A comparative study of the teaching practice preferences of teachers with different learning styles

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Abstract

The aim of this study is to identify how physics teachers who have different learning styles differ in terms of their teaching practices in the classroom. For this purpose, Kolb's Learning Styles Inventory was applied with regard to15 physics teachers who volunteered to take part in the study, leading to a determination of the learning styles of the teachers, culminating with further work with 4 physics teachers who had different learning styles. In this process, teachers were observed for extended periods of time during their classes followed by a two-dimensional analysis of the observations using a class observation form developed specifically for the study. The dimensions analyzed were Teacher Focused-Analysis and Teaching Practices (teaching for different learning skills).

The study contributes to the literature with an analysis of actual class environments, revealing that teachers employ similar teaching practices, regardless of their own learning styles.

Keywords: Learning styles, Physics Education, Teaching practices.

Introduction

The developments in science and technology certainly affect life, and force change upon society. Such rapid changes and developments have also brought about a change in the traits expected of qualified individuals (MNE, 2011). Such individuals are now expected to have both the knowledge required and the ability to use such knowledge to solve problems in a number of fields. In this context, the need for people with the ability to combine and use knowledge in various fields for the solution of personal and social problems exhibits itself in various forms including the ability to create associations between various fields, and the ability to have a different perspective on problems (Dervişoğlu and Soran, 2003; MNE, 2011).

In Turkey, the transition to a new education system took place in 2005 for primary education, and in 2007 for secondary education, with a view to bringing the traits to be instilled in the students in line with current needs (MNE, 2011). As a result of the changes, an experience-based teaching perspective was adopted, on the basis that learning in the physics teaching program should be based directly on real-life experiences (MNE, 2011).

Based on the assumption that every student can be educated, and that no in-educable student exists, the new physics classes employ teaching methods that take into account the active process nature of learning, involving approaches which do not entail a direct transfer of knowledge, while emphasizing individual differences and utilizing experiments and group work (MNE, 2011).

For many years, the individual differences experienced in learning have kept educators busy, and had been a matter of substantial research (Mutlu and Aydoğdu, 2003; Demir, 2006). In particular, recent years have seen an increased emphasis on studies aimed at understanding how individuals think and learn, leading to the understanding that there are differences between individuals, and that different individuals have different thinking and learning styles (Tümkaya, 2011).

Educational research focuses on individual differences in terms of intelligence, talent, character traits etc., not to mention learning styles. One of the most important concepts in any analysis of individual differences - learning styles (Çaycı and Ünal, 2007) - has arisen due to the different physiological, psychological, and cognitive structures with which each individual is endowed (Demir, 2008). One of the integral elements of human life and a most crucial skill for humans –learning- starts with birth and continues throughout one's life, and differs from one individual to another (Can, 2011).

The understanding of learning styles – a most crucial element of individual differences – has its roots in Carl Jung's (1927) Personality Types Theory, culminating in the first mention of the term in 1960 by Rita Dunn (Can, 2011; Demir and Osmanoğlu, 2013; Karademir and Tezel, 2010; Karakış, 2006). The question asks 'What is a learning style?'. A glance at the literature reveals numerous definitions of learning styles. Dunn (1986) defined learning style as the student's venture in unique directions when learning a new and difficult piece of knowledge, or remembering an already learned one. McCarthy (1987) on the other hand, refers to people's use of their skills to discern and process knowledge as their learning style. Kolb and Kolb (2009) define the term with reference to the use of unique routes in a spiral form through a learning circle based on the preferences of individuals. Finally, Özdemir and Kesten (2012) note that learning style is a multi-dimensional concept associated with factors such as perception, implanting knowledge in the mind, past experiences, the impact of the environment, and hereditary features.

The Role of Learning Styles in Education/Teaching

For teaching, with the objective of achieving learning on the part of the student, in order for it to be executed in an efficient manner, while achieving time and cost savings, learning environments compatible with learning styles are among the must-

haves (Bahar, Özen and Gülaçtı, 2009). According to Kolb (1984), in teaching carried out in accordance with learning styles, the students will be able to understand what and why they learn, while both the teacher and the students must have an insight into the state of learning (Coffield, et al., 2004). Furthermore, Kolb (1981) noted that learning is not just about knowledge, skills and talents, and that learning styles also play a role in academic achievement.

The educational activities compatible with learning styles are considered to help the development of a positive attitude towards learning, causing an increased acceptance of what is different, and an increased level of academic achievement (Given, 1996; Denizoğlu, 2008).

Similary, Güven (2004) noted that education in line with learning styles could increase the individual's productivity, while education which is not (particularly) in line with the individual's learning style could lead to changes in feelings of trust, achievement, and anxiety on the part of the individual.

