Learning Styles and Overall Academic Achievement in a Specific Educational System

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Abstract

Experts assert that individuals enjoy various learning styles. In many cases what is being taught has a less impact on learners' achievement than the way materials are presented. In other words, learning styles make an important component in the learning environment. The Learning Styles Survey (LSS), employed in this study, appears to be a viable tool to determine students' learning style. The present study is an investigation of the relationship between learning styles and overall academic achievement. In order to investigate this relationship a total of 317 students participated in this survey study. The Learning Styles Survey (LSS) instrument which is based on Joy Reid's Perceptual Learning-Style Preference Questionnaire (1987) was used. The statistical procedures employed in this study were one-way ANOVA, and multiple regression analysis. The analyses of the data indicated a significant relationship between overall academic achievement and learning styles. It was also found that the high, moderate and low achievers have a similar preference pattern of learning in all learning styles. Moreover, the learning styles framework does not change with subjects, where it actually plays an important role across all the subjects. Therefore, the results here suggest avenues of future research to understand this phenomenon.

Keywords: learner; learning styles; Islamic school; academic achievement; learning environment

1 Introduction

It is known that learning processes vary from person to person due to the presence of biological and psychological differences. As Pask (1988) points out more than three-fifths of a person's learning style is biologically imposed. Moreover, Reiff (1992) states that all learners have individual attributes relating to their learning processes. Sitt-Gohdes (2001) also holds that most teachers teach the way they have already learned. These might have caused the frustration of a good number of learners as they witness that their learning preferences are not accounted for by many teachers. The case is more serious in a context where students come from diverse educational experiences and with different cultural backgrounds. Compared to the extensive work done on methods and instructional activities, one vital area often neglected is the exploration of learning styles in the classroom.

According to Keefe and Ferrell (1990), learning problems are frequently not related to the difficulty of the subject matter but rather to the type and level of the cognitive processes required to learn the material. Additionally, Dunn (1983) found that dramatic improvement in students' achievement in cases where learning styles have been taken into account show that the way things are taught had a greater impact than the content covered in a course of study. It is believed that when teachers are able to analyse the differences and needs of their students, the educational process is likely to become optimised for both students and teachers (Fairhurst & Fairhurst 1995). Learning styles are among the concepts that are postulated by researchers to show learners' differences and varied needs. As a result, the present study aims to examine the relationship between learning styles and overall academic achievement of the students in a school in Malaysia.

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2 Review of the Related Literature

2.1 Learning Style: Definition

'Learning Style' has been defined by various scholars mostly as a signal for individual differences. These differences may manifest itself in 'life styles' and even in personality types (Zhang & Sternberg 2005). Kolb (1984) and Honey and Mumford (1992) describe learning style as an individual preferred or habitual ways of processing and transforming knowledge. According to Kolb (1984), psychological attributes, resulted from individual differences, determine the particular strategies a person chooses while learning. On the other hand, Keefe (1987) emphasizes learning styles as cognitive, affective, and psychological traits that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment. Moreover, Dunn and Dunn (1986) hold that each individual's concentration on, mental processes, internalization and retain of new and difficult information stem from his specific learning style.

For Felder and Henriques (1995), the criterion for classifying learners is their perceptual behaviour. They make two categories: sensing and intuitive learners. 'Sensing' learners are concrete and methodical; they are good at memorising facts and doing hands-on work and are more comfortable with following rules and standard procedures. On the other hand, 'intuitive' learners tend to be abstract and imaginative; they like innovation and dislike repetition. As to the ways in which learners prefer input information to be presented, they can be either visual or verbal learners. Visual learners are those who prefer to receive in the form of pictures, diagrams, films and demonstrations while verbal learners prefer words as a medium for information transfer. Moreover, with respect to the ways of knowledge can be processed, learners can be put into two categories, namely 'active' and 'reflective'. An active learner, as suggested by the name, is someone who prefers to be actively involved in examining and employing knowledge with others. He does so in group discussions and interactions with others. Reflective learners tend to employ their introspection. Active learners benefit the most in dialogue, role-play and team work learning activities while reflective learners are more inclined to ponder on perceived information.

