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Identifying the Individual Differences Among Students During Learning and Teaching Process by Science Teachers

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Abstract

It is important for teachers to know variables such as physical characteristics, intelligence, perception, gender, ability, learning styles, which are individual differences of the learners. An effective and productive learning-teaching process can be planned by considering these individual differences of the students. Since the learners' own learning speeds and interests vary, these characteristics should be taken into consideration by the teacher. The aim of this research is to determine how science teachers are bringing out the individual differences of students during the learning-teaching process. Qualitative research method is used in this research and case is designed according to phenomenology. According to research findings, half of interviewed science teachers stated that individual differences are important for determining the learning styles of students. Again, half of the teachers emphasized that students identify their individual differences with the help of tests, homeworks and activities during the teaching and learning process. Teachers also stated that in order to design the learning-teaching process appropriate to the individual differences of the learners, the learners would make active participation in the lesson and the individual differences could be supported by increasing the experiment and school trips.

Introduction

Individual differences in students are personal differences specific to each student. Individual differences include variables such as physical characteristics (height, weight), intelligence, interest, perception, gender, ability, learning styles and personality traits (Ari and Deniz, 2008). In the process of learning-teaching, it is necessary for the teacher to plan learning by taking these individual differences into consideration. When planning teaching, it is more likely that a plan based on the learning style and speed of the students, rather than the collective instruction, will lead to a more efficient learning environment. Not every student learns in the same way, but every method does not attract the interest of each student on an equal level (Gözütok, 2000). In this process, it is very important to use the teaching methods and strategies that students can use different abilities and skills. In this context, considering the individual differences of the students, they will be able to create a rich learning environment as they draw attention to the lesson.

The needs and structure of the learners are very important factors that guide the behaviors of the learners in the class (Celep, 2004). Therefore, when teaching activities are planned, students will be able to use methods that meet the individual differences, needs and will enable the students to develop their skills as well as to ensure that the teaching process is successful. Since the learners' own learning speed, interest and ability include individual differences, these characteristics should be taken into consideration by the teacher and appropriate activities should be selected according to the student's level. Each learning is individual and there are differences in interest and ability of students (Goldberg and Baker, 1970). Some students are slow, some are quick learners. Some students need extra teacher help, some learn on their own (Moore, 2001). Each individual learns in a unique way, some learn best by hearing, seeing, seeing, reading, and touching some materials (Shaughnessy, 1998). Students who differ in capacity and power of achievement need different activities and assignments (Good and Brophy, 2008). Students differ from each other in terms of experience, socioeconomic status, ethnicity, culture, language and learning style. Using different teaching methods for different students using their own experience and learning backgrounds will be much more efficient (Borich, 2014), revealing the individual differences and special needs of the students. Student performance improves when students' strengths and special needs are matched by different teaching methods (Tomlison, 2010). Students' home background, cultural environment and socio-economic levels are important factors in determining school success (Breen &

Jonsson, 2005). When students choose their own teaching methods, techniques and strategies in the learning process their success increase (D'amico and Gallaway, 2008). At the beginning of the school year, it is necessary for teacher to know physical, psychological, economic, social and academic differences of the his/her students (Başar, 2002). The lack of knowledge on such differences amongst students may cause students not to participate in the learning-teaching process and thus academic failure. Discipline problems in the class can be reduced when the students are directed to meaningful activities and directed to their own interests and abilities. In addition, the influence of the students on the student and the socialization of the student have a very important place in the classroom method (Celep, 2004).

According to the characteristics of Good and Power (1976), students are divided into five categories. These are,

- A) Successful Students are students who tend to learn, are academically successful and prone to cooperate. Participate in the course, bringing very little discipline problem by fulfilling homework and activities.
- B) Social Students are the type of students who have less homework or activity orientation for more people. They prefer to engage in activities that have the capacity to achieve but socialize with their friends.
- C) Dependent Students are the type of students who need more teacher support and motivation. They often need additional clarification and help. They may be excluded by their classmates because the dependent students may be socially immature.
- D) Alienated Students are the type of students who are reluctant to learn and have the potential to leave the school. Some of these students refuse to even come to school. Some of these kinds of students can create hostile attack and challenge problems.
- E) Phantom Students are the type of students who are not recognized or heard in the class. Some of them are shy, some are nervous, some are quiet. They do the activities regularly, but they rarely participate in group work because they are not volunteers.