A glance at the literature reveals that the identification of learning styles, which comprise a significant part of individual differences, could help when it comes to arranging appropriate teaching environments, the teaching strategies applicable, the methods and techniques to be used, and the selection of the materials to be used. For instance, according to Babadoğan (2000), the knowledge of the students' learning styles could lead to a better understanding of the mode of learning and the teaching design required, helping the teacher to develop teaching environments more in tune with his/her needs as well as those of his/her students. Peker et al. (2003) also note that an awareness of the students' learning styles could allow an easier selection of teaching methods, techniques, strategies, and materials, enabling teaching to be in line with the interests of the students. Usta et al. (2011) emphasize the importance of differences regarding the students' processes with regard to receiving, processing, organizing, and outputting knowledge, in terms of designing the teaching process. In addition, teaching environments organized in accordance with the various learning styles would arguably render learning more significant and lasting (Yazıcılar and Güven, 2009).

Taking into account the teacher's responsibilities to create an environment that allows every student to learn, albeit in different ways, the qualifications required of the teacher today generally entail skills involving the planning of a course, the organization of the learning-teaching environment, the enrichment of teaching with individual differences in mind, the recognition of the learning styles of students, etc., even though different definitions of such qualifications are often noted.

Effecting education-teaching in tune with the learning styles of students contributes to permanent learning (Gencel, 2007); hence, it is crucial to establish how to achieve this goal. The earlier studies on learning styles, such as that of Svinicki and Dixon's (1987) summarized how specific teaching activities could be employed with reference to learning styles, as shown in Figure 1.

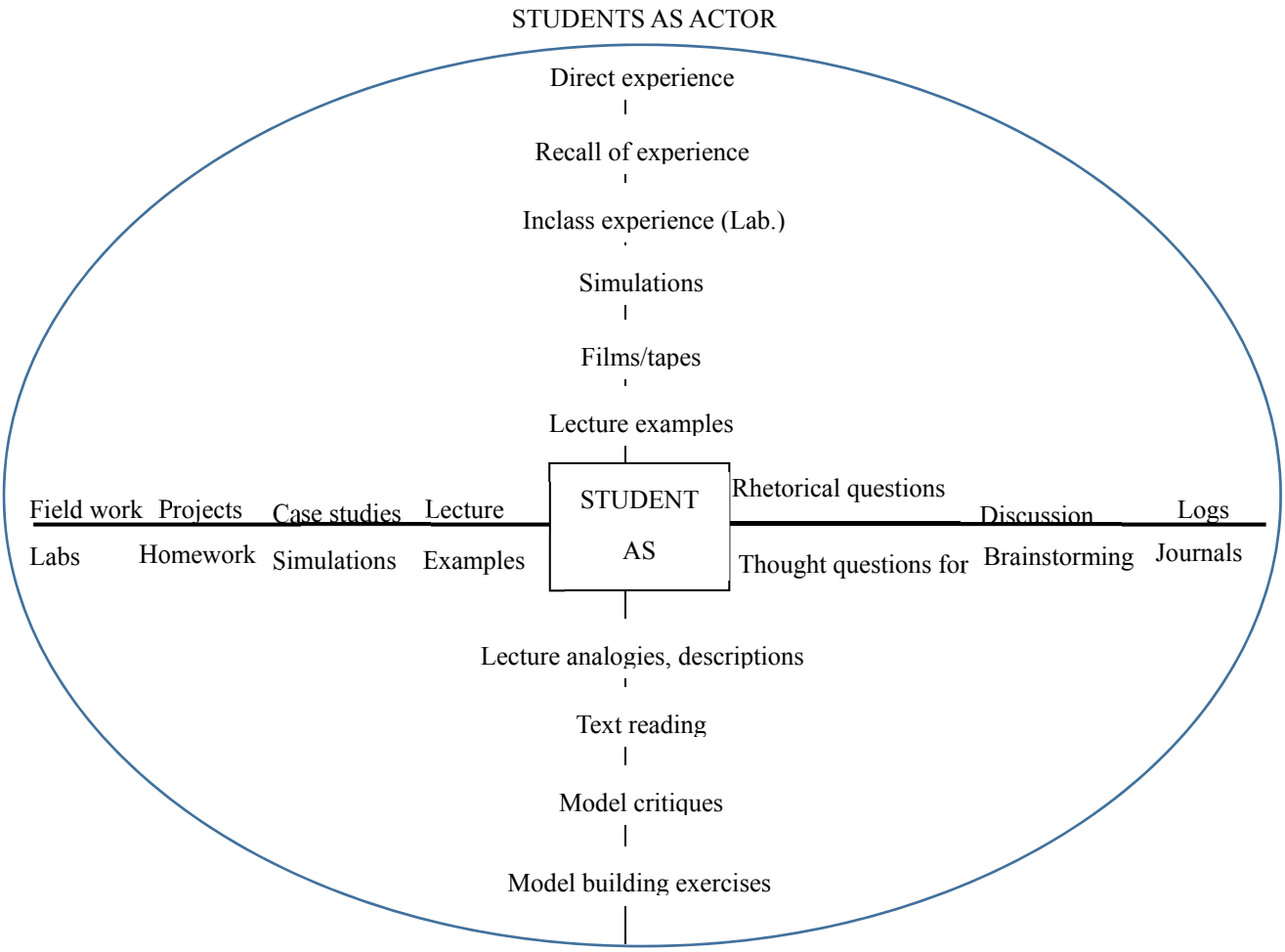

Figure 1. Degree of direct student involvement using various teaching methods (Svinicki and Dixon, 1987, p.146).

