Research on Humanities and Social Sciences
ISSN 2224-5766 (Paper) ISSN 2225-0484 (Online)
Vol.8, No.5, 2018

Matching/Mismatching of Teaching and Learning Styles; and Its Effect on Students' Academic Achievement at Tertiary Level

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Abstract
The overall purpose of the study was to explore the effect of matching/mismatching of teaching and learning styles on academic achievement in higher education. The study was causal comparative in nature to study the cause and effect relationships between matching/mismatching of teaching learning styles and students' academic achievement. The sample for this study, selected through multistage sampling design, consisted of 120 teachers and 240 students of BS-4 year program in four disciplines (Physics, Chemistry, Botany and Mathematics) from six public sector universities of Khyber Pakhtunkhwa, Pakistan. Felder-Solomon Index of Learning Style (FSILS) was used for the identification of learning styles of students while Teaching Style Instrument developed by Letele et al. (2011) was used to identify teachers' teaching styles. These styles of students and teachers were then analyzed to see if they matched or mismatched. The results showed that Visual learning style was the most favorite learning style followed by Balanced and Sensing learning style. Teaching style analysis showed that Visual teaching style was the most favorite style followed by Abstract and Sequential teaching styles. Group statistics indicated 42.75% matched cases and 57.25% mismatched cases. T-test for independent samples revealed that the students with matched learning styles performed significantly better than students with mismatched learning styles. In the light of these results, recommendations were forwarded for teachers, students, educationists, researchers and policy makers.
Keywords: Matching, Mismatching, Teaching Style, Learning Style, Academic Achievement

Introduction

Matching/Mismatching of teaching and learning style has proved to be somewhat divisive subject in research cultures as there are research findings that favor the idea of matching and those that do not (Ford & Chen, 2001). According to Coffield et al. (2004), nine research studies found learning to be more effective when there is match while the same number of studies favored the idea of mismatch. According to Larkin-Hein (2000), the teacher who teaches in the classroom keeping learning style of students in view and uses various strategies to cater for all the students, results in improved conditions in terms of interest, motivation and academic performance.

This study is planned to determine the influence of matching/mismatching on students' performance regarding their academic achievement. Matching/Mismatching illustrates the extent to which students' learning style preferences are similar/dissimilar to teachers' instructional style preferences indicated by the two questionnaires in the study.

Academic achievement is defined as "the attainment of knowledge, competencies, and higher-level status, as reflected in grades, degrees, and other forms of certification or public acknowledgment" (The Greenwood Dictionary of Education, 2011). For this research study academic achievement is the mean score attained by the student at the end of semester examination in the subject taught by the teacher participating in the study.

Learning styles

The Cambridge Advanced Learner's Dictionary (2008) defines style as "a way of doing something especially typical of a person, group of people, place or period" (p.). In the context of education, a teaching style may be defined as "methods, procedures and strategies in instruction and interpersonal relations that have developed and matured through years of personal and professional experience" (The Greenwood Dictionary of Education, 2011, p.3). According to Grasha (1996), teaching style is a combination of manners, tactics and behaviors inherent in the personality of a teacher that immensely influence the teaching learning process.

To date, various definitions of the term learning style exist in research literature. Learning style is described and interpreted in many different ways depending upon one's conception about the term. Some consider it to be relatively stable while some are of the opinion that learning styles have a complex nature and varies according to the context of teaching learning process. These different ideas of learning styles have given birth to various

different definitions. “The term learning style refers to the general approach preferred by the student when learning a subject, acquiring a language, or dealing with a difficult problem.”(Oxford, 2003, p. 273) According to Ellis (2001), learning style is a consistent way of a person’s perception, conceptualization, organization and recalling information. It is the composite of cognitive, affective and physiological behaviors that serve as relatively stable indicators of how a learner perceives, interacts with, and responds to the learning environment (Keefe, 1979). Learning style also tells about the ways a person learns from and adapts to environment, and how a person’s mind operates (Gregorc, 1979).

