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Full Length Research Paper

Science student teachers' preferences for ways of learning: Differences and similarities

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Knowing an individual's learning style is considered important because it can help educators to prepare and develop learning environments in which the individual can enhance his/her learning. In this study, Biology, Physics, Chemistry and Primary science student teachers' learning styles were investigated. The participants were 387 student teachers in a teacher education course during the 2009/2010 academic year at Dicle University in Turkey. The questionnaire developed by Honey and Mumford (1992) was used as the data collection instrument. The data was analysed through SPSS 15.0 version by using t- test, correlations and ANOVA. The analysis of the data revealed that the majority of the participant student teachers strongly preferred learning styles described in the reflector, theorist and pragmatist sub-dimensions. The study found statistically significant differences among subject groups (Biology, Physics, Chemistry and Primary science) only in the pragmatist sub-dimension. Gender differences were found in the reflector and theorist sub- dimensions. Learning styles should be included in teacher education programmes in order to help student teachers to gain a better understanding of different learning preferences displayed by pupils.

Key words: Learning styles, science teacher education, student teachers, teaching and learning activities, attitudes.

INTRODUCTION

Learning is a dynamic process that includes the active involvement of individuals. Individuals who are involved in the process of learning often develop attitudes and behaviours that determine their preference in the way they learn. The various types of individual preferences for the most effective mode of instruction or study are referred to as learning styles (Pashler et al., 2009). Differences between individuals can be detected in many aspects of learning processes, such as, physical, behavioural, thinking styles, interaction styles, method of learning, rate of learning, and the cognitive styles that students choose when receiving new knowledge (Curry, 1990; Dunn, 1992; Keefe, 1987; Reiff, 1992).

Understanding students' learning styles is important for improving learning and developing an appropriate learning environment accordingly (Khan, 2009). Two major reasons are listed for researchers' high interest in learning styles. Firstly, more successful learning occurs when teachers' teaching methods are matched to students' learning styles (Svincki and Dixon, 1987). Secondly, by learning to use a variety of learning styles, students are able to adapt more readily to different learning situations (Dixon, 1985). Educators are seen as responsible to help students to increase their interest and inclination towards learning. Determining suitable learning styles for students can lead to an increase in students' attitude towards learning, productivity, academic performance and creativity (Griggs, 1985). According to Peker and Mirasyedioglu (2008), students' achievement is affected by their attitude towards a subject and their attitude towards a subject is influenced by their preferred learning styles. Students' preferences should be regarded during the teaching/ learning process.

Over the years various instruments have been developed by researchers to identify learning styles. Babrach et al. (1975) developed a questionnaire to identify learning styles. The questionnaire consists of 45 items that are divided into three areas: how an individual collects and

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receives information, how an individual works, and how an individual communicates. Renzulli and Smith (1978)'s Learning Style Inventory consists of 65 items that focus on nine areas: project, exercises, peer teaching, discussion, game, free learning, programmed teaching, lecture and simulation. Dunn et al. (1985) designed the Learning Style Inventory to study the learning styles students in Grades 3 to 12 in the USA. The inventory consists of 104 items and it explains students' perception based on their stimulation, surrounding, emotions and sociological and physical background. Building upon this type of work, Honey and Mumford (1992) developed a questionnaire that is based on four learning styles, and named it the Learning Styles Questionnaire (LSQ). After responding to the questionnaire items, participants reveal their preference for any or all of the four learning styles, based on their learning preferences. Depending on their preferences (as expressed by their responses), participants are classified as an activist, reflector, theorist or pragmatist or as any combination of the four learning styles. Activists are open-minded and enjoy new experiences. However, they become bored if something is repeated. They enjoy becoming involved in a discussion such as brainstorming. The teaching and learning activities that are effective for this group are providing new experiences, problem-based learning, games and group research. The teaching and learning activities that are not effective for this group are one-way lecture, passive learning, learning that involves many mixed and unarranged data, repeating the same activity.