As can be seen in these categories, the classroom environment does not consist of uniform personalities, but rather an environment with many individual differences. Therefore, in such a multi-disciplinary learning environment, passing the same learning-teaching process to all students alike will affect the success of students negatively. The role of the teacher is to observe his / her students and to reveal the individual differences that exist in them and to arrange the learning environment accordingly.

Even if the schools would be equipped with state-of-the-art equipments, the better the physical conditions are, the better the physical environment of the school and the classroom will be, and even if the training programs are perfect, the students will not succeed unless teachers take into account the individual differences of the students. In short, when the teacher is planning the teaching, appropriate tools and materials for the individual differences of the students can help the students to plan and implement the appropriate teaching method technique and strategy for the individual differences, appropriate instructional material, suitable classroom layout for the students, and active participation in the learning-teaching process.

Aim of the Research

The aim of this research is to determine what science teachers are doing to bring out the individual differences of students during the learning-teaching process. In accordance with this purpose,

- 1) According to science teachers, what is the importance of individual differences in students?
- 2) What are science teachers doing to determine the individual differences of students?
- 3) What do science teachers do in their lessons to design a learning-teaching process appropriate to the individual differences of students?
- 4) What are the suggestions of science teachers to support individual differences of students?

Working Group

The study group consists of fourteen science teachers who are working in the province of Muğla in the academic year of 2015-2016. In the study group, these teachers were randomly selected and maximum diversity sampling method was used for purposeful sampling methods. The purposeful sampling method is useful in explaining and explaining facts and events in many cases (Yıldırım and Şimşek, 2013). Purposive sampling is a probabilistic and non-arbitrary sampling method and allows one to study the cases in depth by choosing rich situations in terms of information according to the aim of the study (Büyüköztürk, Çakmak, Akgün, Karadeniz ve Demirel, 2012: 90).

Table 1. Demographic characteristics of working group

Variable	Group	Frequency	%
Sex	Female	10	71.4
	Male	4	28.6
Age	21-25	1	7.1
	26-30	1	7.1
	31-35	1	7.1
	36-40	5	35.8
	41-45	5	35.8
	46+	1	7.1
Seniority	1-5	1	7.1
	6-10	2	14.3
	11-15	4	28.5
	16-20	2	14.3
	21-25	5	35.8
	26+	-	-
Graduated University	Faculty of Education	12	85.7
	Faculty of Arts and Sciences	2	14.3

According to Table 1, the majority of interviewed teachers consist of women and graduates of teacher education faculties. Again, the majority of the teachers who participated in the interview were age range (36-40) and (41-45). As a year of seniority, teachers have more (11-15) and (21-25) seniority.

Method

Qualitative research method is used in this research and case is designed according to phenomenology. The qualitative research, "advocates the use of intuition, deep understanding, fuzzy logic, versatile thinking, counterintelligence instead of reasoning, because there is no such concern as the generalization of scientific knowledge" (Sönmez and Alacapınar, 2011: 70). The use of the qualitative method has been preferred because it provides comprehensive and in-depth information (Yıldırım and Şimşek, 2006) to deal with perceptions and events in a holistic way. Results using qualitative interviews, observations, field notes, and open-ended questions are often based on direct quotations from participants with descriptive explanations rather than statistical reports (Johnson and Christensen, 2012), which aim at in-depth and detailed analysis of events in qualitative research. In the case study, the researcher tries to obtain new information about the cases that are noticed or not by making close and long interviews with the individual or group (Gürbüz and Şahin, 2014).

The study group was selected by using the objective sampling method in determining the teacher for the qualitative data of the research. Purposive / purposeful sampling allows the researcher to select rich cases for in-depth research in terms of information. (Büyüköztürk et al., 2011: 89).

Data Collection

In this study, the semi-structured interview form was developed by the researcher as a data collection tool. Expert opinions were received from four experts in instructional program development and measurement and evaluation. Experimental interviews were held with the two science teachers on whether the questions were

understandable and whether the answers were appropriate for the research questions. At the end of the process, the scope of the interview form was re-examined and edited, and made ready for implementation.