In this diagram, as one moves from the center to the perimeter, the student proceeds from a more passive or receptive stance, to a more active one, through the activities stipulated. For instance, while lectures examples keep the student in a passive position, direct experiences render him/her more active. The activities extending to the right-hand side of the figure would progressively move the individual's reflective observation skills from a passive stance to an active one as that individual moves from the center to the perimeter. For instance, while questions on thoughts keep the individual in a passive position, journals render him/her more active. The activities extending to the lower part of the figure would progressively take the individual's

abstract conceptualization skills from a passive stance to an active one, as the student moves from the center to the perimeter. For instance, while presentation analogies and descriptions keep the student in a passive position, model building exercises render him/her more active. The activities extending to the left-hand side of the figure would progressively take the individual's active experience skills from a passive stance to an active one as s/he moves from the center to the perimeter. For instance, while using examples for teaching keep the student in a passive position, field work activities render him/her more active.

Literature on learning styles

The complex character of the learning styles has intrigued a number of researchers for many years and has generated many different research areas. These areas may be classified as fallows: (a) the relationship between learning styles and academic achievement (e.g. Cano-Garcia and Hughes, 2000; Contessa et al., 2005; Davies et al., 1997; Ekici, 2013, Keith Hargrove et al., 2008), (b) students' learning styles (e.g. Ashford et al., 2003; Ateş and Altun, 2008; Bahar and Sülün, 2011; French et al., 2007; Gunawardena et al., 1996), (c) Learning style and learning environments (e.g. Buch and Bartley, 2002; Buerck et al., 2003; Gardner and Korth, 1998), (d) The relationship between learning styles and gender (e.g. Ateş and Altun, 2008; Bahar et al., 200), Bahar and Sülün, 2011; Gunawardena et al., 1996; Kaya et al., 2012, (e) The relationship between learning styles and program/school type (e.g. Demir and Osmanoğlu, 2013; Gürsoy, 2008; Koçyiğit, 2011; Mutlu, 2008; Şengül et al., 2013); (f) The relationship between learning styles and classroom level (e.g. Ateş and Altun, 2008; Can, 2011; Özdemir and Kesten, 2012; Tuna, 2008; Yenice, 2012). There are also researches focusing on other topics than aforementioned ones. For example: Learning and thinking styles (Cano-Garcia and Hughes, 2000), attitudes of individuals with different learning styles towards group work (Gardner and Korth, 1998), the impact of student learning styles on interviewing skills (Davies et al.,1997).

A literature review showed that studies on the integration of learning styles into teaching activities are limited. It is a matter of concern to identify to what extent teachers take into account the learning styles and, whether they diversify their teaching activities accordingly. . In addition, it is still unbeknown how teachers' own learning styles affect their teaching practices.

Learning Styles and Curriculum Choices

The physics curriculum, based on contextual teaching founded on the principles of constructivist theory, also assumes that learning could be meaningful and lasting in natural settings. That is why the program embraces the learning of concepts and laws

of physics, starting directly with experiences in life, rather than teaching the concepts and laws first, followed by an attempt to present examples from life (MNE, 2011). In other words, the physics curriculum is based on learning by doing and living. A glance at the literature reveals a number of studies attesting to the increased learning in science courses in particular, associated with contextual learning involving doing and living (Barker and Millar, 1999; Barker and Millar, 2000; Bennett et al., 2005; Bulte et al., 2002; Markic and Eilks, 2006; Çekiç and Toroslu, 2011; Acar and Yaman, 2011; Hırca, 2012). A glance at the studies in this area reveals that the majority of achievement indicators are based on the results of teaching executed through conventional perspectives. As these indicators have not been reviewed with reference to learning styles, one of the leading parameters of individual differences, the effectiveness of teaching based on learning through doing-experience alone, for learners with different learning styles, is still unknown.

Purpose of the study

The aim of this study is to determine the teaching practices of physics teachers with different learning styles and to analysis how teaching practices differ according to their learning styles. Accordingly, the following research questions are settled:

- Which activities of learning style teachers use to underpin their teaching practices?
- How do teachers' teaching practices vary according to their learning styles?

Methodology

Sample

Within the framework of the study, sampling was based on the objective of assessing the classroom practices and activities of teachers with different learning styles. That is to say, first of all a total of 15 physics teachers assigned to high schools in the provincial center of Sivas were subjected to Kolb's learning styles inventory.

