction to Physics.

Keywords: *High School Physics Teaching, Difficult Topics in High School Physics Teaching, Opinion of High School Physics*

1. INTRODUCTION

The ability of a country to keep up with the ever-evolving science and technology depends on a quality education system that is open to innovations and provides qualified individuals to the society. The rapid development in science and technology has increased the importance of science teaching in the general education system (Bahar and Polat 2007). In order for the education system to provide qualified individuals to the society, there are aims to be achieved during teaching. Curricula have four main objectives. Each curriculum has special objectives other than these basic objectives. Science curriculum also has special aims as every curriculum has. There are 10 specific objectives in the science teaching programme (MoNE, 2018). It has been observed that the science teaching programme is perceived as difficult at different levels compared to other fields and this has reached a high level in some science subjects (Bahar & Polat, 2007). In some studies, data showing that the most difficult subjects among the subjects in the science course are in the field of physics (Bahar & Polat, 2007; Ogunkola & Samuel, 2011; Timur et al., 2016; Tuncel & Fidan, 2018). As stated, it is a common situation that students have more difficulty in certain subjects within the courses they have difficulty in. The fact that students have more difficulty in certain subjects of the science course, which is difficult to teach due to its nature, can

DOI: 10.5281/zenodo.11140748

be given as an example of this situation. In a study conducted by Ogunkola and Samuel (2011), it was found that students had more difficulty in certain science subjects than others and this had a great effect on the difficulties encountered in science teaching.

One of the specific aims of the science curriculum is to provide students with basic knowledge about certain fields including physics (MoNE, 2018). Physics is the branch of science that mathematically expresses the general properties of matter other than its chemical structure through experiments, observations and applications based on general or temporary laws. Physical science contributes greatly to the advancement of technology by explaining the working principle of today's inventions and the events encountered in daily life. The education of physical science, which is used to explain many natural phenomena such as lightning, mobile phones, motor vehicles, aircrafts and many more, which have a very important place in our lives, is of great importance (Şahin & Yagbasan, 2012).

Our students are introduced to physics, whose teaching is of great importance, as one of the fields that the Science course in primary and secondary school aims to provide basic knowledge about. Physics, which starts to be seen as a separate course in high school after primary and secondary school, takes place in the lives of our students, especially those who are orientated towards positive sciences, for many years. The science course, which is known to have low success in national and international exams, is among the courses that students have difficulty from primary and secondary school classes to later classes (Tuncel & Fidan, 2018). In our country, it has been determined that the physics course, which is included in science sciences, is included among the courses that are difficult to understand by many students (Tuksal, 2018). There are many studies conducted to determine the reasons for the difficulties in physics teaching (Erinosho, 2013; Ornek et al., 2008; Şahin & Yağbasan, 2012). As a result of these studies, it was determined that the fact that physics course contains too many mathematical operations and generally consists of abstract subjects where a concrete representation is not possible, the way the subject is taught and the differences of students cause difficulties in physics education (Şahin & Yagbasan, 2012; Erinosho, 2013; Tuncel & Fidan, 2018). The fact that students have more difficulty in certain subjects in a course is also valid in physics course. Students continue to have difficulty in some subjects of the high school physics course as well as in the physics subjects in the science course. The reason for this may be that the courses that are difficult at the primary education level continue to be difficult in secondary education and university, and this situation may be similar in more than one country (Balar & Polat, 2007). In addition to the difficulties in physics teaching, it has also been observed that students do not like to ask for help from the teacher and answer the questions asked during the physics lesson (Erinosho, 2013).

Students' negative attitudes towards the science course during primary education, society's thoughts that this course is difficult, and students' coming to the course with prejudice may cause problems (Akıncı, Uzunu, & Kışoğlu, 2015). Especially in the early periods, it is difficult for students who have difficulties in science subjects in this way to be successful in learning the subjects in this field at an advanced age (Tuncel & Fidan, 2018). As a result, it can be said that there is a possibility of having difficulty in physics subjects that are difficult in science at high school or university level. Physics, which contains the most difficult subject among the fields that the science course aims to provide basic knowledge about, is among the least preferred branches of science by students (Erinosho, 2013; Tuncel & Fidan, 2018). The majority of students are prejudiced towards the physics course, which students are very afraid and unsuccessful (Aycan & Yumuşak, 2003). The fact that students have difficulties in the course can affect their attitudes towards the course. For this reason, one of the reasons why students do not choose the field of physics may be the subjects they have difficulty in. Determination of the subjects with difficulties will pave the way for determining the causes and solutions of these difficulties. This, in turn, can help students to break their prejudices and increase the rate of orientation towards the field of physics. Identifying the subjects that are difficult is an important step to prevent such possible problems. Identifying the subjects that are difficult in physics course is important for keeping the physics course at the determined standards. In order to keep the physics course, which is of great importance in our lives, at the determined standards, determining which of the subjects in the programme are difficulties will enable the causes to be determined and appropriate solutions to be offered.