Curry (1990) categorizes learning into four dimensions just like the four layers of an onion namely personality traits, information processing, social interaction; and the instructional environment and students learning preferences. Felder and Solomon (1996) developed a learning style instrument called the Index of Learning style. Initially this instrument comprised five dimensions namely Processing (Active/Reflective), Perception (Sensing/Intuition), Input (Visual/Verbal), Organization (Inductive/Deductive) and Understanding (Sequential/Global). Later the organization dimension Inductive/Deductive was dropped from the instrument and presently it consists of four dimensions each with 11 items forming a total of 44 items each having dichotomous nature with two opposite poles.

Active and Reflective learners: Active learners learn best when they are engaged in learning process actively by generating discussion, applying and understanding information through sharing it with others i.e. peers, adults and group members. They enjoy group study and activity based learning while reflective learners like to work alone and think about a problem quietly first before getting physically involved. Listening to lectures and taking notes is greatly favored by reflective learners while disfavored by active learners.

Sensing and Intuitive learners: This dimension was developed on the basis of Jung’s theory of psychological types in which sensing and intuition are the two ways through which people perceive the outer world. People with sensing learning style gather information through senses while people with intuitive style perceive things indirectly by the way of unconscious i.e. speculation, imagination, hunches etc. Sensors prefer data, facts and experimentation whereas intuitors prefer theories and principles. Sensors mostly rely on standard methods for solving problems through step-by-step procedure and they do not like wonders. On the other hand intuitors dislike repetitions and like innovations. Sensors prefer factual where as intuitors prefer conceptual information. (Felder and Silverman, 1988)

Visual and Verbal learners: People receive information in three ways called sometimes modalities, visual-----sights, pictures, charts, diagrams, symbols; auditory-----sounds, words; kinesthetic -----taste, touch and smell. Visual learn best when materials are presented in diagrams, flow-charts, images, films and demonstrations. Contrary to visual learners, verbal learners like spoken and written information in the form of lectures. They memorize those information best which they hear and then explain it to others.

Sequential and Global learners: Sequential learners understand best when problems are solved in orderly and linear steps; global learners solve problems in large heaps but cannot explain how they came up with the solution. Sequential learners are strong in analysis and convergent thinking whereas global learners are best in synthesis and divergent thinking. Sequential learners would like the problem to be solved in small incremental steps where precise, detailed and orderly sequence is involved, on the other hand global learners like situations where information are presented in a holistic form without enough details

Teaching styles

Teaching style is formed on the basis of various distinctive teaching behaviors, approaches and strategies that are applied in promoting students’ learning (Darkenwald, 1989). Teaching styles is the collection of various instructional approaches used by the teacher with ease and comport; and is highly related to the context of learning rather than the content. (Conti, 1989) As described by Hoyt and Lee (2002) teaching style is the amalgamation of a range of instructional approaches while instructional approach is a combination of different teaching methods. Kaplan and Kies (1995) specify teaching style to be a method specific to teacher personal behavior and the media that teacher use to covey and get information. One’s teaching style is the result of the way one learnt and not the way he/she was taught (Dunn and Dunn, 1979). For Zinn (1990) teaching style is based on the teaching philosophy and value system held by the teacher regardless of the method and material. According to Grasha (1996) teaching styles characterize a belief system along with the needs and behaviors that teachers display in class-rooms.

According to Felder and Silverman Model of Teaching (1988), a teacher may either emphasize concrete, factual information or abstract, conceptual and theoretical information. A teacher may either present information through pictures, diagrams, demonstration or it may be verbal through lectures, reading and discussion. A teacher may either encourage students to actively participate in discussions and activities or remain passive simply watching and listening. Lastly, a teacher may prefer a sequential mode of presenting the material in a systematic manner; or they could prefer to present a global picture first and then proceed to break it down.

Matching/mismatching of teaching and learning styles

The need for investigating teachers' teaching styles and learners' learning styles is felt to avoid mismatches in style between teachers and learners (DeBello, 1990; Larkin-Hein, 2000; Zhenhui, 2001; Dasari, 2006; Graf et al. 2007; Alaka, 2011; Letele et al. 2013). The teacher ought to assist students in identifying their learning styles for building their confidence and making teaching learning process more effective (Doyle and Rutherford, 1984; Hoyt & Lee, 2002). Learning style can influence teacher's approach to planning, implementing and evaluating the teaching learning process. The teacher should develop teaching strategies in the light of students' learning preferences to cater for all their needs and to compensate their weaknesses (Herod, 2000).