The validity and reliability of the Learning Styles Inventory was carried out by Aşkar and Akkoyunlu (1993). Cronbach's alpha reliability values are respectively calculated as follows: 0.82 for the concrete experience, 0.73 for the reflective observation, 0.83 for the abstract conceptualization, 0.78 for the active concept, 0.88 for the active concept, 0.88 for the abstract-concrete, and 0.81 for the active-reflector.

In Kolb's Learning Styles Inventory each item consists of 4 sub-options which are evaluated from 1 and 4 points. When answering the inventory, the participant marks

as 4 the most appropriate option and the options values decrease gradually (as 3, 2, 1 respectively). In order to calculate a final score, first of all a point is calculated for each learning abilities (concrete experience, abstract conceptualization, active experience, reflective observation) and then a general total is fixed by adding these points. Calculated scores are checked and finalized by a specialist.

In this study, from the 15 teachers, four physics teachers working in Anatolian high schools and having different learning styles were selected as the sample of this study. In order to minimize the impact of different topics and grades on the research problem under consideration, the teachers who took part in the study were all 9th grade teachers.

Data Gathering Tools and Data Analysis

Class Observation Form

Data of this study were collected using an observation form which has been established based on the instructional activities proposed by Svinicki and Dixon (1987) (Figure 2 cited below). These activities expressed as teaching actions before being transferred to a scale.

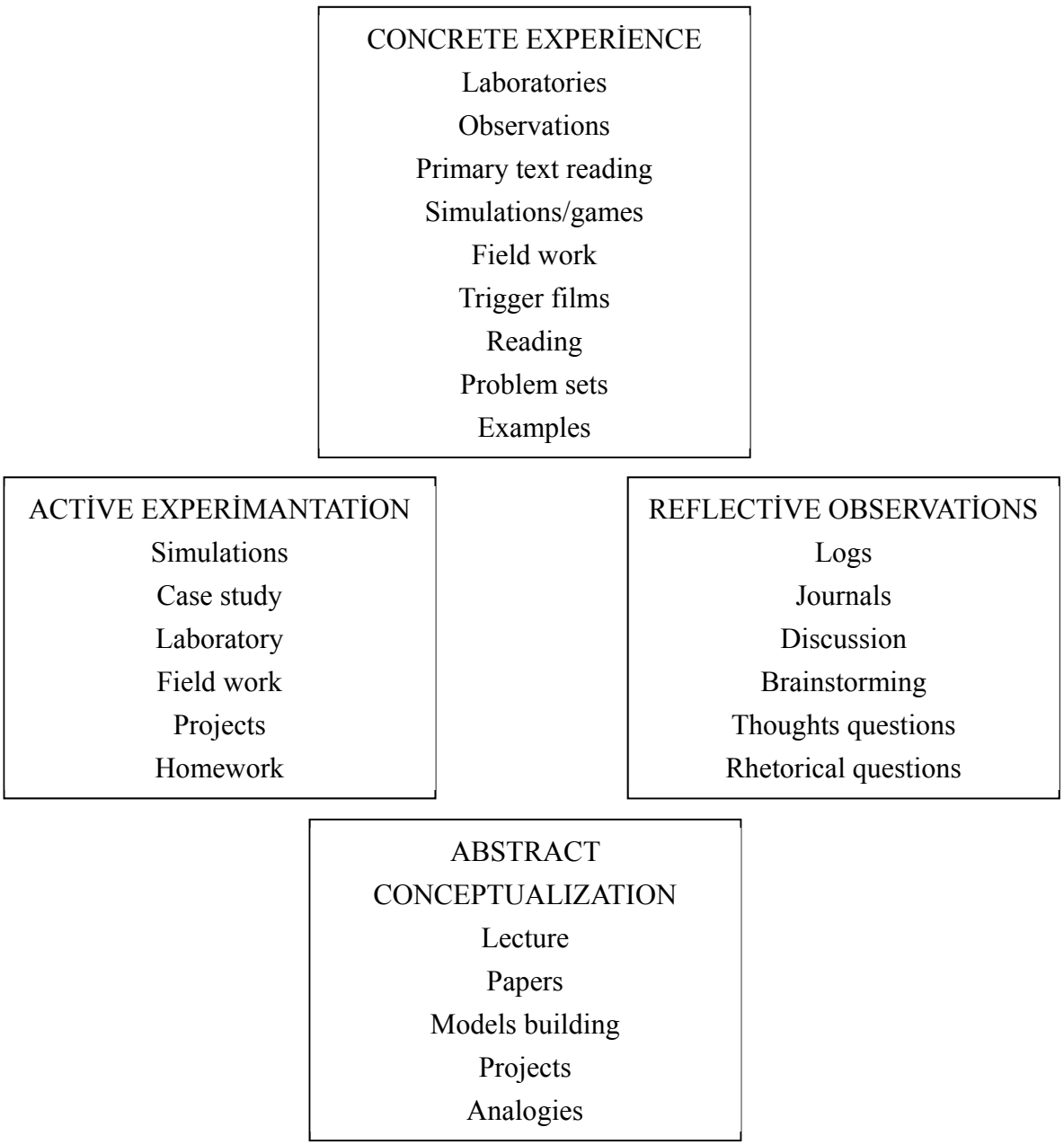

Figure 2. Instructional activities that may support different aspects of the learning cycle (Svinicki and Dixon, 1987, p. 142).