Teachers who create and implement the environment in which the programme will be implemented are the primary people whose opinions should be taken in determining these and similar problems (Bayrak and Bezen 2013). For this reason, in this study, it was aimed to determine the subjects that students have difficulty in high school physics teaching by high school physics teachers.

2. METHOD

Method /Model of the Research

Cross-sectional survey design, which is one of the quantitative research methods, was used in this study conducted to determine the subjects that students have difficulty in high school (9th, 10th, 11th and 12th grades) physics teaching. Quantitative studies examine the relationship between variables and test objective theories. Survey research, another name of which is questionnaire research, generally aims to obtain the opinions of a large mass of people about a particular subject (Fraenkel et al., 2012).

Study Group of the Research

The population of the study consists of high school physics teachers in the Eastern Anatolia region. Due to time and resource limitations, a medium-sized province in Eastern Anatolia was selected as a sample from the population. In this province, 35 high school physics teachers participated in the study.

Data Collection Tools and Process

Quantitative data were collected using a questionnaire consisting of closed-ended questions. In order to determine the subjects that students have difficulty in teaching high school 9th, 10th, 11th and 12th grade physics courses, a questionnaire for determining the subjects that students have difficulty in physics teaching developed by the researchers was applied to 35 high school physics teachers. This questionnaire consisted of 18 items. In the questions in the questionnaire, the units in the physics course of 9th, 10th, 11th and 12th grades were stated as they are included in the curriculum. Teachers were asked to indicate the difficulty level of the unit by marking one of the options of 0%, 25%, 50%, 75% and 100%, taking into account the grade level at which these units were taught.

In order to collect the data of the study, ethics committee approval was obtained from Erzincan Binali Yıldırım University Human Research and Educational Sciences Ethics Committee (Date:

DOI: 10.5281/zenodo.11140748

30/05/2022, No: 05/12). The data of the study were obtained by using the questionnaire for determining the subjects that students have difficulty in physics teaching. The questionnaire was applied to high school physics teachers participating in the study.

Analysing the Data

The data collected through the questionnaire were subjected to quantitative data analysis. These quantitative data were analysed with descriptive statistics.

3. BULGULAR

The percentages of the obtained data calculated with the help of the statistical programme are presented in Table 1.

Table 1: Percentages of the subjects according to their difficulty

Units	N	Difficulty Percentages of Subjects
9.1. Introduction to Physics	35	25,00
9.2. Matter and Properties	35	43,57
9.3. Motion and Force	35	53,57
9.4. Energy	35	48,57
9.5. Heat and Temperature	35	52,86
9.6. Electrostatic	35	44,29
10.1. Electricity and Magnetism	34	59,56
10.2. Pressure and Lifting Force	35	55,71
10.3. Waves	35	53,57
10.4. Optics	34	54,41
11.1. Force and Motion	34	55,88
11.2. Electricity and Magnetism	33	64,39
12.1. Circular Motion	34	56,59
12.2. Simple Harmonic Motion	34	56,62
12.3. Wave Mechanics	34	60,29
12.4. Introduction to Atomic Physics and Radioactivity	34	53,68
12.5. Modern Physics	34	54,41
12.6. Applications of Modern Physics in Technology	34	43,38

As seen in Table 1, it was determined that the first subject that high school physics students had the most difficulty in was Electricity and Magnetism, Unit 2 of Grade 11, the second subject was Wave Mechanics, Unit 3 of Grade 12, and the third subject was Electricity and Magnetism, Unit 1 of Grade 10. In addition to this result, it was determined that the first subject that high school physics students had the least difficulty was Introduction to Physics Science, Unit 1 of Grade 9, the second subject was Applications of Modern Physics in Technology, Unit 6 of Grade 12, and the third subject was Matter and Its Properties, Unit 2 of Grade 9. The graphical representation of the percentiles is shown in Figure 1.