Reflectors like to collect and analyse data and are quite careful at making decisions. They do not like to become leaders. The teaching and learning activities that are effective for this group are those that are stimulating such as watching a video as well as providing them with time to think before reacting and to provide conclusions without pressure. The teaching and learning activities that are not effective for this group are placing them in the role of leader or having them perform in front of people. They experience stress if required to perform immediately after a brief instruction. Theorists are quite objective, and they do not enjoy things that are subjective. They prefer to make conclusions based on evidence, data analysis and logic. They have clear minds. The teaching and learning activities that are effective for this group are providing them with time to organise their feelings and to ask questions and process the methodology, assumption or logic in detail. The teaching and learning activities that are not effective for this group are learning that involves emotion, feelings, and activities that are unstructured. Pragmatists enjoy considering a new idea, expanding the idea, and solving problems especially for real life situations. The teaching and learning activities that are effective for this group are demonstrating practical techniques, providing them with the opportunity to express what they have learned and focusing on the practical issues. Learning methods that are not related to immediate need and performance with no clear practice or outline are not suitable for this group.

Despite the substantial popularity of research on learning styles, many researchers question the value of understanding learning styles as they argue that there is a lack of credible supportive evidence relating learning styles and enhanced learning (Constantinidou and Baker, 2002; Massa and Mayer, 2006; Pashler et al., 2009). The current study is based on the assumption that the way in which an individual is educated affects his/her preference for a certain way of learning. Therefore, individuals who are trained to become future teachers are likely to be influenced by the way that they have been taught and reflect this influence in their teaching related activities.

The purpose of this study was to investigate science student teachers' preferences for ways of learning and examine differences among science student teachers according to their subjects.

The study is aimed at achieving the following objectives:

1. To study the differences in student teachers preferences' for certain ways of learning according to their subject.
2. To study gender differences in terms of student teachers subject groups.
3. To examine correlations among four learning styles and to suggest implications for teacher education.

MATERIALS AND METHODS

Participants

The sample comprised 387 student teachers in the first semester of 2009/2010 academic year in the Department of Secondary Science and Mathematics Education and Department of Primary Science Education at Dicle University in Diyarbakır (in Turkey). Participants were student Physics [N= 95 (24.5%)], Biology [N= 116 (30%)], Chemistry [N=91(23.5%)] and Primary Science student teachers [N= 85 (22%)]. Both genders were represented; 200 male (51.7%) and 187 female (48.3%) student teachers, using the Cluster Sampling Technique.

Instruments

In this study a questionnaire was administered as the data collection instrument. The questionnaire was divided into two main sections: A and B. In section A, there were three questions about the demographics of the student teachers. In section B, the 80 five-point scale items from the Learning Styles Questionnaire (LSQ; Honey and Mumford, 1992) were included without modification. The 80 items in the instrument include 20 items for each of the four learning styles and are essentially randomly ordered by the authors. The directions ask the participants to respond to each item by marking from "totally disagree (1)" to "totally agree (5)". The items with the highest frequency are used to represent the students' learning styles.

The LSQ by Honey and Mumford (1992) was preferred because it was reported to have high reliability and was suitable for teenagers (Riding, 1991). The Learning Styles Questionnaire includes 4 sub-dimensions, which describe the four distinct learning styles:

1. Activist sub- dimension (20 items).

Table 1. Correlation coefficients of the LSQ sub-dimensions.

	Activist	Reflector	Theorist	Pragmatist
Activist	1	0.294**	0.325**	0.482**
Reflector	0.294**	1	0.657**	0.566**
Theorist	0.325**	0.657**	1	0.705**
Pragmatist	0.482**	0.566**	0.705**	1

** Correlation is significant at the 0.01 level (2-tailed).

Table 2. Student teachers preference of learning activities identified in activist sub-dimension.