In the observation form, the Instructional activities given in Figure 2 are defined as teaching activities and items related to four learning skills are settled. For example the teaching activities supporting the active experimentation learning skills are written as follows:

- Using simulations

- Using case study
- Laboratory activities are included
- Resort to field study work
- Project work is carried out

The observation form, consisting of 26 items, has been converted as a 5-item Likert scale employing "Always", "Most of the time", "From time-to-time", "Rarely", and "Never" options, with a view to assessing the frequency of the activities investigated using the form.

The validation of the form was achieved through consultations with 6 experts who held PhD or subsequent degrees. Through consultation, inappropriate items were revised, two items about similar activities were merged into one, and a final class observation form of 25 items was developed with respect to learning skills. These revisions were followed by a request for further approval from the experts which was given.

Data analysis

In consideration of the research questions, collected data were analyzed in two stages:

- **Determining teaching practice frequency :** During observations, the classroom activities of each teacher were examined according to the items of the observation form and scored according to the scale ('0' for 'Never', 1 for 'Rarely', 2 for 'From time-to-time', 3 for 'Most of the time', and 4 for 'Always'). During this phase of the analysis, it was determined how often the participant teachers performed the teaching practice during the course observations.
- **Determining the average score of the teaching practice:** The frequency of use of each teaching practice described in the observation form was subsequently identified, to arrive at the frequency scores for individual teaching practices, divided by the number of observations, producing the average frequency of use. A comparable scoring procedure was applied in the PhD dissertations of Özsevgeç (2007), Saka (2006) and Tekbıyık (2010). Those studies considered the use of any teaching activity as being "sufficient" if the activity in question had an average score of 3 or more. In the present study, on the other hand, the application of any teaching activity at a level of 3, which would mean that such activities were employed by the teacher "most of the time", leading to a state of affairs where other teaching activities would not be employed at a sufficient level. This is why the present study, with reference to Kolb's (1981, 1984) works, assumes that a course should employ teaching activities for all learning styles in a specific cycle, and considered the use of any teaching activity "acceptable", if it received an average frequency score of 2 or more.

The scoring scheme can be described better with an example: If a teacher used any teaching practice (for example: simulations) in all courses "most of the time" the frequency of this practice is established on the basis of the average score (AP-Average of Practice).

$$AP = \frac{\Sigma(\text{Frequency of Use Score for Practice} * \text{Observation Count for the Practice})}{\text{Overall Observation count}}$$

For this teacher, the AP for the simulations is calculated as follows:

$$\frac{3 * 10}{10} = 3$$

The AP values thus calculated were used for interpretation with reference to the following categories identified through an adaptation of the categories employed in the project executed by Saglam-Arslan et al. (2017):

$0 \leq AP < 1$: Not developed at all

$1 \leq AP < 2$: Underdeveloped

$2 \leq AP < 3$: Acceptable

$3 \leq AP$: Excessive

Observation Processes

During observations, one of the researcher has observed the behaviors of the teachers in the natural environment without any intervention to the lessons (for a total of five weeks- 10 lesson hours).Before the observations, the researcher was in the class for two weeks so that both students and teachers could get used to the situation.

Results

Analysis of Teaching Practices

Results stemming from the first stage of data analysis (i.e. determining the frequency of teaching practice) is summarized in Table 1.

Classroom Practices of Teachers with Diverging Learning Styles (TDLS)

A glance at Table 1 reveals that, according to observations through 10 hours of classes the teacher with a diverging learning style employed just 2 out of 9 activities which target the concrete experience learning skill (using problem sets and using examples). In this context, the teacher in question used the problem sets most of the time on 2 occasions, from time-to-time on 6 occasions, and rarely on 2 occasions, whereas examples were used for most of the time on 7 occasions, and from time-to-time on 3 occasions. Furthermore, the teacher was observed to employ just two out of five activities which target the reflective observation learning skill. The teacher with the diverging learning style made rare use of thought-provoking questions on 7 occasions through 10 hours of classes, while unplanned key questions which would nonetheless encourage students to engage in discussion and thinking in line with the flow of the course, were again employed rarely on 4 occasions. In her lessons, out of a total of six practices TDLS was observed to employ homework practice which target the active experiment learning skill, only rarely, on 3 occasions. On the other hand, the teacher was observed to make frequent use of the practice of teaching through presentation, in all her classes, out of a total of 5 practices which target the abstract conceptualization learning skill.