While research shows that a greater learning occurs when teaching and learning styles match, Felder and Brent (2005) are of the opinion that the teacher should adopt a balanced teaching style to facilitate all the students having diverse learning styles, otherwise, some students will be satisfied while some will feel dissatisfied with the instructional process.

Making teaching congruent with the learning style of students is well supported by the case study of a teacher teaching English to the 11th grade students as described by Dunn (1996). In this study it was evident that the score of those students who had been taught the curriculum in accordance with the learning style of students was relatively very high as compare to those students who had been taught in the traditional way.

The concept of teaching, with learning style in view, is getting popularity across all disciplines particularly in the fields of Engineering and Physics. In a study, Tobias (1990) reported that the failure and dropout on the part of the students in science education in most of the cases were caused by the instruction not congruent with the students' learning styles. In this study he also noticed that a match between the styles of students and teachers give positive results in terms of students' motivation, interest, conceptual understanding and retaining information for a longer period of time. On the contrast, mismatching between students and teachers leads to mistrust, losing interest and even changing to other fields by the students. (Felder, 1993)

Among various scales and instruments used for the identification students' learning styles, the Index of Learning Styles (ILS) developed by Felder and Solomon based on Felder and Silverman learning style model, is the most comprehensive (covering all the essential aspects and dimensions of the learning style), short, valid and reliable instrument (Graf et al., 2007, Felder & Spurlin, 2005). The ILS is a self-report dichotomous scale with four dimensions, each representing two opposite learning styles. Each dimension comprises 11 items forming a total of 44 items. The first dimension Sensing/Intuition is related to how student perceives information. The second dimension Active/Reflective is concerned with the way student processes the information. The third dimension Visual/Verbal is about the way student intakes information and the fourth Sequential/Global is related to understanding and organization of information.

Method

In this study a Causal-Comparative Research design was used, in which data was collected with the help of two questionnaires to achieve the mentioned objectives. In causal comparative design, two groups differing on independent variable (the cause) without manipulation are compared for dependent variable (the effect), to determine cause and effect relationship (McMillan & Schumacher, 1989; Gay, 1996). In this study, independent variable called the cause was the matching of teaching and learning styles and the dependent variable called the effect, was the academic achievement. Learning style, in this study, can be operationally defined as any one of the eight learning styles identified by FSILS. Similarly, teaching style is defined as any one of the eight teaching styles identified by teaching style questionnaire. Matching/mismatching illustrates the extent to which students' learning style preferences are similar/dissimilar to teachers' instructional style preferences indicated by the two questionnaires in the study. Academic achievement in this study is the mean score attained by the student at the end of semester exanimation in the subject taught by the teacher participating in the study.

Objectives of the Study

The main purpose of the intended study was to investigate "Matching/Mismatching of teaching and learning styles and its effect on academic achievement at tertiary level. The objectives of the study were:

- To identify teaching styles of teachers at Tertiary level;
- To identify learning styles of learners at Tertiary level;
- To point out matching and mismatching between teacher's teaching style and learner's learning style at Tertiary level; and
- To determine the effect of matching/mismatching between teachers' teaching style and learners' learning style on academic achievement at Tertiary level.

Hypotheses of the Study

- H_1: There is significant difference between the mean achievement scores of students with matched styles and mismatched styles in the subject of Physics.

- H_{01}: There is no significant difference between the mean achievement scores of students with matched styles and mismatched styles in the subject of Physics.
- H_2: There is significant difference between the mean achievement scores of students with matched styles and mismatched styles in the subject of Mathematics.
- H_{02}: There is no significant difference between the mean achievement scores of students with matched styles and mismatched styles in the subject of Mathematics.
- H_3: There is significant difference between the mean achievement scores of students with matched styles and mismatched styles in the subject of Chemistry.
- H_{03}: There is no significant difference between the mean achievement scores of students with matched styles and mismatched styles in the subject of Chemistry.
- H_4: There is significant difference between the mean achievement scores of students with matched styles and mismatched styles in the subject of Botany.
- H_{04}: There is no significant difference between the mean achievement scores of students with matched styles and mismatched styles in the subject of Botany.