Subject	N	Mean	Std. deviation	ANOVA result
Biology	116	3.33	0.459	
Physics	95	3.20	0.474	F: 2.193
Chemistry	91	3.24	0.475	Sig:0.088
Primary science	85	3.16	0.538	P>0.05
Total	387	3.24	.487	

2. Reflector sub- dimension (20 items).
3. Theorist sub-dimension (20 items).
4. Pragmatist sub- dimension (20 items).

Each sub- dimension assesses a continuum of learning style preference, ranging from very low preference to very strong preference. High subscale scores indicate a very strong preference, whereas lower scores are indicative of a very low preference. A score from 1 to 1.80 is very low preference, 1.81 to 2.60 is low, 2.61 to 3.40 moderate, 3.41 to 4.20 strong preference and 4.21 to 5.00 very strong preference. In the current research, the reliability coefficient (Cronbach's alpha) for the total scores of the LSQ was 0.878. The Cronchbach's alphas values for the sub- dimensions were 0.683, 0.721, 0.712 and 0.691, respectively.

Data analyses

The data from Section A of the questionnaire were analysed by frequency and percentage. The data obtained from Section B of the questionnaire were analysed by using frequency, arithmetic means, correlation coefficient and t-test for differences between genders and ANOVA for determining significant differences among subject groups (Physics, Biology, Chemistry and Primary science). Analysis was carried out using SPSS 15.0 version.

Procedure

The instruments were administered during a regular class meeting and each administration of the LSQ was administered at the beginning or the ending of the class period. None of the student teachers in the classes declined to participate in the study. The student teachers spent approximately 25 to 30 min in completing the instrument, which was not timed.

RESULTS

Correlations among sub-dimensions

The correlation values of the four sub- groups suggest that activists, pragmatists, theorists and reflectors were positively correlated to each other (Table 1).

Activist

Table 2 displays the one-way ANOVA results for participant student teachers. The results do not show any significant differences (p>0.05) among Biology, Physics, Chemistry and Primary science student teachers preferences for the ways of learning that is identified as activist by Honey and Mumford (1992). When the mean scores were considered, student teachers of all four disciplines identified as moderate activists. These results imply that the participant student teachers did not mind receiving lecture- type instruction and they preferred not to become involved in discussions or hands-on activities (Table 3).

The study did not reveal statistically significant difference between male and female student teachers in terms of the ways of learning that are included in the activist sub section (p>0.05).

Both male and female student teachers moderately preferred to learn through activities included in the activist sub-dimension.

Reflector

The significant value in Table 4 is 0.117 (P> 0.05); thus, there were no statistically significant differences observed in preferred learning styles by Biology, Physics, Chemistry and Primary science student teachers in the reflector sub- dimension. When the mean scores were considered all four groups of student teachers strongly preferred learning ways identified in the reflector

Table 3. Gender preferences in activist sub-dimension.

Gender	N	Mean	Std. deviation	Result
Male	200	3.25	0.501	t: -0.323
Female	188	3.23	0.473	Sig:0.743

Table 4. Student teachers preference of learning activities identified in reflector sub-dimension.

Subject	N	Mean	Std. deviation	ANOVA result
Biology	116	3.74	0.430	
Physics	95	3.82	0.401	F: 1.978
Chemistry	91	3.66	0.428	Sig:0.117
Primary science	85	3.70	0.583	P>0.05
Total	387	3.73	0.463	

Table 5. Gender preferences in reflector sub-dimension.

Gender	N	Mean	Std. deviation	Result
Male	200	3.78	0.481	t: -1,997
Female	188	3.68	0.439	Sig:0.046

Table 6. Student teachers preference of learning activities identified in theorist sub-dimension.

Subject	N	Mean	Std. deviation	ANOVA result
Biology	116	3.72	0.441	
Physics	95	3.76	0.408	F: .918
Chemistry	91	3.65	0.454	Sig:0.432
Primary science	85	3.68	0.592	P>0.05
Total	387	3.70	0.474	

sub-dimension. According to these results, the participants of the study enjoy being stimulated by a visual presentation such as watching a video, CD or a computer simulation. The student teachers preferred to have time to think before they react. They did not like to take initiative to act as they did not like to be leaders. Teaching and learning activities that were not effective for this group were placing them in the role of leader or requiring them to perform in front of people. When gender was considered statistically significant differences in the learning styles of Physics, Biology, Chemistry and Primary science student teachers' were identified in the reflector sub-dimension (Table 5). The mean scores indicate that male students more strongly preferred learning styles identified in the reflector sub- dimension. This suggests that female student teachers are less inclined to be passive learners in comparison to male student teachers.

