

EXPLORING EFFECTS OF LEARNING STYLES ON LEARNING OUTCOMES

Dr. Faryal Razzak, Sadia Shaikh, and Dr. Ayub Siddiqui

ABSTRACT

Learning Styles are the cognitive attributes of how one prefers to learn. The logic of lifelong learning suggests that students will become more motivated to learn by knowing more about their own strengths and weaknesses as learners. 'Learning to learn' skills may provide a foundation for lifelong learning. In Pakistan, most students are unaware of their learning styles and how they prefer to learn; moreover, little effort is put to incorporate learning styles in teaching methodologies. The study will highlight the importance of learning preference before designing courseware and tailoring instruction mediums. Moreover, knowledge of learning style and preferences will help improve employees' and managers' performance in the organizations. To conduct the research, survey questionnaires were floated to assess the most preferred learning style. In the same session students who were given VARK learning style inventory questionnaires, were apprised about their learning style and how to best use it for accelerated learning and mind mapping. Lastly, assessment of the impact of the knowledge of learning styles on learning outcomes was computed through the sample student's GPA, as no significant interventions to improve learning outcomes were introduced during that period. Prior and post-examination results were evaluated using covariance analysis, ANOVA models with and without interactional effect. The result indicated that a few students have knowledge of learning styles, and only the interactive effect of VARK variables was significant with previous GPA.

Keywords: Learning Styles; Learning Skills; Learning Outcomes; VARK Variables; Teaching Methodologies.

INTRODUCTION

The idea that people learn differently is an ancient concept attributed to ancient Greeks (Wratcher, Morrison, Riley, & Scheirton, 1997). Learning styles are personal qualities that influence a student's ability to

acquire information to interact with peers & the teacher, & otherwise participate in learning experiences (Grasha, 1996).

With the advent of technology, many instruction mediums have emerged and the existing one evolved. It is need of the day to tailor the curriculum to cater for diverse stakeholders. The paradigm of education has shifted from instructor-centric to student-centric; therefore, for effective education to take place, knowledge of how the students prefer to learn is of paramount importance. In general, limited awareness exists about learning styles and how students can learn best. Little is known about the effect of incorporating learning styles in teaching, especially in Pakistan and what benefits can be accrued from it. There are many studies that emphasize the learning styles' importance (Wilson, 2018; Putintseva, 2006; Bostrom, Olfman, & Sein, 1990). Most students are unaware of their learning styles if no intervention is allowed, they are unlikely to start learning in new ways (Merrill, 2000). This study supports the premise that it is important to teach students what their learning style is.

Similarly, if encouraged to know one's and other's learning styles, the maximum benefits of metacognition can be accrued (Coffield, Mosely, & Ecclestone, 2004a). This also comprises part of the research question that whether the awareness of learning styles improve learning outcomes. In another study, it was established that customizing learning materials based on preferred learning style can provide a measurable benefit to the learner e.g. improved learning outcomes (Gregg, 2007). It also strengthens the claim that the learning outcomes will be conclusive if teaching is based on how the students learn best.

According to the studies conducted by Coffield, Mosely, & Ecclestone (2004a), for the magnitude of impact of different interventions in the learning environment for students, the learning preference part comprises; students' prior cognitive ability, disposition to learn, effective attribute, individualization, and behavioral objectives, moreover instructional quality and reinforcement also depends upon catering of different learning styles. According to their research, the effect size of the above-mentioned attributes of learning preferences comes down to about 60%.

The current paper aims to acknowledge that learning styles exist, and different people learn differently. Learners should be provided with an opportunity to realize their learning strength; it will help in optimizing their learning and knowledge and may help in improving the learning outcomes.

LITERATURE REVIEW

In this era of information technology, paradigms of conventional academia have been changed from instructor oriented to the learner-centric (Fischer, Troendle, & Mandi, 2003). E-learning or electronic learning is a computer or Internet-based learning. Electronic is further defined as the insertion and application of a computer in the processes of communication, data collection, management & manipulation of databases, process automation and information (Ian, 2002). 'E-learning is becoming an influential force in higher education, thus, providing professionals with a dynamic environment for growth. Two main factors have led to an explosion of interest in e-learning: the growing need for continual skills upgrading, retraining; and the technological advancements that have made it possible to teach more and more subjects at a distance' (UNESCO, 2002).