Population and Sample

Population for this study consisted of all the teachers and students of 19 public sector universities of Khyber Pakhtunkhwa, Pakistan. A sample of 360 (240 students and 120 teachers) respondents, was selected through multistage sampling design. In the first stage six public sector universities were purposively selected from Khyber Pakhtunkhwa, namely Hazara University (HU), Mansehra, University of Malakand (UOM), Dir (L); University of Peshawar (UOP), Abdul Wali Khan University (AWKU), Mardan; Kohat University of Science and Technology (KUST), and University of Science and Technology Bannu (USTB). From each of these six universities four disciplines or departments namely Physics, Mathematics, Chemistry and Botany; and from each of these departments 10 students and 5 teachers of BS (4-years program) were selected through Stratified and Quota sampling.

Instrumentation

The data was collected with the help of two questionnaires to achieve the mentioned objectives. Felder and Solomon Index of Learning Style (FSILS) was used to identify students' learning style while teaching style inventory developed by Letele et al. (2013) based on Felder and Silverman theory of teaching style, was used to identify teachers' teaching style. FSILS has 44 items with four dimensions (active/reflective, sensing/intuitive, visual/verbal, and sequential/global), each dimension with 11 items. Like FSILS teaching style instrument has also 44 items with four dimensions (active/passive, concrete/abstract, visual/verbal, and sequential/global), each dimension with 11 items. All items in FSILS have dichotomous nature with two opposite poles (a) and (b) indicating two learning styles on one dimension with contrasting styles.

Matching/mismatching between teachers' teaching style and students' learning style was conducted according to the following scheme as shown in the table.

Table1

Preferred Learning Style and Corresponding Teaching Style

Preferred Learning Style	Corresponding Teaching Style
Active/Reflective	Active/Passive
Sensing/Intuitive	Concrete/Abstract
Visual/Verbal	Visual/Verbal
Sequential/Global	Sequential/Global

(Adopted from Felder and Silverman, 1988)

Validity and Reliability of the instruments

A pilot study was conducted prior to main study, for assessing feasibility of the research procedure, validity and reliability of the two research instruments and any potential flaws in the research study. For this purpose data was collected from a sample of 20 teachers and 29 students not included in the main study. Both the instruments i.e. FSILS(Felder-Solomon Index of Learning Style) and teacher teaching style instrument were validated by the team of experts from IER (Institute of Education and Research) and Department of Psychology at University of Peshawar; and declared it suitable for the said purpose in local environment. The internal consistency test of reliability for both the instruments was conducted with the help of SPSS-17 for the said samples of students and teachers. The Cronbach's alpha values for FSILS obtained in this study were found to be 0.71 for Sensing-Intuitive (Sen-Int) dimension, 0.67 for Visual-Verbal (Vis-Vrb) dimension, 0.65 for Active-Reflective (Act-Ref) and 0.58 for Sequential-Global (Seq-Glb) dimension. In the same way the Cronbach's alpha values for teacher style instrument turned out to be .687 for Concrete-Abstract, .634 for Active-Passive, 0.72 for Visual-Verbal and

0.578 for Sequential-Global dimension.

Table 2
Cronbach's Alpha Coefficients for ILS

Act-Ref	Sen-Int	Vis-Vrb	Seq-Glb	N	*Source*
0.65	0.71	0.67	0.58	29	Current Study
0.60	0.70	0.63	0.53	557	Zywno
0.56	0.72	0.60	0.54	242	Livesay *et al.*
0.62	0.76	0.69	0.55	584	Spurlin
0.51	0.65	0.56	0.41	284	Van Zwanenberg *et al.*
0.60	0.77	0.74	0.56	572	Litzinger

Analysis of data

The data was analyzed with the help of SPSS-17 in the form of frequencies and percentages. T-test for independent samples was used for comparing the groups. For matching/mismatching, the most dominant learning and teaching styles were considered on all four dimensions for both instruments. Analysis included the distribution of learning and teaching styles, group and t-statistics results regarding matching/mismatching of teaching-learning styles and significance.