Learning styles were found to affect learners' learning behaviours. Learners having different learning style preferences would behave differently in the way they perceive, interact, and respond to the learning environment (Junko 1998). Since learners differ in their preferences to certain learning styles, it will be important for teachers to examine the variations in their students on the features of their learning styles, because the information about learner's preference can help teachers become more sensitive to the differences students bring to the classroom (Felder & Spurlin 2005). Adjustments can then be made to accommodate the students' varied needs. This study, therefore, aims at depicting the relationship of learners' learning style preference and the overall academic achievement of a group of Malaysian students in a religious secondary school.

2.2 Learning Styles and Academic Achievements

There have been many attempts made to enhance students' academic achievements. It has always been the main concern of many dedicated teachers and parents that their students and children be as much successful as possible. In relation to this, many teachers are convinced that students need the positive attitude to succeed academically. Often, one's learning style is identified to determine strengths for academic achievement. Dunn, Beaudry and Klavas (1989) assert that through voluminous studies, it has been indicated that both low and average achievers earn higher scores on standardized achievement and attitude tests when they are taught within the ealm of their learning styles.

Chuah Chong-Cheng (1988) discusses the importance of learning styles as being not only necessary, but also important for individuals in academic settings. Most students favour to learn in particular ways with each style of learning contributing to the success in retaining what they have learnt. As such, studies carried out conclude that students retain 10% of what they read, 26% of what they hear, 30% of what they see, 50% of what they see and hear, 70% of what they say, and 90% of what they say as they do something (Chuah Chong-Cheng 1988). These facts reveal that each learning style has its own strengths and weaknesses. Some students learn in many ways, while others might only favour one or two. Those students with multiple learning styles tend to gain more and obtain higher scores compared to those who rely solely on one style (Dunn, Beaudry & Klavas 1989). Additionally, the differences in learning styles have also been reported between gifted and the underachievers; between the learning disabled and average achievers; among different types of special education students; and among secondary students in comprehensive schools and their counterparts in vocational education and industrial arts (Dunn & Dunn 1986). Some special students favour Kinesthetic instruction, such as experiential, active and hands-on, while many others are more auditory and visually oriented (Dunn 1991).

Dunn and Dunn (1986) also believe that low achievers tend to have poor auditory memory. Although they often want to do well in school, their inability to remember information through lecture, discussion, or reading causes their low achievement especially in traditional classroom environment where teachers dominate and students mostly listen or read. It is not only the low achievers learn differently from the high achievers, they also vary among themselves. Impulsive students for instance, when compared to reflective ones, show poor academic achievement (Kagan and Kagan, 1970). Other studies show that Field Independent students achieve more than Field Dependent ones (Chapelle 1995). Studies also reveal that matching teaching and learning styles can significantly enhance academic achievement at the primary and secondary school levels (Smith & Renzulli 1984). According to Felder (1995), students learn more when information is obtainable in a variety of approaches than when only a single approach is applied. Much experiential research indicates that learning styles can either hamper or increase academic performance in several aspects even though not much research has been conducted on the relationship between instructional design of learning materials and learning styles (Riding & Cheema 1991). In general, a rich data have been obtained through studies on learning styles; however, the data have rarely been exploited by designers of instructional programs thereby a greater understanding of learners' approaches to learning can be obtained.

2.3 Learning Styles in Malaysian Contexts

One of greatest aspirations of any country is to become a centre of excellence in education at the global level, Malaysia is no exception. Generally speaking, although teachers in school have three major tasks to accomplish, that is, to select and formulate achievable objectives, to plan effective learning experiences to attain objectives, and to evaluate the extent to which the objectives have been achieved for the success of the school educational programme (Della-Piana 1965), many a time most teachers fail to achieve their mission to enhance students' achievements. This might be due to the differences in learning styles that students bring into the classroom and may play a significant role in creating opportunities in students' learning experiences. Moreover, this can bring to the surface issues that help administrators think more deeply about their roles and the organizational structure in which they carry out their responsibilities (Claxton & Murrell 1987). The present study seeks to investigate the learning styles of the Muslim students studying in an Islamic school in northern Malaysia. The main language is the Malay Language, followed by Arabic as the second most important medium of instruction. Additionally, the students have a heavy workload of a minimum 21 subjects to study with a 35 minutes slot per lesson. This is much larger than what is practised in the national type secondary schools. Nevertheless, this particular Islamic school has actually achieved a commendable result in the SPM examination which is the standardised government examination every year.