Theorist

Table 6 did not reveal any statistically significant differences (p>0.05) among Biology, Physics, Chemistry and Primary science student teachers' preferences for the ways of learning that are included in the theorist sub-dimension. The mean scores indicate that student teachers in all four groups strongly preferred learning activities identified in the theorist sub-dimension. The teaching and learning activities that were effective for this group was providing them with them time to organise their feelings and with time to ask questions and process in detail. The teaching and learning activities that were not effective for this group were learning that involves emotion, feelings, and unstructured activities.

Table 7 indicates significant differences in the learning styles of Physics, Biology, Chemistry and Primary science student teachers (-2.091 t- value, P<0.05) in the

Table 7. Gender preferences in theorist sub-dimension.

Gender	N	Mean	Std. deviation	Result
Male	200	3.75	0.480	t: -2.091
Female	188	3.65	0.463	Sig:0.048

Table 8. Student teachers preference of learning activities identified in pragmatist sub-dimension.

Subject	N	Mean	Std. deviation	ANOVA result
Biology	116	3.67	0.401	
Physics	95	3.69	0.387	F: 4.225
Chemistry	91	3.54	0.413	Sig: 0.006
Primary science	85	3.50	0.556	P<0.01
Total	387	3.61	0.445	

Table 9. Gender preferences in pragmatist sub-dimension.

Gender	N	Mean	Std. deviation	Result
Male	200	3.63	0.449	t: -1.052
Female	188	3.58	0.440	Sig: 0.293

theorist sub dimension according to gender. When mean scores were considered, male students were more strongly in favour of learning through activities identified in the theorist sub-dimension.

Pragmatist

Differences in the learning styles of student teachers were ascertained by F -test (Table 8). Statistical analysis showed that there were important differences among student teachers' preferred ways of learning that are identified in the pragmatist sub-dimension (P<0.01). The mean scores indicate that student teachers in all four groups strongly preferred activities included in the pragmatist sub-dimensions. The teaching and learning activities that were effective for this group were demonstrating practical techniques, providing the students with the opportunity to express what they learned and focusing on the practical issues. The teaching and learning activities that were not effective for this group included learning that is not related to immediate need and performing with no clear practice or outline. This result is justified by the fact that students preferred teaching learning activities that involved test solutions or problem solutions as the main aim of classes was to prepare students for national exams. Therefore, it is not difficult to understand student teachers' strong preference for learning activities identified in the pragmatist sub-dimension.

Table 9 did not display any statistically significant differences between male and female student teachers in the pragmatist sub-dimension. When mean scores were compared, male student were slightly stronger in their preference of learning activities identified in the pragmatist sub-dimension.

DISCUSSION

The fact that students' responses to learning styles in all four dimensions are similar in general suggests that students do not always prefer one way of learning. Rather, to a certain extent, they would prefer to through various learning activities identified in all of the dimensions described by Honey and Mumford (1992). These findings support the claims by Vermetten et al. (1995) and Slaats et al. (1999) that students use a specific learning style based on the task they are faced with at the time. Research reports individuals view of teaching or a teacher are shaped by the way they are educated. In Turkey, students are mostly educated through teacher-centred learning activities. This general view was justified by the Education Ministry in 2003 during his speech on the need for a student-centred education system.

"We have a memorisation-based education system at present in Turkey. In this system students are in passive roles. We have started to handle a situation no government

has so far dared to address. If this situation needs lancing, we will do it. In the year 2004, the information-based education system in Turkey will be replaced by a constructivist system. If we want to catch up with the world, if we want to reach (the aim of) modern education, we have to do this. When we change teaching method, curriculum and textbooks need to be changed in parallel with it (Celik, 2003)".