E-Learning accommodates the diverse learning styles which a conventional system of education is unable to address. "E-learning no longer applies merely to distance learning but also to traditional courses that have incorporated electronic elements into the day-to-day teaching." (McLean et al., 2003). Almost all the higher education institutions in Pakistan, specially Bahria University, Islamabad, from where the study sample was collected, use multimedia as a regular teaching aid. The model applied to this study, the VARK framework is particularly useful in illustrating and explaining the concepts through multimedia teaching (Othman & Amiruddin, 2010).

Keefe (1979), defines learning styles as, "the characteristic composite of cognitive, affective, and physiological factors that serve as relatively stable indicators of how a learner perceives, interacts with, and responds to the learning environment." It is quite evident from the definitions that learning styles are not really concerned with "what" learners learn, but rather "how" they prefer to learn. That means it is not actually learning "styles," rather they are learning "preferences," that how one prefers some learning style/styles over others. Fleming and Mills (1992), suggested four categories that seemed to reflect the experiences of the students and teachers in learning i.e. audio, visual, reading/writing, and kinesthetic. Grasha (2002), has defined learning styles as, "personal qualities that influence a student's ability to acquire information, to interact with peers and teachers, and otherwise participate in the learning experiences."

Educationalists throughout history have acknowledged the fact that

students exhibit distinct preferences in learning. Blackmore (1996), stressed that the first step perhaps to enhance the learning process is a realization that there are diverse learning styles. Merrill (2000), presented the argument, that most students are unaware of their learning styles and if no intervention is allowed, they are unlikely to start learning in new ways. This finding emphasizes that knowledge of one's learning styles can be a potent tool to increase self-awareness about their strengths and shortfalls, as learners. If one is encouraged to know his and other's learning styles, it will help in self-realization and in understanding the cognitive process for effective learning (Coffield, Mosely, & Ecclestone, 2004a; Coffield, Moseley, Hall, & Ecclestone, 2004b).

Mathew and Dohery-Poirier (2000), emphasized, "Research on the cognitive information processing model of learning suggests that customizing learning materials based on the individual's preferred learning style or on the personality can provide a measurable benefit to the learner." However, there have been divergent results on effects of learning styles on learning outcomes, for instance, Liew, Sidhu, and Barua (2015) found that there was no significant contribution of learning styles on learning outcomes. Kirschner (2017), provides an empirical study that suggests that preferred learning style has no effect on learning outcomes. Contrarily, Rogowsky, Calhoun, and Tallal (2015), found that providing learning based on preferred learning styles improves learning, justifying the famously meshing hypothesis which asserts that the alignment between instruction and learning style results in optimal outcomes. Relatedly, it is interesting to note that how one prefers to learn might not be their actual learning style, thus, emphasizing whether the students even know how they learn best? Therefore, it is imperative to study the ground realities of comprehension of adult students about their learning styles before we can assess whether it affects their learning outcomes.

The knowledge of how one learns best can make the learning experience more prudent, effective, and fruitful, and incorporating it in teaching style will help students learn more efficiently (Graf, 2007). It helps students to capitalize on their strengths; and teachers in designing the courseware, curriculum, and deliverance (Othman & Amiruddin, 2010). For effective learning to take place in a classroom it should also be focused around preferred learning styles (Dearing et al., 1997). Many studies illicit that direct effect of learning outcome is not attributed to learning styles preferences but they do conclude that the knowledge can

definitely modify results in pedagogy and individual achievements (Almigbal, 2015), as the actual learning style category is more important than perception or preference of student's learning style.

Understanding learning styles also help in realizing the differences in preference of learning styles; as knowledge of one's learning styles can be a potent tool to increase self-awareness about their strength and shortfalls as learners. Given the complexity and use of online learning in conventional systems of education, many studies have not only highlighted the crucial role of learning styles in online participation but also the importance of individual constructivism and social interaction for effective online learning (Cheng & Chau, 2016). The researchers may have divergent views on whether learning styles' knowledge leads to learning outcomes but there seems to be a consensus among all researchers that the knowledge itself can benefit the students in learning and academics to tailor their instructional materials. Understanding its importance, however, research to explore the effect of learning styles for student's self-awareness, or to attribute it to their learning outcome are scarce in developing economies (Yousef, 2018).