The revised curriculum for secondary school in Malaysia, called KBSM, recognizes that learners differ from each other in the way they learn as each learner has his or her own strength and unique intelligence, and where possible individual needs should be taken into account in the teaching process (Sukatan Pelajaran KBSM 2001). Although learning styles has not received full consideration in the local educational context, it is certainly the time that learning styles be fully incorporated into the teaching services. However, without proper research in this area, it is difficult to illustrate the contribution and positive intervention of learning styles with students' overall academic achievements. The present study was conducted primarily within the framework of the Learning Styles Survey (LSS) in order 1) to identify the learning styles profile of upper secondary students in an Islamic school in Malaysia, and 2) to examine students' learning styles with respect to their overall academic achievement. It attempts to help teachers understand the preferred learning styles of their students so that they would be able to develop effective instructions that make the most of their students' abilities.

As such, the concept of learning styles will challenge teachers to rethink of their methods to improve students' academic achievement. After all, as (Guild & Garger 1985) assert, effective educational decisions and practices must derive from an understanding of the ways that individuals learn. Teachers in this particular Islamic secondary school should be made aware of the learning style patterns their students bring to the classroom. By understanding the connection between their methods of teaching and the ways their students learn, they can accumulate a general profile of their class and then orient their teaching styles to meet the needs of their students.

3 Method

3.1 Research Design

This study mainly seeks to establish the empirical data on students' learning styles in an Islamic school in Malaysia. A survey research design is used to investigate, assess opinions and preferences in educational issues and problems. This design is considered the most appropriate method to measure attitudes, beliefs or personality structures in a natural setting through tests or attitude scales or questionnaires (Leedy 1993).

Therefore, the research design for this study advocates a survey that is mainly identifies with a quantitative mode of inquiry. The research design necessary to provide answers to the research questions would require comparison between an independent variable which is the students' overall academic achievement, while the dependent variable here is their learning styles. As to the learning styles, the 'Dunn and Dunn Learning Styles Model' was selected. In this model nine distinct learning style elements namely, Visual, Auditory, Kinesthetic, Global, Analytic, Impulsive, Reflective, Individual, and Group, in three specific dimensions of Physiology, Psychology, and Sociology are incorporated. Out of the nine elements the first three are for physiology dimension, the next four are related to psychology dimension and the final 2 introduce sociology dimension. The nature of this study is descriptive-interpretive, and designed to investigate whether the learning styles used by students in a particular religious school, influence their overall academic achievement. The data are collected by means of Learning Styles Survey (LSS), which contains 45 closed-ended statements addressing the concerns of students with regard to nine learning styles. This instrument was piloted in a school which has similar setting with the actual research school to evaluate its effectiveness in terms of validity and reliability. All the selected participants answered the survey administered by their teachers. Then, statistical measures were employed to check the data collected through the instrument to make sure that the future analyses would be accurate.

3.2 Participants

A total of 317 upper secondary class students were selected to act as participants in the present study. These students were consistent in their learning style patterns and all were Malay boys and girls with an average of 16 years of age.

3.3 Instrumentation

In the initial screening procedure in constructing the Learning Styles Survey (LSS) a number of factors were taken into consideration. These included examining and identifying the nine learning styles and their associated traits, cues and explanation. Studies conducted by researchers like Dunn and Dunn (1986), Reid (1987), Brown (2000), Kolb (1984), Oxford and Lavine (1991), Guild and Garger (1985), and Deporter and Hernacki (1992) are closely attended to. At the same time, the researchers also looked into several published sources which contained established questionnaires and inventories that had been tested and re-tested in their validity and reliability effectiveness. Some of the published sources include Reid (1987), Dunn, Dunn and Price (1985), and Kolb (1984), as well as some other sources. It was observed that most of the instruments for measuring each of the learning styles contained items which were quite related to each other in terms of their content. Finally the researchers proceeded to develop the LSS pertained to Reid's PLSP survey as most of her items were quite pertinent for this study. The questionnaire developed was based on a Likert scale. Similarly, the PLSP format was reproduced as perceptual learning style research has typically relied on self-reporting questionnaire (Hyland, 1993) and various studies show students can precisely identify their own learning styles (Dunn 1984). However, the rest of the items were adapted from learning traits defined by Dunn and Dunn (1985), while some other items were also modified to suit the Malaysian context.