This announcement by the Education Minister of the time heralded a 'catastrophe in education' two weeks later when 40,500 students (6.7% of all students) scored zero (0) points on the Secondary Institutions Student Selection and Replacement Exam (OKÖSYS), which is carried out to select students for Science Schools, Anatolian Schools, Anatolian Fine Arts Schools, Anatolian Teacher Training Schools, and Vocational and Technical Secondary Schools. On the same exam, 108,545 (18%) students were successful. This exam is taken by many students in Turkey after eight years of compulsory education. The authorities were quick to argue that the poor scores were because of the fact that the exam was prepared to measure students' interpretation and problem solving skills. This argument met with an angry response from the people concerned about the education system in Turkey. Hasan Bulent Kahraman, a writer for a prominent Turkish Daily Newspaper criticised the excuses presented by the authorities in his article titled 'Catastrophe in Education' by arguing that the real problem was that the current education system is recall based and it is a flimsy excuse to suggest that the exam was prepared to measure students interpretation and problem based skills as multiple selection test is not the correct method for this type of measurement (Kahraman, 2003).

Despite the dominance of the constructivist approach in science education in many parts of the world over the last two decades, Turkish schools continue to witness the predominant practice of didactic teaching methods. Therefore, initial teacher education and in-service programs fail to include the constructivist view of learning in their courses (Cakici, 2001). According to Ersoy (1995) and Ekiz (2001) learning activities in Turkey are strongly dominated by teachers and learning mainly depends on the memorisation of topics. Thus, as Cakici (2001) argues,

"The objective of classroom teaching and learning in science education in Turkey, then, is to provide the student with as much scientific information as possible by emphasising the teaching of basic facts and definitions, and then to measure the quantities of scientifically acceptable information retained by children," (p. 9).

This type of teaching tradition is bound to fail in terms of students' cognitive development and social skills, as it perceives students as machines and not social beings. In this tradition, students are loaded with a large amount of scientific information not because they may need to use it in their life to reason about scientific developments, but because they will be asked to recall this information in exams. The focus of the national curriculum is not flexible enough to allow teachers to use teaching methods that broaden the students' perspectives and promote social development. The Turkish national curriculum includes too many topics and does not allow teachers the flexibility to select the content (Cakici, 2001). The pressure of covering all of the topics in an allocated time is a substantial burden and inhibits the exploration of different methods that focus on meaningful learning. When a teacher candidate embarks on preservice teacher education, observes school life in a classroom from a teacher perspective and becomes a practising teacher, his/her impression of a teacher begins to change. We believe that because the participant student teachers were in the above mentioned stage, they began to see the benefit of student-centred learning activities and therefore they were in a process of changing their practice or at least having a change of mind for their preferences of learning. Considering the education system that student teachers have experienced, it is not surprising to see them prefer learning ways included in the theorist sub-dimension. Experiencing an education system drowned by exams that focus primarily on students' correct answers on national exams without exception every year from year six to year twelve, student teachers prefer structured learning activities. Students primarily prefer to learn through the use of material that were previously utilised by teachers.

Conclusions

In this study, science student teachers' learning preferences were investigated according to the sub-dimensions identified by Honey and Mumford (1992). Biology, Physics, Chemistry and Primary science student teachers (N= 387) participated in the study. The study revealed that science student teachers preferred all four dimensions of the different learning styles. While science student teachers moderately preferred learning styles identified in the activist sub-dimension, they strongly preferred learning styles in the reflector, theorist and pragmatist sub-dimensions. These differences were linked to the general education system in Turkey where a strong teacher centred learning environments exists. It is argued that as student teachers have experienced an education that favoured theory rather than practice or hand on activities, it is not surprising that student teachers have a lesser preference for learning through activities that include individual active participation in the teaching-learning process. Data analysis revealed positive correlations among all four sub-dimensions of learning styles. Taking the findings into consideration, researchers suggest that as well as identifying learning styles of student teachers and providing opportunities for them to develop these styles, learning environments

should be organised to help student teachers to develop learning styles identified in all four sub- dimensions used in the study. Furthermore, learning styles should be included in teacher education programmes in order to help student teachers to gain a better understanding of the different learning preferences displayed by pupils. By knowing students learning style preferences, applying differentiation in the classroom (generally considered as a difficult practice), may become easier as identification of student preference for way of learning becomes apparent.

