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The Impact of Differentiated Instructional Media on the Motivation and Opinions of Students towards Science Learning in Terms of Learning Styles

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Abstract

This study, it was aimed to determine the motivation of students to learn science according to learning styles and the effect of differentiated teaching practices on their opinions. A mixed research design consisting of a preliminary post test-tekrar test model with a control group and a qualitative data combination was used. The survey was conducted on 4th-grade students. 63 students, 30 in the experimental group and 33 in the control group, constituted the study group. The data were collected using the "Motivation Scale for Science Learning" and the "semi-structured interview form." As a result of non-working findings, it is concluded that differentiated teaching practices according to learning styles are more effective for students' motivation towards science learning than traditional teaching methods and that teaching-oriented student views support differentiated teaching practices.

Keywords: Differentiated instruction, Motivation, Science learning, Learning styles

Introduction

When the researches related to the factors affecting the learning process of the students are examined, learning environment and individual differences are important factors. In the related literature, the methods and techniques used by teachers and strategies are among the factors affecting students' attitudes towards learning, attitudes and motivations towards learning, learning styles, and individual differences such as intelligence areas of learners. (Allen, 1995; Collison, 2000; Dart et al., 1999; Dunn, et al., 1993; Ekici, 2013; Heacox, 2002; Postlethwaite, 1993; Tomlinson, 2003).

There are many studies in the literature that have been developed taking into consideration the individual differences of learners and learning styles, which have a positive effect on the academic achievement and attitudes of the students. (Bozkurt & Aydogdu, 2009; Demirkaya, 2003; Mutlu, 2004; Peker, 2003; Uzuntiryaki, et al., 2003; Uyganör & Dikkartin, 2009).

The first studies on learning styles in the literature were seen at the beginning of 1890s and many models of learning styles were tried to be presented until the time of day. The most common learning style models; These models are developed by Kolb (1984), McCharty (1987), Dunn and Dunn (1989), Myers (1962), and Jung (1921). The Kolb Learning Style Model also referred to as the experiential learning model, is based on the learning cycle model proposed by Carl Jung.

In the experiential learning model, there are four different learning abilities: concrete life, concrete conceptualization, active life and reflective observation. According to Kolb (1984), there are two dimensions in the learning process: knowledge comprehension and processing dimensions. The concept of grasping extends from abstract thinking to abstract conceptualization. While analyzing how an individual perceives it, The process dimension extends from the reflective observation to the active life and analyzes how the individual operates the knowledge (Ekici, 2013).

In experiential learning theory, the individual's learning style is a component of four learning abilities. In the direction of these four skills, Kolb (1984) divides individuals into a learning style that segregates, transforms, assimilates and places them.

- Characteristics of individuals with disintegrating learning style: Problem-solving, decision making, logical analysis of ideas and systematic planning are important. They are successful in problem-solving and systematically plan when solving problems. They like to work in a planned way. Learning by doing is important.
- The characteristics of individuals with a changing style: They are aware of their ability to think, values and meanings. They tend to focus on concrete situations in many ways and organize relationships in a meaningful way. In learning, they are patient, objective, careful judges, but not in action. Their thoughts and feelings are of primary importance.
- Characteristics of individuals with assimilative style: The creation of conceptual models is the most prominent feature. When they learn something, they focus on abstract concepts and ideas.
- The characteristics of the individuals with the style of placing: Planning, making decisions and taking part in new experiences are the main features. In the case of learning, individuals are open-minded and adapt easily to change.

It is necessary to acknowledge that individual differences in learning are the individual differences in learning when students are thought to have the subjective knowledge capacity, thoughts, and experience they have used to achieve the learning outcomes and that all these characteristics are likely to be effective in the learning process (Atalay & Ay, 2016).

One method that fits the constructivist understanding of the basic philosophy of new teaching programs and advocates increasing diversity based on the individual differences in class is differentiated teaching. Differentiated teaching is defined as an approach that allows students to adapt to all of the subjects with different content, process and product dimensions, teaching themes presented in the teaching environment, different desires, different learning approaches and different readiness levels (Heacox 2002; Oliva, 2005; Tomlinson 2005). Differentiated instruction offers different ways for learners to learn, understand and express what they learn during the learning process. Through these different ways, students can effectively internalize subjects and concepts related to themes.

This study, it is aimed to answer the following problems to test the differentiated teaching practices according to the learning styles of the students, to test the motivation of the students to learn science and the opinion that they will influence their views positively.