The process of developing items was carried out with the assistance of some colleagues who were experts in Teaching English as a Second Language in the School of Educational Studies, Universiti Sains Malaysia (USM) The questionnaire was then translated into the Malay language because the respondents were at a school where the medium of instruction was Malay Language and Arabic, while English was just one of the school subjects. Through the translation, it was highly hoped that the participants would not have problems understanding the needs of the questionnaire and would be able to respond accurately. To study the patterns of relationships among the nine learning styles, an exploratory factor analysis was used. The aim was to investigate the effect of the learning styles towards the students' overall academic achievement. Therefore, factor analysis was conducted directly on the collected sample (n=100) in order to explore the items in the survey.

A linear factor analysis was conducted in two stages, i.e. factor extraction to attain the Eigen value by way of the major component solution, followed by Varimax with Kaiser Normalization (factor) rotation. The results of factor analysis demonstrated the emergence of nine factors representing the nine learning style constructs. This was a rather promising validity. There were a total of nine factors extracted with Eigen value less than 1.00. As shown in Table 1, all the nine factors accounted for 76.13% of the item variance. As a result, cluster of items that have magnitude loadings greater or equal to 0.30 were chosen for this study. The factorial structure can be seen until the 9^{th} factor. The variance accounted for in the measured variables by the first leading factor was 15.18%, and had high factor loadings in visual learning styles.

The second factor accounted for 11.57% of the item variance having a high loading in reflective style. Factors 3 to 9 accounted for 9.36%, 7.82%, 7.42%, 6.90%, 6.66%, 6.04%, and 5.17% of the Variance respectively and in turn had high loadings in 'auditory', 'global', 'Kinesthetic', 'analytic', 'individual' and 'impulsive' styles. Table 1 provides a summary of nine subscales that can be pooled accordingly into nine factors and interpreted in certain specific factor loadings.

Insert table (1) about here

Moreover, a reliability test was run to determine the accuracy of the survey. The result revealed that the Cronbach Alpha ranges from 0.61 to 0.82 for all the nine learning styles, and as such each subscale had a rather high reliability (Table 2). According to Nunnally (1969), a construct or variable is said to be reliable when Cronbach Alpha value is more than 0.60.

Insert table (2) about here

3.4 Data Analysis

The statistical analysis conducted by Reid (1987) is adapted in this study because of the similarity in terms of determining students' preferences in 5 learning style elements. The descriptive statistical method was used first to analyze the data which had been extrapolated. The preference mean score for each set of variables was divided into three categories, namely, major, minor and negligible learning styles. The mean score of 13.50 and above represented the major learning style while the mean range between 11.50 and 13.49 stood for the minor learning style, and finally a mean score of 11.49 or less showed a negligible learning style. A further analysis is carried out by way of frequency count in order to determine a complete students' learning styles profile. The second method of data analysis concerns inferential statistics, i.e., to examine the preference of the subgroups by category for differences in overall academic achievement. As such, one-way ANOVA and multiple regression analyses were done to obtain the required results. The standard $p<0.05$ was used for this analysis. In conclusion, the selected method of data analysis should be able to pave the way to find answers to all the research questions in the present study.

4 Results

4.1 The Learning Styles Profile of Students

Firstly, the learning styles profile of students were determined by examining the mean score of the learning style dimensions and secondly by taking into account the learning style elements. As this study has tailored Reid's measuring instrument (1987), the results were compared to Reid's assigned mean score classification of major, minor and negligible learning style categories. At the end, the frequency count was included in this analysis to describe the students' learning styles profile effectively.

Table 3 displays the mean scores and standard deviation of students' learning style dimensions. Every learning style dimension has produced a mean score above 13.49; therefore this indicates that the learning style dimension to be the main learning style of the students. The highest mean score is 15.16 attained by the physiology dimension. The second highest is the psychology dimension with a mean score of 14.55, followed by the sociology dimension with the lowest score of 13.75.