The data obtained from the interviews were analyzed and coded by reading the written texts in the direction of the research sub-problems. After the teacher interview records are done, the responses of the teacher candidates to the questions are examined and coded separately by an academic in addition to the researcher. After this step, the compliance coefficient was calculated using the reliability formula proposed by Miles and Huberman (1994) [Opinion union / (Unity union + Dispersion of opinion) x 100]. As a result of the calculation, the reliability of this research was found to be 87.92%. Over 70% of the reliability calculations are considered reliable for research (Miles and Huberman, 1994). In this context, the results obtained in the percentage of compliance in this study are considered reliable for the research. The personal information of the teachers participating in the interview was kept and the teachers were coded T1, T2, T3 ... T14. For example, the second teacher who participated in T2 interview, T8 represents the eighth teacher candidate, T14 represents the fourteenth teacher.

Results

Findings on Teachers' Responses to the Question "What is the importance of individual differences in students' education?"

Table 2. Codes for the importance of student individual differences

Codes	Frequency	Teacher
Learning Style	8	3,4,5,10,11,12,13,14
Appropriate Teaching Method	4	2,4,6,7
Readiness Level	3	1,4,6
Learning Speed	2	1,4
Achievements	2	4,8

According to Table 2, about half of science teachers stated that it is important to determine individual differences to determine learning styles of students. They also emphasized the importance of choosing the appropriate teaching method, determining the level of readiness of the students, realizing the achievements and determining the individual differences to reveal the speed of learning. Teachers have expressed these views as follows;

"Students have different learning styles, there are individual differences, different types of intelligence, intelligence levels, understanding capacities are all different. For this reason, it is very important that the individual differences of the individuals are determined. " (T3)

"Because every student has a different ability to learn, they need to be identified because they are different. For example, some can learn by seeing, some can learn by doing, some can learn in a friend environment, so if they are known better education can be provided. " (T5)

Findings on Teachers' Responses to the Question "How do you determine individual differences of students in science class?"

Table 3: Codes for how individual differences are determined

Codes	Frequency	Teacher
Test, homework and activities	8	2,3,4,5,6,7,9,10
Observation	4	2,3,5,11
Projects	4	3,6,11,12
Directory Teacher	3	2,6,7
Drawing attention, example from daily life	2	1,10

According to Table 3, about half of the teachers stated that they identified the individual differences of the students with the help of tests, assignments and activities. In addition, the observation emphasized that the

students were able to draw individual daily differences by taking notes of the students. Teachers have expressed these views as follows:

"We are already in constant communication with the students already. School guidance teachers can also help us when individual differences are determined. Questionnaires can be developed about this. Apart from that, we are trying to determine the individual differences of the children by providing the activities, the projects, the experiments we have done, and the active participation of the children. " (T6)

"We are now performing a readiness test such as a leveling test at the beginning of the semester. When I enter the course, we can ask questions to identify the previous knowledge of the students. According to the answers given by the students according to that question, the level of self-confidence of the students also emerges. Apart from that, there are also techniques that guide teachers can apply. Does it emerge at the beginning of that period? No, it gradually appears during the period. For example, say in sociometry style, in the form of questionnaires to determine the reasons for failure, by applying surveys this student may have to pay attention to this feature. Another thing is that class teachers, class teachers are making meetings with individual students. The determinations there may come in here and teachers may say that one person in the room or one of his friends at work has the following characteristic of the student. " (T7)

Findings on Teachers' Responses to the Question "What are you doing in order to design a teaching-learning process in accordance with individual differences among science class students?"

Table 4. Individual differences codes for designing an appropriate teaching-learning process

Codes	Frequency	Teacher
Student responsibility	6	3,4,6,9,10,11
Experiment	3	5,8,10
Learning speed	2	1,3
Different teaching methods	2	5,6
Individual training plan	1	2
Student at the bottom level	1	2
Same ones in the same set	1	3

According to Table 4, teachers stated that they designed a teaching-learning environment suitable for their individual differences by giving students responsibilities, experimenting, adjusting to learning speeds, using different teaching methods, adjusting to the slowest learning speed and putting the same learning speeds into the same set. Teachers have expressed their views as follows;

"Firstly, I learn how my students learn, the types of intelligence. Students who are close to each other or who have the same intelligence type are placed close to each other in the same cluster position. Because they have identified their individual differences on this issue, and because they will also enjoy working together, individual differences have been reduced to a minimum. " (T3)