Much emphasis is given to the research on learning styles & its benefits in designing courseware but what is the effect on the students after the knowledge of learning style is under-theorized. Therefore, the question arises that does the awareness of how one learns best, provide better results in learning outcomes? The aim of this research paper is hence to impart the awareness, and gauge results in Pakistan context as the knowledge and enquiry on learning styles is scarce in Pakistan. Moreover, the study accentuates whether the teaching methods are according to the preference of the students, as it stresses a total quality management issue in education.

RESEARCH METHODOLOGY

The sample was randomly selected in a cross-sectional study, from BBA and MBA students from the Department of Management Sciences at Bahria University, Islamabad, Pakistan. VARK Questionnaire version 7.0 to assess learning style was floated to two hundred and sixty (260), participants who consented to participate in the study during their regular classes with the consent of the teachers (about 1/3rd of the total population). In the same session, another questionnaire with qualitative aspects of perceived learning style and preferred learning style with other

qualitative variables like age and gender were also administered. Students were also told what their dominant learning style was and were taught some strategies to learn best according to VARK framework before the commencement of final assessment for the semester. The scale VARK version 7.0 is a very widely used measure (Akbulut & Cardak, 2012). The acronym VARK stands for Visual, Aural, Read/write, and Kinesthetic sensory modalities that are used for identifying learning information (Fleming & Mills, 1992). Broadly speaking that the model provides four preferences which differ in strength and usage, but they are not discrete in nature. People may adopt any learning style depending upon the course content and teaching strategy. This model relates closely to the general learning styles in Pakistani society.

After a thorough analysis, one hundred and eighty (180) questionnaires were found useful and complete. As there was no intervention between the period before result and knowledge of learning style, the GPA for that semester (compared with the previous semester GPA) was taken as the dependent variables along with perceived learning style and preferred learning style.

Firstly, the data was analyzed for descriptive statistics, then the OLS methods for dummy variable regression model (ANOVA models) with seven (7) dummy variables for perceived and preferred learning styles along with five (5) VARK variables were regressed for learning outcomes and learning styles. Dummy variables are used for qualitative (usually nominal scale) variables indicating a presence or absence of a quality or attribute. It is devised to classify data into mutually exclusive categories e.g. assigning value '1' for a presence of quality and '0' for the absence of that quality. The dummy variable points out the differences between the categories defined (Gujarati & Porter, 2004).

Hypotheses

Following hypothesis was tested in the study that the coefficients of the learning styles have no effect in the learning outcome;

$$1. H_{10} : \beta_V = \beta_A = \beta_{RW} = \beta_K = \beta_{MM} = 0$$

Where V= Visual Style, A= Auditory Style, RW= Read/ Write Style, K= Kinesthetic Style and MM= Multi-model style.

2. Similarly, it was hypothesized that the previous GPA significantly effects current semester GPA to check this hypothesis it was assumed that:

$$H1_{0a}: \beta_{\text{Previous_GPA}} = 0$$

3. Similarly, to check the interactional effect of dummy variables, it was assumed that learning styles will have no effect on learning outcomes.

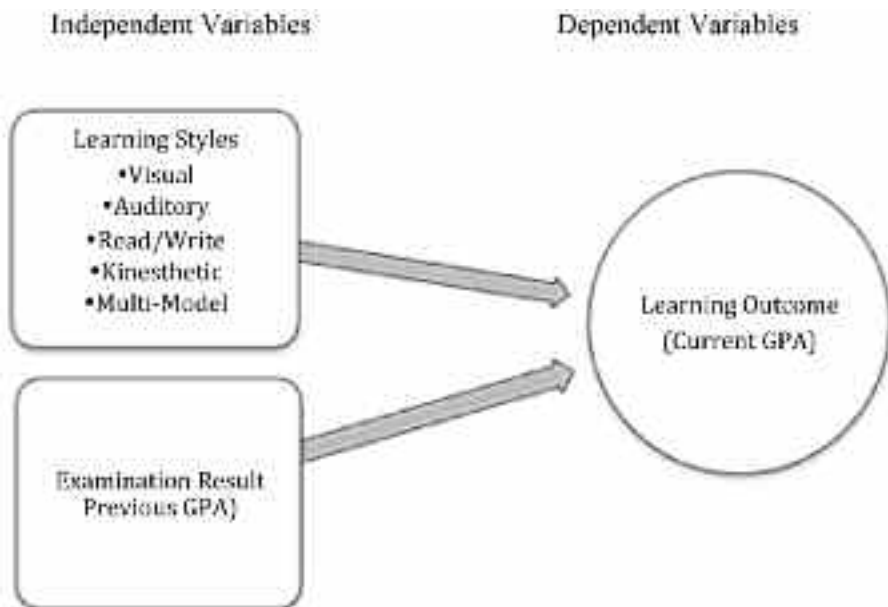
$$H2_0: \beta_V = \beta_A = \beta_{RW} = \beta_K = \beta_{MM} = 0$$