REFERENCES

Babrach AM, Burdine P, Allbright L, Randol P (1975). Centre for Innovative Teaching Experience Learning Style Instrument. Wichita: Murdock Teacher Centre.

Constantinidou F, Baker S (2002). Stimulus Modality and Verbal Learning Performance in Normal Aging. Brain Lang., 82: 296- 311.

Cakici Y (2001). Exploring Upper Primary Level Turkish Pupils' Understanding of Nutrition and Digestion. Unpublished (Ed.) Thesis, Universtiy of Nottingham, Nottingham.

Celik H (2003). Liselerde Sistem degisiyor. Hurriyet (Turkish daily newspaper, 15/07).

Curry L (1990). A Critique of Research on Learning Style. Educ. Leadership. 50 – 56.

Dunn R, Dunn K, Price GE (1985). Learning Style Inventory. Lawrence Kansas : Price System.

Dunn R, Dunn K (1992). Teaching Students through Their Individual Styles: Practical Approach. Reston : Rescon Publishing Co.

Dixon NM (1985). The Implementation of Learning Styles Information. Lifelong. Learning, 9(13): 16-20.

Ekiz D (2001). Exploring Primary School Teachers' Preactive Teaching and Practical Theories of Teaching Science: Multiple Case Studies from Turkey. Unpublished (Ed) Thesis, University of Nottingham, Nottingham.

Ersoy Y (1995). Continuing Education of Math Teachers towards the Information Era. Paper presented at the Ma TEI.

Griggs SA (1985). Counseling Student Through Their Individual Learning Style. ERIC, The National Institute of Education. The University of Michigan.

Honey P, Mumford A (1992). The manual of learning styles. (3rd ed.). Maidenhead, England: Honey.

Kahraman HB (2003). Eğitimin Dehşet Hali. Radikal (Turkish daily newspaper, 30/07).

Khan ZN (2009). Differences between Learning Styles in Professional Courses at University Level. J. Soc. Sci., 5(3): 236-238.

Keefe J (1987). Learning Style Theory and Practice. Reston: National Association of Secondary School Principals.

Massa LJ, Mayer RE (2006). Testing the ATI hypothesis: Should multimedia instruction accommodate verbalizer- visualizer cognitive style? Learn. Individ. Diff.. 16: 321–336.

Pashler H, McDaniel M, Rohrer D, Bjork R (2009). Learning Styles: Concepts and Evidence. Psychol. Sci. Public. Interest, 9(3): 105-119.

Peker M, Mirasyedioglu S (2008). Pre-Service Elementary School Teachers' Learning Styles and Attitudes towards Mathematics. Eurasia J. Math. Sci. Technol. Educ. 4(1): 21-26.

Reiff J (1992). Learning Styles. Washington DC: National Education Association.

Renzulli JS, Smith LM (1978). Learning Style Inventory: A Measure of Student's Preference for Instructional Technique. Manafield Center. Creative learning Process.

Riding RJ (1991). Cognitive styles analysis. Birmingham: Learning and Training Technology.

Slaats A, Lodewijks HGLC, Senden JMM (1999). Learning Styles in Secondary Vocational education: disciplinary differences. Learn. Instr., 9: 475- 492.

Svincki MD, Dixon NM (1987). The Kolb model modified for classroom activities. Coll. Teach., 35(4): 141-146.

Vermetten YJM, Vermunt JDHM, Lodewijks HGLC (1995). Changes in Learning Styles as a Result of Student Oriented Education. Paper presented at the Biannual Meeting of the European Association for Research on Learning and Instruction. Nijmegen.