Method

Research Model

In the study, a quasi-experimental design with the pre test-post test control group (Çepni, 2010) was used. Experimental patterns; cause-effect relations (Karasar, 2009). In the study, a semi-experimental design was chosen from experimental designs; because students in the experimental and control groups are not randomly dispersed. The similarity of pre-test achievement levels of students was determined by academic achievement test and "Science Learning Orientation Motivation Scale" was used as pre-test and post-test in both groups. In the process, the lessons were maintained in the experiment group with the science and technology curriculum supported by the differentiated teaching methods according to the learning styles of the students and in the control group with the current 2005 science and technology curriculum.

Participants

The research was conducted with the 4th-grade students studying at Ziyapaşa Elementary School in the spring semester of the 2014-2015 academic year. 63 students, 30 in the experimental group and 33 in the control group, constituted the study group. Before the differentiated teaching and traditional teaching methods were applied, the students 'achievement test scores differed; in other words, students' pre-test achievement levels were similar and t-test was used.

Table 1: t-Test Results on Academic Achievement Scores of 1 Experiment and Control Group Students

Group	N	$\bar{X}$	S	sd	t	p
Experiment	30	24.62	5.371	69.247	-1.100	0.293
Control	33	26.43	4.038			

As shown in Table 1, no statistically significant difference was found when the pre-test results of the experimental and control group students participating in the study were examined (t (69,247) = 1.100, p = 0.293 > 0.05). This result shows that the students have similar levels of achievement before the application and therefore are suitable for testing the essays of the study.

Data Collection Tools

The "Motivation Scale for Science Learning" and "Semi-structured Interview Form" were used as data collection tools in the study to determine students' motivation levels for learning science.

Motivation Scale for Learning Science

In the study, the "Motivation Scale for Science Learning" developed by Dede and Yaman (2008) was used. The motivational scale consists of 5 items of Likert type and 23 items. The items in the scale are rated with 1 score "I Participate Totally" 5, "I Participate" 4, "I am Undecided" 3, "I Do Not Participate" 2 and "Never Participate". Negative items were reversed during the scoring phase. The reliability coefficient of the scale was calculated as 0.80. The Cronbach's alpha reliability coefficient of your scale was 0.87.

Semi-Structured Interview Form

The semi-structured interview form used for gathering the data was developed based on a comprehensive field-type scan. To determine the validity of the form, three scholars in the field of educational sciences have been consulted. The draft form has been finalized by making necessary corrections in line with the suggestions. Before the application, focus group work was carried out with four students who matched the sampling scale used in the research to control the questions in the draft form in terms of content and narration, and arrangements and additions were made to the questions. The opinions of the students were written in the article and descriptive and content analysis were performed on all the data. However, the direct citation has also been included to reflect original ideas and thoughts. (Yıldırım & Şimşek, 2005).

Application Process

The following steps have been followed in implementing the differentiated instructional methods prepared for the Unit 4 science and technology lesson primary education unit of the living world. Under the Ministry of National Education, Science and Technology curriculum, sub-acquisitions for each lesson were set out from the acquisitions in the Introduction to the Living World. After determining the achievements, topics were determined using the 4th-grade primary science and technology lesson book, internet, and science and technology auxiliary resource books. This main concept and rules are differentiated according to the learning styles of the students. Students are provided different products according to their learning styles by passing through different learning processes. Below, information about the methods, techniques and teaching works applied by the learning styles during the application is given.

Concrete Experience Phase

Individuals with a concrete experience learning style need to feel learning about individual situations in the learning process, such as photo-painting and

individual-bilingual studies. In the experiment group, the following methods and techniques were applied by the concrete experience learning style and the photo-image examination related to the learning topic.

A) Role Playing Method

- It has been applied to gain the concept of learning through concrete experiences.
- Volunteer students selected
- The role cards of the creatures prepared by the researcher are distributed.
- Time for preparation is given.
- Students have played game with their role cards.
- At the end of the game, there was a class discussion about roles and features

B) Case Study Method

- It has been applied to feel the situation related to the learning topic and give concrete experience.
- Short texts prepared by the researcher for the problems in the living world are presented written form as a case study
- The problems in the text were summarized by the students
- The possible solution recommendation is listed.

C) Is it True? Is that Wrong? Technique One

- It has been implemented through individual study to enable students to feel the situation related to the learning topic and obtain individual information.
- Worksheets in which some true and false statements about the learning topic are included are distributed
- There is a period for the students to find out which statement is correct and incorrect.
- The accuracy and mistakes of the expressions are discussed in class.
- The necessary explanations have been made by the teacher.