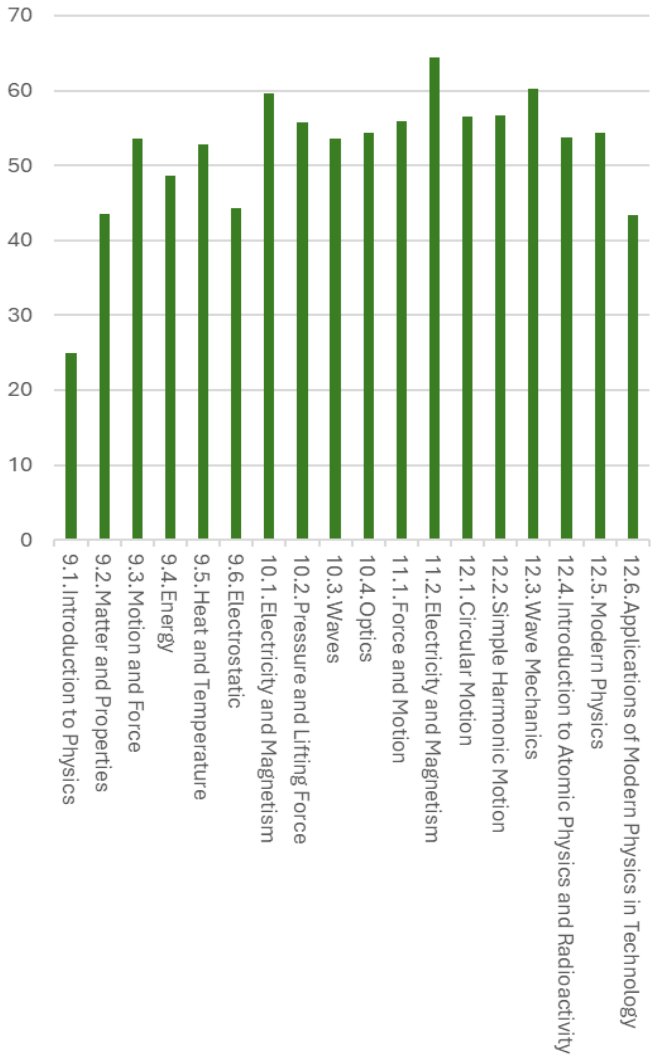

Figure 1: Column graph according to the difficulty of the subjects

In Figure 1, it is clearly seen that the most difficult subject in high school physics is Electricity and Magnetism, which is the second subject of the 11th grade with 64.39%.

4. DISCUSSION AND CONCLUSION

As a result of the study, according to high school physics teachers, two of the three subjects that high school physics students have the most difficulty in physics course are "Electricity and Magnetism". The findings are remarkable and important in terms of teaching high school physics course and are similar to the results of some studies in the literature (Akdeniz et al., 2000; Aycan & Yumuşak 2003; Aytekin, 2018; Bayrak & Bezen, 2013; Chabay & Sherwood, 2006; Günbatar & Sarı, 2005; Şahin & Yağbasan, 2012; Turgut et al., 2006). In a study conducted by Akdeniz et al. (2000), in which the sample group was 320 elementary science students, it was concluded that 70% of the students had difficulty in understanding the subject of electricity and 40% had difficulty in understanding the subject of magnetism. In a study conducted by Aycan and Yumuşak (2003) in which the sample group was university students, students stated that the most difficult physics subject was "Electricity and Magnetism". In a study conducted by Aytekin (2018), as a result of an interview with physics teachers, it was concluded that the subjects and concepts in the "Electricity and Magnetism" unit are difficult to explain and understand. In a study conducted by Bayrak and Bezen (2013), it was concluded that

DOI: 10.5281/zenodo.11140748

teachers think that they have difficulty in learning six subjects including electricity and magnetism. It has been observed that even successful students often find electricity and magnetism difficult and confusing (Chabay & Sherwood, 2006). In a study conducted by Günbatar and Sarı (2005) in which the sample group consisted of 27 physics teachers and 390 students from 8 high schools, it was concluded that 19.3% of the students had difficulty, 31.2% did not have difficulty and 49.5% sometimes had difficulty. In a study conducted by Şahin and Yağbasan (2012) in which the sample group was physics teacher candidates, it was concluded that magnetism was the most difficult subject. In a study conducted by Turgut et al. (2006), in which the sample group was university first year students from certain departments, it was concluded that subjects such as electromagnetic induction, which is one of the subtopics of electricity and magnetism, and electromagnetic waves, which is one of the subtopics of wave mechanics, were perceived as difficult by students. The results of the mentioned studies are in line with the findings of our study. In addition, it is seen that the physics subject that is difficult in elementary science course is compatible with the subject that is difficult in high school. This correspondence shows that students continue to have difficulty in the subjects they have difficulty in primary and secondary school classes until the next grades. Determining the subjects that students have difficulty in physics course is important in terms of providing appropriate solution suggestions in future studies.

Recommendations

It can be investigated whether the subject identified with the data obtained as a result of the study is also seen as difficult by the students and if it is seen as difficult, what are the reasons. It can be investigated whether the factors affecting the perception of the subject as difficult are due to students, teachers, curriculum or past learning. Determining these is important in terms of offering solutions. In order to prevent the subjects that students have difficulty in high school physics course, solutions can be offered to this difficulty. It can be investigated why students continue to have difficulties in the following years in subjects that are difficult at the primary school level and appropriate solutions can be offered. For example, if the reason why the subject is seen as difficult is due to the curriculum, more time can be allocated to the subject in the curriculum, the content of the subject can be lightened or more efficient teaching methods and techniques can be used during the explanation of the subject.

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DOI: 10.5281/zenodo.11140748