"Children have different teaching methods according to their different intelligence levels. We are trying to keep these methods too high during the course. For example, it is not just a lecture, it is not just a question-answer, but we are trying to replicate these training methods. Apart from that, as we have said before, we also see differences in our active participation of children. " (T6)

According to Table 5, the teachers suggested to increase the experiments to support individual differences, to make more trips, to make groups according to individual differences, to use the laboratory actively and to choose teaching method according to individual differences. In addition, teachers have proposed to develop individual tools to support individual differences, individual extra support for students, exploration of learning styles, activity design for individual differences, individual design of the course book, and assignment of homework, projects and parents. Teachers expressed their views as follows;

"For example, textbooks can be edited accordingly. For example, I see our textbooks as fairly barren. We do not have everything we need to practice it, but we do have different activities, different tests, different things, visually, or visual material can be presented to us. " (T5)

"Absolutely the experiment should be increased. Students will touch materials in lessons so that they can learn better. I do not defend too many interactive boards, although I use too many mysterious interactive

boards, because the child is satisfied with seeing just one presentation. I especially say that experimentation and observation should be given weight because some children like planting, some children-we have a telescope in our school- I like to observe the sky, I think that individual differences can be supported by doing different activities like this. I think that activities need to be boosted, not just on paper, but practical education can give children something much more in an individual sense. " (T14)

Findings on Teachers' Responses to the Question "What are your suggestions for promoting individual needs of your students in science courses?"

Table 5: Recommendation codes to support individual differences of students

Codes	Frequency	Teacher
Experiments increased	5	1,3,5,9,14
Excursions	4	6,9,10,12
Individual difference group	3	2,6,13
Active laboratory	2	1,10
Teaching method	2	2,6
Guide teacher	2	2,7
Tools	1	1
Extra support	1	2
Learning styles	1	3
Activity design	1	3
Textbook	1	4
Homework and projects	1	6
Parent Involvement	1	7

Discussion and Conclusion

Learning styles of students are different from each other. The fact that learning styles are different is not a shortcoming but rather a feature that enriches the learning environment. If the student feels ready for self-learning, this is the learning style for the student. In other words, how the student wants to learn is the best learning style for this student. When the learning environment is oriented towards natural tendencies such as studying, exploring, touching the student, the student is willing to participate in the lesson. In addition, the matching between learning styles and learning activities in the learning environment positively affects the academic success of the student. Above all, identifying the learning styles of the students and designing the activities accordingly will also make learning easier for students who have a learning disability. It is very important for the teachers to reveal the learning styles of the students and to shape the learning process accordingly. In this context, the fact that teachers reveal learning styles of students can be evaluated positively. Although prior knowledge of students is not in accordance with scientific facts, this preliminary information is important and should be taken into consideration (Richey, 1995). The level of readiness can vary so much as the individual differences of the learners vary. Teacher class should learn the individual differences of the students and discover the readiness levels of the students and develop and apply the teaching methods and techniques accordingly. Of the 14 interviewed teachers, only three mentioned the importance of the level of readiness of the students. However, one of the most important tasks of the teacher is to determine the level of readiness of the students and to determine their needs. It will be very difficult to realize learning in a learning environment where students will not be present and need to be prepared.

Instructional activities must conform to the level of development in which the student is involved. The physical and spiritual development of each student is different. Given that there are students with very different individual differences in the learning environment, it is very difficult for teachers to achieve gains with a single approach or teaching method. In this context, the appropriateness of the teaching methods, techniques and strategies of the teacher to the achievement of the learners is a problem. Otherwise, all the teaching methods, techniques and strategies to be implemented will be very difficult to achieve the desired effect on the student. Only four of the 14 teachers interviewed indicated that they would apply appropriate teaching methods considering the individual differences of the students. However, in order to achieve student success, teachers need to include many different teaching methods and techniques in consideration of individual differences. In

the survey we conducted, it was revealed that most of the teachers did not include the different teaching methods and techniques appropriate to their needs in the learning-teaching process.