Reflective Observation Phase

Individuals with a reflective learning style of learning need to be addressed through various perspectives on learning issues and why and why their questions are answered. In the method of discussion, according to the learning style, brainstorming technique and discussion method were used.

A) Discussion Method

- Used to give students the opportunity to think about the subject, to provide a complete understanding of the subject and to provide examples of past experiences.
- Groups of five people were created and discussion topics were given.
- After a while, there was a lot of discussion about the topic.
- The students list the results of the discussion on the worksheets.

B) Fish Bread Information Map

- Used to reveal the causes and consequences of historical events.
- Students have been given empty fishbone worksheets.
- Students are asked to write the events at the top of the fishbone and the results at the bottom of the fishbone.
- Talked about the writings on the worksheets.

C) Brain Storming Technique

- It is used to reveal different aspects of the view.
- A student has been selected as a writer.
- Discussion topic presented
- The students talked about their thoughts on the subject.
- These are written on the board.
- The ideas written on the throne are discussed.

Abstract Conceptualization Phase

Individuals with an abstract conceptualization learning style need to be given theoretical knowledge to present the learning concept logically. For this reason, the method of expression has been utilized by this learning style.

- The purpose of giving theoretical information is summarized.
- The teacher gave information about the subject and summarized it
- Students were asked questions from time to time, and the narration was shaped according to the answers.

Active Experience Phase

Individuals with active experience learning need to relate to, learn from, apply to, express in different

ways. For this reason, in the last part of the course, the Bil-curiosity-learning technique, information map and puzzle worksheets were applied.

A) Bil-Curiosity-Learning Technique

- It has been applied to establish a relationship between pre-learning and new learners.
- Students first list what they know about the subject.
- Then, list their curiosity about the subject.
- In the third stage, they write about the information they have reached by doing researches and interviews about the topics they are curious about.
- Students present their three-part lists to their friends.

B) Information Map

- It has been applied to observe the learning and to establish the relationship between the learners.
- Students are provided with worksheets containing basic information on the subject.
- There is a period for the students to remember what they know about the information or ideas on the worksheets.
- Students add the information they remember to their worksheets.
- The students presented their studies to their friends.

C) Puzzle

- Puzzles were Prepared by the Researcher Regarding the Topic
- The students answered the puzzles.
- The answer to the puzzles is discussed in class.

In the control group, the following processes were carried out in the coursework.

- The subjects were carried out by the guidelines set out in the teacher's manual.
- The differentiation of learning styles of learners has not been realized during the activities.
- Lecture, question and answer techniques are used.

All the materials (study papers, cardboards, etc.) used in the lessons were prepared by the researcher. Prepared lesson plans were examined by 3 class teachers and their approvals were taken. In the study, materials that are suitable for the multi-disciplinary teaching method were developed.

Assessment in differentiated teaching is done in two dimensions, determining the degree of achievement of learners and assessing the effectiveness of teaching (Tomlison, 2001). In this study, the two dimensions that were mentioned in the evaluation studies were carried out. At the end of each lesson, written or verbal reflection was taken from the students and both the learning process and the teaching process of the students were evaluated. In line with the reflections from the students, the course plans have been changed and necessary changes have been made. To evaluate the products produced by the students, the worksheets they have worked on at the end of each lesson are collected and necessary feedbacks and corrections are indicated. The next lesson is given back to the students.

Process Steps

The following steps were followed in implementing the differentiated teaching methods.

- The motivation scale for learning science was applied to all the students who participated in the research.
- After applying the scale to the students, the implementation of teaching methods has been started.
- The application lasted 6 weeks (18 lessons). During the application, the teachers' opinions were taken in the control groups and the studies were made simultaneously.
- The motivation scale for learning science applied before the unit was processed in the last application was applied as a post-test after the application.

Analysis of Data

In the study, the use of non-parametric analysis methods was found to be more appropriate as the number of students in the experimental and control groups was 30-33. Çepni (2010) states that the non-parametric test method is used instead of parametric tests when the sample does not represent the distribution. The number of samples is small enough to be mathematically untreated. Mann-Whitney U test was used to compare independent groups and Wilcoxon Marked Rank tests were used for dependent groups. The Mann-Whitney U test is used

to compare the nonparametric alternative to the t-test and whether the distributions of two independent sample measures differ (Balci, 2007). The Wilcoxon Signed Ranks test is used to test the significance of the difference between the scores of two related sets of measures (Büyüköztürk, 2006).

Results

Findings Related to the First Subproblem

The Mann-Whitney U test results for the independent groups regarding the differences in the scores of the experimental group and the control group 'Motivation Scale for Science Learning' were given in Table 4 before the application.