Results

Table 3
Distribution of Learning Styles

Dimensions	Learning style	Frequency	Percentage (%)
1	Sensing	23	9.58
	Intuitive	19	7.92
2	Active	16	6.67
	Reflective	13	5.42
3	Visual	42	17.50
	Verbal	15	6.25
4	Sequential	13	5.42
	Global	16	6.67
	Mixed Styles	44	18.32
	Balanced Style	39	16.25
	Total (N)=	**240**	**100**

Table 3 shows that among single styles, the most dominant learning style was Visual (17.50%) followed by Sensing learning style (9.58%). Moreover, 18.32% students were using mixed learning styles while balanced learning style was preferred by 16.25% students.

Table 4
Distribution of Teaching Styles

Dimensions	Teaching Style	Frequency	Percentage (%)
1	Concrete	8	6.67
	Abstract	11	9.17
2	Active	5	4.17
	Passive	10	8.33
3	Visual	33	27.50
	Verbal	8	6.67
4	Sequential	11	9.17
	Global	8	6.67
	Balanced	8	6.67
	Mixed Styles	18	15.00
	Total (N)=	**120**	**100**

Table 4 shows that majority of teachers (27.5%) were using Visual teaching style followed by Abstract and Sequential styles used by 9.17% teachers each. Moreover, 8.33% teachers were using Passive teaching style while Concrete, Verbal, Global and Balanced teaching styles were being used by 6.67% teachers each. In addition, 15% teachers had mixed teaching styles.

Table 5
T-Test for matched and mismatched groups of students of Physics in terms of their academic achievement

Teaching Style	N	Mean achievement score	Std. Deviation	df	Sig. (2-tailed) p-value
Students with matched styles	111	73.98	6.89		
Students with mismatched styles	189	70.71	8.34	298	0.001*

* Significant at α=.05

Table 5 shows that the mean achievement score of the matched group of students is 73.98 while that of mismatched group is 70.71 and p=0.000<.05, so therefore the null hypothesis that there is no significant difference between the mean achievement score of matched and mismatched group in the subjects of Physics, is rejected and the research hypothesis is accepted. It is, therefore, concluded that academic achievement of students with matched styles is significantly higher than the students with mismatched styles in the subjects of Physics.

Table 6
T-Test for matched and mismatched groups of students of Chemistry in terms of their academic achievement

Teaching Style	N	Mean achievement score	Std. Deviation	df	Sig. (2-tailed) p-value
Students with matched styles	120	75.18	10.08		
Students with mismatched styles	180	70.76	9.23	298	0.001*

*Significant at α=.05

Table 6 shows that the mean achievement score of the matched group of students is 75.81 while that of mismatched group is 70.76 and p=0.000<.05, so therefore the null hypothesis that there is no significant difference between the mean achievement score of matched and mismatched group in the subjects of Chemistry, is rejected and the research hypothesis is accepted. It is, therefore, concluded that academic achievement of students with matched styles is significantly higher than the students with mismatched styles in the subjects of Chemistry.

Table 7
T-Test for matched and mismatched groups of students of Mathematics in terms of their academic achievement

Teaching Style	N	Mean achievement score	Std. Deviation	df	Sig. (2-tailed) p-value
Students with matched styles	115	76.93	9.22	298	0.000*
Students with mismatched styles	185	70.60	12.78		

*Significant at α=.05

Table 7 shows that the mean achievement score of the matched group of students is 76.93 while that of mismatched group is 70.60 and p=0.000<.05, so therefore the null hypothesis that there is no significant difference between the mean achievement score of matched and mismatched group in the subject of Mathematics, is rejected and the research hypothesis is accepted. It is, therefore, concluded that academic achievement of students with matched styles is significantly higher than the students with mismatched styles in the subjects of Mathematics.

Table 8
T-Test for matched and mismatched groups of students of Botany in terms of their academic achievement

Teaching Style	N	Mean achievement score	Std. Deviation	df	Sig. (2-tailed) p-value
Students with matched styles	167	76.46	10.80	298	0.000*
Students with mismatched styles	133	70.03	10.61		

* Significant at α=.05

Table 8 shows that the mean achievement score of the matched group of students is 76.46 while that of mismatched group is 70.03 and p=0.000<.05, so therefore the null hypothesis that there is no significant

difference between the mean achievement score of matched and mismatched group in the subject of Botany, is rejected and the research hypothesis is accepted. It is, therefore, concluded that academic achievement of students with matched styles is significantly higher than the students with mismatched styles in the subjects of Botany.