Table 1. The frequency of observation of each teaching practice employed by the participating teachers.

		Diverging					Accommodating					Assimilating					Converging				
		4	3	2	1	0	4	3	2	1	0	4	3	2	1	0	4	3	2	1	0
Concrete Experience	The classes make use of laboratory activities.	-	-	-	-	10	-	-	-	-	5	-	-	-	-	10	-	-	-	-	10
	Students are made to observe certain events and cases related with the course contents.	-	-	-	-	10	-	-	-	-	5	-	-	-	1	9	-	-	-	-	10
	The students are made the read basic texts to remind the foundations of the topic to be covered.	-	-	-	-	10	-	-	-	-	5	-	-	-	-	10	-	-	-	-	10
	The students are made to engage in simulation / games during the course.	-	-	-	-	10	-	-	-	-	5	-	-	-	-	10	-	-	-	-	10
	Field study work is carried out.	-	-	-	-	10	-	-	-	-	5	-	-	-	-	10	-	-	-	-	10
	Motivating/attention grabbing/guiding films are used.	-	-	-	-	10	-	-	-	-	5	-	-	-	-	10	-	-	-	-	10
	Reading activities are carried out.	-	-	-	-	10	-	-	-	-	5	-	-	-	-	10	-	-	-	-	10
	Problem sets are utilized.	-	2	6	2	-	-	-	2	2	1	-	1	6	2	1	-	2	1	5	2
	Examples are utilized.	-	7	3	-	-	-	1	3	1	-	1	3	6	-	-	-	7	3	-	-
Reflective Observation	The students are made to keep reflective notes, diaries, or journals.	-	-	-	-	10	-	-	-	-	5	-	-	-	-	10	-	-	-	-	10
	Discussion technique is employed.	-	-	-	-	10	-	-	-	1	4	-	-	-	1	9	-	-	1	2	7
	Brainstorming technique is utilized.	-	-	-	-	10	-	-	-	1	4	-	-	-	-	10	-	-	-	-	10
	Thought provoking questions are asked.	-	-	-	7	3	-	-	-	2	3	-	1	-	1	8	-	1	1	4	4
	Unplanned key questions which would nonetheless encourage students to discussion and thought in line with the flow of the course are asked.	-	-	-	4	6	-	-	-	1	4	-	1	-	-	9	-	1	-	3	6

Active Experiment	Simulations are employed.	-	-	-	-	10	-	-	-	-	5	-	-	-	-	10	-	-	-	-	10
	Case studies are employed.	-	-	-	-	10	-	-	-	-	5	-	-	-	-	10	-	-	-	1	9
	Laboratory activities are used.	-	-	-	-	10	-	-	-	-	5	-	-	-	-	10	-	-	-	-	10
	Field study work is carried out.	-	-	-	-	10	-	-	-	-	5	-	-	-	-	10	-	-	-	-	10
	Project work is carried out.	-	-	-	-	10	-	-	-	-	5	-	-	-	-	10	-	-	-	-	10
	Homework is assigned.	-	-	3	-	7	-	-	1	-	4	-	-	-	-	10	-	-	-	-	10
Abstract conceptualization	Teaching is effected through presentation.	-	10	-	-	-	-	5	-	-	-	-	10	-	-	-	-	9	1	-	-
	The students are made to write articles about the subject, based on what they learn in or outside the class.	-	-	-	-	10	-	-	-	-	5	-	-	-	-	10	-	-	-	-	10
	Model development activities are used.	-	-	-	-	10	-	-	-	-	5	-	-	-	-	10	-	-	-	-	10
	Projects are executed.	-	-	-	-	10	-	-	-	-	5	-	-	-	-	10	-	-	-	-	10
	Analogies are utilized.	-	-	-	-	10	-	-	-	-	5	-	-	-	-	10	-	-	-	-	10

Classroom Practices of Teachers with Accommodating Learning Style (TALS)

The analysis of Table 1 with a view to understanding the teaching practices employed by the teacher with the accommodating learning style reveals that the teacher in question employed just 2 out of a total of 9 activities which target the concrete experience learning skill (using problem sets and using examples), in her classes. In this context, the teacher had used the problem sets from time-to-time on 2 occasions, and rarely on 2 occasions, whereas examples were used for most of the time on 1 occasion, from time-to-time on 3 occasions, and rarely on 1 occasion. In her classes, TALS was observed to employ 4 out of 5 teaching practices which target the reflective observation learning skill. The teacher with the accommodating learning style made rare use of discussions on 1 occasion throughout the10 hours of teaching, while brainstorming techniques were used rarely on 7 occasions, thought provoking questions were employed rarely on 1 occasion, unplanned key questions which would nonetheless encourage students to engage in discussion and thinking in line with the flow of the course were again employed rarely, on 4 occasions. In her classes, the teacher was observed to employ only homework practice out of all classroom practices which target the active experiment learning skill, on just 1 occasion. Finally, TALS was observed to employ (most of the time) teaching through presentation activity among all the 5 teaching practices which target the abstract conceptualization learning skill.