Table 2: Results of the Students' Preliminary Test Scores on the "Motivation Scale for Science Learning"

Group	N	Mean	Total	U	p
Experiment	30	18.29	338.00	151.30	.798
Control	33	18.63	348.00		

When table 2 is examined, there is no significant difference between the scores of the experimental (SO = 18.29) and control (SO = 18.63) students' motivation to science learning scores (U = 151.30, p>.05). In this context, it can be said that the experimental and control group students' motivation levels for learning science are similar.

The Mann-Whitney U test results for the independent groups of students in the experimental group and the control group after the application were compared according to the scores of the "Motivation Scale for Science Learning."

Table 3: The results of the students' "Motivation Scale for Science Learning" Final Test Scores

Group	N	Mean	Total	U	p
Experiment	30	24.37	421.00	79.50	.007
Control	33	14.34	258.00		

As shown in Table 3, there is a significant difference between the scores of the "Motivation Scale for Science Learning" scores of the experimental group and the control group after the application (U = 79.50, p <.05). When the order average is taken into consideration, it is seen that the experimental group with the differentiated teaching science and technology curriculum is 24.37, while the control group with the science and technology curriculum is 14.34. According to these findings, the motivation levels of the students in the group in which the differentiated instruction was applied increased significantly compared to the control group. In this context, it can be said that the students with differentiated education influence the level of motivation for learning science.

The results of the Wilcoxon Marked Quartile Test on whether the scores of students in the experimental and control groups differ from the "Motivation Scale for Science Learning" used to examine motivation levels are given in Table 4.

Table 4: Conclusions Concerning Preliminary Test-Final Test Scores Compared to Students' "Motivational Scale for Learning Science"

Group	Pre-Post Test	n	Mean	Total	Z	P
Experiment	Negative	0	0	194.00	3.69	.000
	Positive	30	9.55			
	Equal	0	0			
Control	Negative	0	0	0	2.11	.188
	Positive	33	10.50	153		
	Equal	0	0	0		

As can be understood from Table 4, it is seen that there is a meaningful difference between the scores of the students who applied differentiated instruction before and after the application of the "Motivation Scale for Science Learning" (z=3.69, p<.05). Positive rankings of this difference are observed when the average scores and total scores of the students in the experiment group are taken into account, are added to the final test score. According to these findings, it can be said that differentiated instruction affects the motivation levels for learning science positively. There was no significant difference between the pre-test and post-test scores of the motivation levels of the control group students applying the science and

technology curriculum (z = 2.11, p>.05). The rank order and rank totals of the students in the control group are in the positive direction and the end test is in favor. In this context, it can be said that the 2005 science and technology curriculum has no significant effect on the motivation levels of the students. In contrast, differentiated teaching affects the motivation levels of the students.

Findings related to the Second Subproblem

The third sub-problem of the study was defined as "what are the views of the students applying differentiated teaching methods to practice?" The opinions of the students were written in the article and descriptive and content analysis were performed on all the data. However, the direct citation has also been included to reflect original ideas and thoughts.

60.66% of the students in the experimental group stated that they did not meet with such activities before, compared 13.33% and 26.66% partially, while 90% of the students expressed their active participation in the class by activities and 3.33%, While 6.66% stated that they were partially active.

- …E8... We have never treated science classes like this before ...
- ...E14... it was different from other courses, we had a lot of fun as a group ...
- ...E21... We had similar activities to these last year ...

93.33% of the students in the experiment group stated that they liked the activities, 3.33% did not like the activities and 3.33% of the students liked the activities partially. While 83.33% of the students stated that they did not understand how the students spent in the activities and lessons, 6.66% stated that no answer in this case and 10% did not understand how the students spent in the activities and lessons.

- …E11… I can not wait ... when we will study the lesson ...
- ...E13... the lesson was very quick in the lessons ...

90% of the students in the experiment group stated that they were interested in taking part in the activities, 3.33% said they did not like to take part in the activities, and 6.66% they liked to take part in the activities. They stated that 80% of the students provide their strengths and weaknesses, 10% do not recognize their strengths and weaknesses, and 10% are partly strong and weak. While 76.66% of the students stated that their confidence increased at the end of the activities, 6.66% did not increase their confidence and 16.66% stated that they increased their confidence partially.

- ...E14… I was so happy that I fulfilled both my duty and the time of my duty ...
- ...E9… I realized that I learned things in a different way than my friends ...