The more the sense organ participates in the learning-teaching process, the better the learning takes place. In the teaching process, the tools and equipment have a great influence in supporting the teaching process by affecting the sense organs. Tools that support the individual differences of on-site and on-time students will be able to provide effective and fast learning as well as enriching the teaching process. Some learners learn better when they see, some listen, some read and some with the help of different tools. As the number of equipment suitable for the individual differences of the learners increases in the learning-teaching process, the probability of effective learning will also increase. None of the interviewed teachers mentioned about the importance of tools in order to design a learning-teaching process appropriate to the individual differences of the students. Only one of the teachers presented it as a proposal. However, in the process of learning-teaching, students will not learn to use rich tools that are suitable for their individual differences, so that they will achieve achievements. In other words, rather than using a single teaching method, combining with several different methods will positively affect the learning of students with different learning styles.

Teacher-student communication is important at every stage of the education as well as student-student communication is very important. Three of the interviewed teachers proposed a teaching process by putting students with similar individual differences into the same group. Working within the group can be regarded as positive in terms of improving cooperation and cooperation feeling by allowing interaction among students. However, the fact that some students work in the group and others do not work can cause harm such as some students not actively participating in the class. In addition to this, the fact that the groups are not well formed without fully considering the individual differences will make it difficult to capture the desired level of learning by gathering all of the students with low achievement levels.

Apart from the classroom environment, natural places such as historical places, museums, libraries, zoos, natural parks, lakes have a great importance in terms of on-site inspection of objects, trees, facts and events that cannot be brought to class. These environments offer opportunities for students to recognize, learn and experience events, objects, and people in a natural environment. From this point of view, teachers can take students to different places in accordance with the topics. Despite some limitations, education is a huge contributor when field trips are well planned (Myers and Jones, 2012). This will enable students to interact with objects in the nature and create a concrete and understandable learning environment. It is therefore crucial for effective learning to plan trips and observations, taking into account the individual differences of the students, by examining the historical and tourist sites, institutions and establishments, museums, natural parks, Fourteen teachers have emphasized only four, suggesting a trip method that provides the opportunity for learners to learn from the first hand and to experience learning by doing. The fact that teachers do not include the method of travel will prevent students from learning in the natural environment where they have objects and objects, and they will also have the opportunity to get acquainted with their close environment. In addition, the events, people, objects and objects of the students may cause the opportunity to observe and learn the environment in the natural learning environment.

Laboratory and experiment is the indispensable element of science education. Experiments provide opportunities for students to develop hands-on skills and cognitive-level thinking skills by providing an active learning environment (Duru, 2010). Learning in science lessons becomes more permanent as experiments make active participation in the learning process by making students live. In science teaching, the use of laboratories, especially at the primary and secondary school levels, has a great deal of precaution. This is because students' knowledge and skills acquired during this period provide the basis for their subsequent learning, enabling them to understand the real world at a later age (Banchi, 2009). Only a few of the teachers suggest proactive use of the laboratory to support individual differences. The fact that laboratory teachers who have a great deal of teaching in the teaching of abstract concepts by living, feeling and doing in science teaching do not take part in learning teaching process can be regarded as a great negativity. It is very difficult for students to research, observe and experiment in a science teaching that does not involve the use of laboratories. For this reason, effective and permanent learning will not take place because it is difficult to convert the learned knowledge into practice.

As soon as the child first arrives in the world, the first people around him are his parents. Therefore, until the child's school life begins, the parents are the first teachers of the child. Mothers and fathers are also the most important models for the child's personality formation. In this context, the education of the student also depends on the interaction of the teacher with the student's parents. When the child begins to study, the adaptation of the school-family relationship is reflected in the success of the student. Therefore, family relations are very

important for the success of the student. The fact that the children never communicate with their teachers for the success of their children means that the children are unsuccessful at school (Kaufman, Bradby, Owings, 1992). Teachers were offered as suggestions only one of the parental involvement to support individual differences. However, teachers need students about life outside of school. In addition, since the source of some disciplinary problems in the classroom may be out of the classroom, teachers should be in constant contact with their parents. The positive result of intervention in a problem at school is very difficult without the supportive attitudes of parents at home (Lawrence-Lightfoot, 2003). The environment and family structure in which students come from have a great influence on the formation of the individual differences of the learners. In this context, it is important for student success to communicate with the family, to identify the individual differences of the students, to design their needs and to design a learning-teaching process in accordance with this need. Therefore, even if only one of the teachers interviewed emphasizes parental involvement, it can be said that the teachers' communication with the family, which has a great influence in the education of the student, is disconnected. In this, it can be said that the teacher who needs information about the life of the student outside the school will not be able to design this effective and productive learning-teaching process.

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