Classroom Practices of Teachers with Assimilating Learning Style (TAsLS)

A consideration of Table 1 reveals that the teacher with an assimilating learning style employed 3 out of 9 teaching practices which focus on concrete experience learning skills. In this context, the teacher was observed to use problem sets most of the time on 1 occasion, from time-to-time on 6 occasions, rarely on 2 occasions, while examples were used always on 1 occasion, most of the time on 3 occasions, and from time-to-time on 6 occasions. Furthermore, the teacher was observed to make the students observe certain events and cases regarding the lesson contents, rarely on 1 occasion. The teacher was observed to utilize 3 out of 5 practices which focus on the reflective observation learning skill, employing a discussion technique rarely on 1 occasion, thought-provoking questions most of the time on 1 occasion, and rarely on another, and unplanned key questions which would nonetheless encourage students to engage in discussion and thinking in line with the flow of the lesson most of the time on 1 occasion. The TAsLS was observed not to use any of the 6 teaching practices which focus on active experiment learning skill, while she used teaching through presentation in all 5 teaching practices which focus on the abstract conceptualization learning skill, most of the time in all lessons.

Classroom Practices of Teachers with Converging Learning Style (TCLS)

A consideration of Table 1 reveals that the teacher with a converging learning style employed just 2 out of 9 teaching practices which focus on concrete experience learning skill. In this context, the teacher with the converging learning style was observed to use problem sets most of the time on 2 occasions, from time-to-time on 1 occasion, and rarely on 5 occasions, while examples were used most of the time on 7 occasions, and from time-to-time on 3 occasions. The TCLS was observed to employ, among a total of 5 teaching practices which focus on the reflective observation learning skill, the discussion technique from time-to-time on 1 occasion and rarely on 2 occasions, asking thought-provoking questions most of the time on 1 occasion, from time-to-time on 1 occasion, and rarely on 4 occasions, while unplanned key questions which would nonetheless encourage students to engage in discussion and thinking in line with the flow of the lesson were utilized most of the time on 1 occasion and rarely on 3 occasions. On the other hand, this teacher was observed to utilize only the case study practice out of all 6 teaching practices regarding the active experiment learning skill. The teacher with the converging learning style was observed to use the case study rarely on just 1 occasion in her classes. The TCLS's classroom activities, analyzed in the light of abstract conceptualization learning skill, reveal that the teacher employed only teaching through presentation out of all 5 teaching practices regarding this skill, most of the time on 9 occasions, and from time-to-time on 1.

Comparative Analysis of Teaching Practice

Results stemming from the second stage of data analysis (i.e. determining the average score of the teaching practice) are presented in Table 2.

Teaching activities which focus on the concrete experience learning skill

Table 2 suggests that teachers who took part in the study utilized just three of the activities which focus on the concrete experience learning skill: making students observe certain events and cases regarding the course contents, utilizing problem sets, and using examples. In this context, the practice of "using examples" among the teaching practices which focus on this skill was observed to be utilized at an acceptable level by all participating teachers, and hence had a general use average score above 2. An acceptable level of use of the problem sets, among all practices in this category, was unique to the teacher with the diverging learning style, and the general use average score for this activity was low, suggesting an underdeveloped level of use on the part of the remaining three teachers. On the other hand, only the teacher with the assimilating learning style was observed to make students observe

certain events and cases regarding the course content, and then only at a very low level, far below the acceptable level of use, and considered to be not developed at all.

Teaching activities which focus on the reflective observation learning skill

Table 2 reveals that, among the teaching activities with a focus on the reflective observation learning skill, brainstorming techniques, asking thought-provoking questions, and using unplanned key questions which would nonetheless encourage students to engage in discussion and thinking in line with the flow of the course are the practices employed by the participating teachers. Three of the participants were observed to employ four of the reflective observation practices in their classes, while the fourth used just two. A review of the teachers' average of practice scores (AP) for each practice clearly reveals, on the other hand, that no practice regarding this learning skill was used at an acceptable level by the teachers. All the teaching practices in this context were marked by general use average scores of below 1, reflecting a level of use which was not developed at all with respect to their use in the classroom.