While 63.33% of the students in the experiment group stated that they enjoyed working with their friends, 16.66% stated that they did not enjoy the activities and 20% expressed that they enjoyed the activities in part. 56.66% of the students stated that they knew their strengths and weaknesses at the events, 16.66% did not recognize the strengths and weaknesses of their friends at the events, and 26.66% at least part of the activities knew the strengths and weaknesses of their friends.

- ...E27... I noticed that I understood better in class with my friends whom I did not play in breaks ...
- ...E2… I did not know that he was going to write such a beautiful piece of paper ...

While 90% of the students in the experiment group stated that they could express their opinions in written and oral form in the events, 10% stated that they partially expressed their opinions in written and verbal ways. 63.33% of the students stated that the activities developed the research skills, 13.33% the activities did not improve the research skills, and 23.33% the activities partially developed the research skills. Within the scope of the research, 66.66% of the students stated that the activities had increased their interest in science and technology lesson, 10.33% said that the activities did not increase the science and technology lesson and 3.33% said that they increased their activities partially in science and technology lesson.

- ...E30... science and technology course took place among my favorite courses ...
- ...E4... I expressed myself more in writing, I hesitated in expressing myself verbally, but at least I was able to do so, so I was very happy ...

It was stated that 56.66% of the students in the experiment group could use the knowledge and skill they could gain in the other courses, 13.33% could

not use the information and skills they gained in the activities and 30% could use the knowledge and skills they have gained in the activities partially in other courses. While 83.33% of the students stated that the activities provided a better understanding of the subjects, 3.33% stated that the activities did not provide a better understanding of the subjects and 13.33% of the participants provided the events partially better understanding the subjects. In addition, 56.66% of the students stated that they learned more about the activities in the environment, 6.66% said that they learned more about the activities. In comparison, 13.33% said that they did not become permanent, while 30%, 16.66% of the living things in the environment did not contribute to better observations. They observed that the living things in their surroundings were partially better observed.

- ...E22... I felt like I was in the Turkish language in the Science and Technology course ...
- ...E7... now I know much more about the characteristics of animals and plants around ...

Discussion

According to learning styles in research, differentiated teaching practices are an important factor for students' motivation to learn science. It is considered that the superior aspects of differentiated teaching from the data obtained in the direction of classroom teachers 'observations, teacher evaluation forms, student evaluation forms, student work files and student opinions are considered as positive contributions to the students' scores.

Differentiated teaching methods, especially considering the learning styles of the students, need to be taken into account, have to work with their friends at their level, to feel belonging within the group, to encounter more material and stimuli about the subject, to take responsibilities and responsibilities at their level, It is believed. In addition, it is considered that the developmental periods of elementary school students should be more willing to cooperate and support their willingness to live their sense of accomplishment, which will contribute to the interest and motivation of the lesson and also contribute to the academic achievement scores in this case.

It is in parallel with the related literature that the students work with their friends at their level, the feeling of belonging within the group, their lives, their duties and responsibilities to their level, and the learning that makes them more effective. As a result of the research conducted by Samms (2009), the differentiated teaching methods have increased solidarity among students, improved communication skills, and increased interaction with friends in the group ". McCartney (1997), Smutny (2003) finds that differentiated teaching methods are more likely to be performed by students with their colleagues, group consciousness, and improving their responsibilities.

It has been observed that providing students with the opportunity to use student-centered techniques in their differentiated instructional methods provides positive contributions to the success of the students, to their active involvement in the process, to the increase in classroom awareness, and their motivation. As presented in the daily plans of the researcher in this study process, brainstorming, discussion, internet research, drama, individual and group studies and flexible group work are the strengths of these methods. It is believed that the way these practices, which are known to differentiated teaching students, is not frequent in traditional teaching has a positive effect on the success of the students. In addition, these activities have been observed to increase the students' awareness of the students who are in motion due to their duties and responsibilities within the class.

It is in line with the relevant literature on how differentiated teaching methods provide students active participation in the learning process and increase their motivation. The finding that students' attendance and motivation increased in classrooms where differentiated teaching methods of the research were applied suggested that McAdamis (2001) suggested that "Being and Being and Sweeny" (2001) suggested that the teachers were more motivated and more motivated to learn in the application of the differentiated teaching approach. (2008), Chen (2007), Coulter and Groenke (2008), Fahey (2000), Geisler and others (2007), Kapusnick and Hauslein (2001), Tieso (2001), Tomlinson and McTigne (2006) findings and opinions.

Differentiated teaching methods have been used to prove the positive effects of the student's success on the study, and these methods are quite rich with many different techniques. Studies to determine the effects of different techniques of differentiated teaching-based learning on students' access should be undertaken in future studies.

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