Insert table (3) about here

As for the learning styles profile of students with respect to their Learning Style Element, the overall mean score of 317 students and their learning styles, is shown in Table 4. The highest mean score of 15.54 was recorded by auditory learning style while the lowest mean score of 12.75 was obtained for impulsive learning style. The high mean score reflects major learning style for auditory, visual, reflective, analytic, global, Kinesthetic and group type in descending order of preferences. The result indicated that most students possessed multiple learning styles.

Insert table (4) about here

The data were further evaluated to record the frequency of occurrence for the three categories of leaning styles as shown in Table 5. The frequency analysis showed a similar distribution across the nine learning styles as produced by the mean scores. Nevertheless, the frequency count generally provides a more detailed data than the mean score for the major, minor and negligible learning styles. Based on the frequency count, 7 out of 9 (77.8%) learning styles were easily identified as their major learning styles. Among all the major learning styles, the most preferred one was the auditory style which consisted of 194 students or 61.2% of the total number of students. This is followed by the visual learning style with 189 or 59.6% classified under the major learning style. The third favoured learning style was the reflective preference with 183 major style students (57.7%). The third most liked learning style is the reflective preference with 183 major style students which is 57.7%. However, there are 97 (30.6%) minor style and 37 (11.7%) negligible style students in the reflective type.

Insert table (5) about here

On the other hand, minor learning style was indicated by individual style with a nearly high majority of 144 minor style students (45.4%). Nevertheless, there were 135 students who preferred the individual learning style.

4.2 Learning Styles and Overall Academic Achievement

A one-way analysis of variance (ANOVA) was conducted to investigate the existence of possible differences among learning style dimensions and the three overall academic achievement groups, and secondly the differences between learning style elements and the same achievement groups. The results of the analysis are displayed in Table 6 where the data show the difference among high, moderate and low achievement groups is trivial with respect to physiological learning style dimension ($F = 0.443$, $p<0.05$ level). The results also denote that there is not that much difference in preference for this learning dimension among high, moderate and low achievement groups. Additionally, the results of the ANOVA show that the difference with respect to psychology ($F = 0.645$, $p<0.05$) and sociology dimensions ($F = 1.666$, $p<0.05$) is not significant. The preference for both learning style dimensions among high, moderate and low achievement groups are the same. On a whole, the academic achievement groups have similar preference for all the three learning style dimensions.

Insert table (6) about here

As shown in Table 7, the difference is not significant for visual preference ($F=0.415$, $p<0.05$), auditory ($F=0.790$, $p<0.05$) and Kinesthetic preference ($F=2.230$, $p<0.05$). Moreover, the learning styles for visual, auditory and Kinesthetic among the high, moderate and low achievement students are relatively the same. The results also shows the difference is not significant for analytic style ($F=2.743$, $p<0.05$), the impulsive style ($F=0.826$, $p<0.05$), reflective style ($F=0.419$, $p<0.05$), and individual style ($F=1.136$, $p<0.05$).

Insert table (1) about here

Based on the analysis for global learning style, the results of the ANOVA show that the F value = 3.721 is significant at $p<0.05$ level. It is clear that there is a difference for this learning style at least between two achievement groups. The data were further evaluated using the Tukey HSD comparison test to determine which mean scores were significantly different from other mean scores for global learning style among the students. Table 8 shows the summary table for the Tukey HSD test. It is found that the mean score is significantly different between high achievers and the moderate achievers, i.e. -1.38, and between high achievers and low achievers which is -1.28. This means the high achievers preferred global learning styles more than the other students.

Insert table (9) about here

As for group learning style, the results of the ANOVA show that the difference at least between two achievement groups is significant ($F=3.885$ at $p<0.05$). Further analysis using the Tukey HSD multiple comparison test showed there was a significant mean score difference between high and low achievers (1.61) on group learning style unlike the difference between the high and moderate achievers (0.74) which indicate no significant difference in the mean score (Table 9).

Insert table (9) about here

Subjected to ANOVA, the global and group learning styles revealed significant differences within the overall academic achievers. Specifically the high achievement group was more oriented to engaging in global learning patterns. Nevertheless, the analysis showed that the difference was not significant for the rest of the learning styles. This means the ways of learning among the high, moderate and low achievers for the rest seven learning styles mentioned earlier were similar.