Table 9

T-Test for matched and mismatched groups of all the students in all four disciplines in terms of their academic achievement

Teaching Style	N	Mean achievement score	Std. Deviation	df	Sig. (2-tailed) p-value
Students with matched styles	513	75.73	9.583	1198	0.000*
Students with mismatched styles	687	70.56	10.336		

*Significant at α=.05

Table 9 shows that the mean achievement score of the matched group of students is 75.73 while that of mismatched group is 70.56 and p=0.000<.05, so therefore the null hypothesis that there is no significant difference between the mean achievement score of matched and mismatched group, is rejected and the research hypothesis is accepted. It is, therefore, concluded that academic achievement of students with matched styles is significantly higher than the students with mismatched styles.

Discussion

The findings of this study is in line with the findings of various other researchers like (Zenhui, 2001; Tamimi & Shuib, 2009; Felder and Silverman, 1998) who came up with similar results in their studies where majority of learners were reporting Visual style as their most dominant learning style. Zenhui added that Visual learning style was popular among most of the Korean, Japanese and Chinese Students. Similarly a study conducted by Moallem (2007) revealed findings similar to this study who also found that percentage of students with Visual style was the highest.

The most important finding of the study that matching-mismatching of teaching-learning style do affect the academic achievement of students positively, is in complete agreement with the findings of the studies conducted by Letele et al. (2011), Dasari (2006), Ford and Chen (2001), Fazarro, D. E., Pannkuk, T., Pavelock, D., & Hubbard, D. (2009), Charkins, O'Toole, Raines (1978), and Honigsfeld & Dunn, (2006) . As findings of this study revealed that matching of teaching-learning styles had a positive and mismatching a negative impact on academic achievements of students, is well supported by Felder and Brent (2005). In contrast, the study conducted by Spoon and Schell gave contrary result where mismatched students outperformed the matched students. Similar results were also reported by Terry (2001), Scerba (1979), Ruhnau (2006) and Campbell (1989) where matching of teaching-learning had no or very small impact on students' performance. The findings of this study is also inconsistent with the study of Spoon and Schell (1998) who reported in their study that academic performance of incongruent students was better than that of congruent students in adult basic skills classes. One possible cause of these contrasting results may be the factors like culture, environment, prior experiences, students' effort, disciplines, history and other physical and psychological factors related to students and teachers. Among other possible causes for these contrasting results might include various learning and teaching style instruments, research methods and samples. However, one thing is evident that matching of teaching and learning styles results in greater satisfaction, motivation and self-efficacy on both the part of students and teachers (Felder and Brent, 2005; Larken-Hein,2000; Peacock,2001;Spicer,2004).

Conclusion

Research findings revealed that Visual learning style was the most dominant learning style used by majority of students followed by balanced and mixed learning styles. In case of teachers, after Visual style, the mixed and Sequential were the most preferred teaching styles used by most of the teachers. Analysis of data regarding matching-mismatching of teaching-learning styles revealed that the percentage of students with mismatched styles was higher than percentage of students with matched styles. Most importantly, from over all data analysis it was concluded that there was a significant difference between the mean scores of matched students and mismatched students; and that the mean score of matched students was significantly higher than the mean score of mismatched students.

Recommendations

In the light of these findings and conclusions, following are some of the recommendations

- As evident from conclusions that majority of teachers and students were using Visual style so

institutional administration should provide teachers with AV aids and other teaching materials so that they may be able to fully utilize these resources to address all issues in classrooms regarding learners' learning styles.

- Educational practitioners, policy-makers and curriculum designers should revise course contents, academic programs and other training programs keeping learning style of students in view.
- Teachers are recommended to direct their presentation, evaluation and planning to learning styles of students during teaching learning process in classrooms to accommodate all the students with various learning styles in order to develop a peaceful, conducive and harmonious environment for learning.
- School administration and teachers should form classroom sections and students' groups on the basis of students' learning styles and those teachers should be assigned to those sections and groups of students where teachers' teaching style match students' learning style to enhance students' motivation, satisfaction and academic achievement.
- Government is recommended to take initiative to search out further empirical evidences by funding various organizations and agencies across the country to conduct extensive researches related to the concept of teaching learning styles.

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