Table 2. Average Scores for the Frequency of Utilization of Teaching Practices (AP) by the Teachers

Classroom Practices	AP-Diverging	AP-Accommodating	AP-Assimilating	AP-Converging
Concrete Experience				
The classes make use of laboratory activities.	0	0	0	0
Students are made to observe certain events and cases related with the course contents.	0	0	0.1	0
The students are made the read basic texts to remind the foundations of the topic to be covered.	0	0	0	0
The students are made to engage in simulation / games during the course.	0	0	0	0
Field study work is carried out.	0	0	0	0
Motivating/attention grabbing/guiding films are used.	0	0	0	0
Reading activities are carried out.	0	0	0	0

Problem sets are utilized.	2	1.2	1.7	1.3
Examples are utilized.	2.7	2	2.5	2.7
Reflective Observation				
The students are made to keep reflective notes, diaries, or journals.	0	0	0	0
Discussion technique is employed.	0	0.2	0.1	0.4
Brainstorming technique is utilized.	0	0.2	0	0
Thought provoking questions are asked.	0.7	0.2	0.4	0.9
Unplanned key questions which would nonetheless encourage students to discussion and thought in line with the flow of the course are asked.	0.4	0.2	0.3	0.6
Active Experimentation				
Simulations are employed.	0	0	0	0
Case studies are employed.	0	0	0	0.1
Laboratory activities are used.	0	0	0	0
Field study work is carried out.	0	0	0	0
Project work is carried out.	0	0	0	0
Homeworks are assigned.	0.6	0.4	0	0
Abstract Conceptualization				
Teaching is effected through presentation.	3	3	3	2.9
The students are made to write articles about the subject, based on what they learn in or outside the class.	0	0	0	0
Model development activities are used.	0	0	0	0
Projects are executed.	0	0	0	0
Analogies are utilized.	0	0	0	0

Teaching activities which focus on the abstract conceptualization learning skill

Table 2 summarizing the classroom practices of teachers with different learning styles, reveals that among all the teaching activities which focus on the abstract

conceptualization learning skill, only teaching through presentation was used by the teachers. None of the practices of having students write texts or develop models, project preparation, and utilization of analogies, which are considered as other practices focusing on this learning skill, could be observed. On the other hand, teaching through presentation, with reference to this skill, received high scores in terms of use on the part of the participating teachers, reflecting an excessive level of use of this practice.

Discussion and Conclusion

The present study aimed to identify the classroom teaching practices of physics teachers who have different learning styles, and to understand how the practices were affected by the identified learning styles.

The analysis of the data gathered in the study led to the conclusion that physics teachers who have different learning styles made limited use of teaching practices which focus on concrete experience and abstract conceptualization, while teaching practices which focus on active experimentation and reflective observation learning skills have been virtually disregarded. Against this background, one can forcefully argue that the participating teachers did not make sufficient use of teaching practices focusing on students who have different learning styles.

The study produced findings which arguably support the claim that teachers with different learning styles carry out their teaching activities in a similar manner, making use of a uniform and monotonous teaching framework. This is possibly an indicator of the lack of influence of their own learning styles, in terms of determining the teaching practices used by the teachers. The similarities in the practices employed by the teachers, despite the differences in their learning styles, suggest some kind of linkage with their own education life under the shadow of educational and teaching activities in line with the conventional approach based on the principle of "uniformity of students". A more detailed insight would refer to the preference on the part of teachers whose own education had been shaped by conventional teaching practices, for implementing the teaching practices they were used to. On the other hand, this very finding also shows that the teachers ignore the principle of the "uniqueness of every student" requiring an eye for individual differences in learning, as part of the physics curriculum that is based on modern teaching perspectives along with a changing identity. Ignoring that principle leads to a state of affairs in teaching activities, whereby the teachers believe that all students have the same characteristics. One can forcefully argue that a student who is subjected to teaching activities which are not oriented towards his/her individual characteristics cannot assume an active

role in learning activities, and even if s/he did so, such activities would be restricted to the classroom, falling short of application in solving the problems faced in daily life.

The teachers' inclination towards a frequent use of presentation for teaching, and the utilization of examples, suggest that the students have remained in a rather receptive position in terms of education and teaching activities, and have failed to assume a more active stance. This is clearly shown in Figure 1, developed with reference to the work of Svinicki & Dixon (1987). In addition, one can also argue that the "active learner" trait should not solely be associated with the "learning by doing-experience", with reference to the existence of different learning styles. Even though the literature seems to be in consensus with the idea that students can learn by doing/experience, it is possible to argue that this view would apply only for a specific group of students, taking into account the fact that individual differences would certainly affect learning styles. Felder (1986) described such a perspective, noting that some individuals were better at focusing on phenomena, data, and algorithms, while some others were more comfortable with theories and mathematical models; some preferred visual forms such as schemes, figures and graphs, whereas others reacted more strongly to written and verbal statements; some had an inclination towards active and interactive learning, while others choose internal reflection and individual work.

On the other hand, teaching by doing/experience, as highlighted by the contemporary curricula, has been put into effect at schools as if using a magic wand. This could be considered as a contradiction in and of itself, with the principle of the "uniqueness of each student", if it is taken as a perspective claiming that all students could learn in the same way – i.e. by doing/experience – in a surprising parallel to conventional approaches which have been criticized for many years. The principle of "learning by doing-experience", serving as the basic pillar of the new physics curriculum, should be revisited against the background of learning styles, a major component of individual differences, asking the community of scholars the questions 'can every student learn by doing-experience?'

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