5 Conclusions and Discussions

In most cases, a very successful learner learns in several different ways. On the whole, every student has certain degree of preferences in each type of learning style, and the majority of them have dominance in one or more styles of learning. Within the learning style dimension, the findings revealed that the subjects strongly preferred the physiology type which includes the visual, auditory and kinaesthetic elements. In terms of learning style element, out of nine selected learning styles, students selected seven learning styles as major learning styles, beginning with auditory, followed by visual, reflective, analytic, global, kinaesthetic, and group learning styles. Moreover, it can be understood from the results that there is a similar preference for analytic, impulsive, reflective and individual learning styles among the students. As a result, we can infer that most students possessed multiple learning styles or a combination of different learning styles. As such, they are able to learn effectively.

This is an obvious indication that learning styles make an impact on the students' overall achievement. A good number of students preferred auditory and visual learning styles. This is probably due to the religious-oriented students who are typically taught in oral lecture format, especially in content courses of Islamic Studies. They are trained to be good listeners in order to differentiate the Arabic sounds intensively. Besides, they also need to discipline their eye contacts with the learning stimulus, such as relying on written instructional materials. They construct a framework to 'see' and 'sense' the overall picture and eventually transfer this learning skill to other academic fields. These findings match the ones obtained by Willing (1989), who stresses that Arab students with strong Islamic background in ESL colleges in Australia preferred visual and auditory learning styles. The results also confirmed that high achievement students are more global than the moderate and low achievement students. With global learning style mindset, the high-flyers are able to take the numerous workloads related to the many subjects and to be able to work on two or more tasks simultaneously. The high achievers also prefer group learning variable than low achievers. The high achievers have a strong liking for group learning which contributes substantially for peer-group interaction and opportunities to discuss and apply what is learnt and being learned for better comprehension, retention power, and performance in the examination.

This study revealed significant differences in students' overall academic achievement. It showed the majority of students surveyed have multiple learning styles or a combination of different learning styles. According to Dunn and Dunn (1986), multi-style learners tend to achieve more and score better than learners with one or two learning styles. As such, it is inferred that learning styles do make an impact on the students' overall academic achievement. Such finding highlights the importance of recognizing students' varying learning styles. Teachers should be aware of the usefulness of learning styles for effective learning to take place. The learning styles framework does not change with subjects, where it actually plays an important role across all the subjects. Therefore, the results here suggest avenues of future research to understand this phenomenon. As a related matter, a study of other learning style variables should also be conducted to bring essential variables to the forefront. As such, the variables which might be significant for learning and related to the Malaysian culture can be discovered and utilized.

The present study, in fact, uncovered the existence of different learning styles, multiple learning styles and a variety of major, minor and negligible learning styles among students. Most educational psychologists would agree that multiple learning styles can significantly enhance academic achievement (Felder 1995). Dunn and Dunn (1986) state that in most cases, a successful learner learns in several different ways. However, students with naturally one or two learning styles can improve significantly when taught through other learning styles. Thus, it is essential for teachers to know the effective way of teaching. By this way, teachers can come close to providing optimal learning environment for most students in a class (Felder 1995).

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TABLES

Table 1 : Summary of the 9 factors and the relevant items in the questionnaire

Factors	Leaning Styles	Eigenvalue	% Variance	Items
1	Visual	14.37	15.18	1, 12, 19, 22, 28
2	Reflective	4.35	11.57	2, 5, 8, 10, 15
3	Auditory	4.01	9.36	3, 6, 9, 11, 21
4	Global	2.43	7.82	33, 335, 38, 41, 43
5	Group	2.38	7.42	4, 16, 20, 23, 30
6	Kinesthetic	1.87	6.90	7, 14, 17, 24, 27
7	Analytic	1.73	6.66	26, 31, 36, 39, 44
8	Individual	1.64	6.04	32, 37, 40, 42, 45
9	Impulsive	1.47	5.17	13, 18, 25, 29, 34

Table 2: Reliability value of learning style survey items (n=100)

Dimension	Element	No. of Items	Cronbach Alpha
Physiology	Visual	5	0.77
	Auditory	5	0.70
	Kinesthetic	5	0.61
Psychology	Global	5	0.68
	Analytic	5	0.67
	Impulsive	5	0.72
	Reflective	5	0.71
Sociology	Individual	5	0.63
	Group	5	0.82

Table 3 Mean Score and standard deviation of students' learning style dimension

Learning Style Dimension	Mean Score	Standard Deviation
Physiology	15.16	2.34
Psychology	14.55	2.01
Sociology	13.75	1.56

Table 4 Mean score and standard deviation of students' learning style element

Learning Style Element	Mean Score	Standard Deviation
Visual	15.41	3.21
Auditory	15.54	3.16
Kinesthetic	14.52	3.22
Global	14.98	2.72
Analytic	15.21	2.78
Impulsive	12.75	2.58
Reflective	15.28	3.12
Individual	13.31	2.37
Group	14.18	3.34

Table 5: Learning styles profile of students

Learning Styles	Major Learning Style		Minor Learning Style		Negligible Learning Style	
	F	%	F	%	F	%
Visual	189	59.6	69	21.8	59	18.6
Auditory	194	61.2	72	22.7	51	16.1
Kinesthetic	166	52.4	63	19.9	88	27.8
Global	172	54.3	106	33.4	39	12.3
Analytic	180	56.8	101	31.9	36	11.4
Impulsive	123	38.8	132	41.6	62	19.6
Reflective	183	57.7	97	30.6	37	11.7
Individual	135	42.6	144	45.4	38	12.0
Group	161	50.8	95	30.0	61	19.2

Table 6 : The results if the ANOVA done on learning style dimension for the achievement groups

Learning Style Dimension	Source	Sum of Squares	df	Mean Squares	F
Physiology	Between Groups	4.87	2	2.43	.443
	Within Groups	1725.69	314	5.50	
	Total	1730.55	316		
Psychology	Between Groups	5.23	2	2.62	.645
	Within Groups	1273.39	314	4.06	
	Total	1278.62	316		
Sociology	Between Groups	8.11	2	4.05	1.666
	Within Groups	764.20	314	2.43	
	Total	772.31	316		

Table 7 : The overall ANOVA solution on learning style element for the achievement groups

Learning Style Elements	Source	Sum of Squares	df	Mean Squares	F
Visual	Between Groups	8.58	2	4.29	.415
	Within Groups	3250.28	314	10.35	
	Total	3258.86	316		
Auditory	Between Groups	15.83	2	7.91	.790
	Within Groups	3147.00	314	10.02	
	Total	3162.83	316		
Kinesthetic	Between Groups	45.95	2	22.97	2.230
	Within Groups	3235.16	314	10.30	
	Total	3281.11	316		
Global	Between Groups	54.11	2	27.05	3.721*
	Within Groups	2282.74	314	7.66	
	Total	2336.85	316		
Analytic	Between Groups	42.03	2	21.01	2.743
	Within Groups	2405.64	314	7.66	
	Total	2447.67	316		
Impulsive	Between Groups	10.96	2	5.48	.826
	Within Groups	2084.35	314	6.64	
	Total	2095.31	316		
Reflective	Between Groups	8.20	2	4.10	.419
	Within Groups	3074.25	314	9.79	
	Total	3082.45	316		
Individual	Between Groups	12.74	2	6.37	1.136
	Within Groups	1759.35	314	5.60	
	Total	1772.09	316		
Group	Between Groups	85.21	2	42.61	3.885*
	Within Groups	3443.54	314	10.97	
	Total	3528.75	316		

Note: * The mean difference is significant at p<0.05 level

Table 8: Tukey HSD Comparison Test on global learning style mean for high, moderate and low achievement groups

Global Learning Style	Mean	Mean Difference		
		High	Moderate	Low
High	16.18	-	- 1.38 *	- 1.28 *
Moderate	14.80	- 1.38 *	-	- 0.10
Low	14.90	- 1.28 *	- 0.10	-

Note: * The mean difference is significant at p<0.05 level

Table 9: Tukey HSD Comparison Test on group learning style mean for high, moderate and low achievement groups

Group Learning Style	Mean	Mean Difference		
		High	Moderate	Low
High	13.21	-	0.74	1.61 *
Moderate	13.95	0.74	-	0.87
Low	14.82	1.61 *	0.87	-

Note: * The mean difference is significant at p<0.05 level