4. The interactive effects of previous GPA on each learning style should be significant. To test this hypothesis it was assumed that the coefficient of interactive effects of previous GPA with each learning style is 0.

$$H2_{0a}: \beta_{\text{Previous_GPA}} = \beta_{V* \text{ Previous_GPA}} = \beta_{A* \text{ Previous_GPA}} = \beta_{RW* \text{ Previous_GPA}} = \beta_{K* \text{ Previous_GPA}} = \beta_{MM* \text{ Previous_GPA}} = 0$$

Where V= Visual Style, A= Auditory Style, RW= Read/ Write Style, K= Kinesthetic Style, MM= Multi-model style, V* Previous_GPA = the interactive effect of previous GPA on Visual Style, A* Previous_GPA = the interactive effect of previous GPA on Auditory Style, RW* Previous_GPA = the interactive effect of previous GPA on Read/Write Style, K* Previous_GPA = the interactive effect of previous GPA on Kinesthetic Style and MM* Previous_GPA = the interactive effect of previous GPA on Multi-model style.

Figure 1. The Relationship Between Independent and Dependent Variables



DATA ANALYSIS

The aim of this research was to assess whether knowledge of learning style effects learning outcomes in terms of GPA, perceived learning styles, and perceived preferred learning style. When the data was processed first on the excel sheet it was revealed that about 71.66 % of students (129/180) had no idea what learning styles actually are. As far as what the preferred learning style of the students in their perception was, about 86.87% had no clue (139/180). Out of the 228 sample (before they were discarded for not providing either the university registration number to check the current semester's GPA or did not tell the previous GPA to compare) only 22 i.e. 9.64% students were correct in their perception about what their learning style actually was as compared to VARK framework. Similarly, only 17/228 i.e. 7.45% of students correctly related their preferred learning style to their actual learning style according to VARK framework. There was another interesting finding, those students who were correct about their perceived learning style, were oblivious for preferred learning styles and vice versa, with respect to their actual learning styles according to VARK framework.

Partial Covariance Analysis

Table 1. Partial Covariance Analysis with previous GPA as a controlling variable

Correlation Statistic Probability	A	K	CURRENT_G_C_PRF	C_PLS	MM	RW	V	
A	1							
K	-0.455951	1						
	-16.71115	30.40750						
	-6.815797							
	0							
CURRENT_GPA	-0.033798	0.067751	1					
	-1.105147	1.69494	20.42180					
	-0.449913	0.90344						
	0.6514	0.9625						
C_PRF	-0.032153	0.036778	0.072488	1				
	-1.182286	0.812319	1.81557	30.69678				
	-0.427989	0.356382	0.566754					
	0.6621	0.722	0.3340					
C_PLS	-0.032451	0.054033	-0.002769	0.121764	1			
	-1.288727	1.851309	-0.075864	4.030379	25.79742			
	-0.432013	0.78664	-0.007238	1.633112				
	0.6664	0.6564	0.8709	0.3383				
MM	-0.440099	-0.365011	-0.065051	-0.005862	-0.37873	1		
	-15.74607	-2.90019	-1.546562	-0.594961	-4.078047	28.18647		
	-0.520559	-3.85676	-0.66729	0.113913	-1.692654			
	0	0.0003	0.387	0.5094	0.0923			
RW	-0.306117	-0.368872	0.008669	-0.018223	0.182628	-0.178984	1	
	-8.564701	-4.350566	1.735382	-0.425627	4.601363	-4.072877	17.77211	
	-4.277994	-2.530747	1.21386	-0.342478	2.468467	-2.420306		
	0	0.0134	0.3364	0.8087	0.0145	0.0165		
V	-0.100829	-0.096281	-0.073191	0.027162	-0.022074	-0.093688	-0.065386	1
	-2.570993	-1.407021	-0.79844	0.8624	-1.526603	-1.217757	-0.668975	5.79986
	-3.167918	-1.819809	-0.981802	0.581802	-1.28018	-1.281885	-0.837803	
	0.0513	0.1906	0.3302	0.7182	0.2203	0.2113	0.3550	

(A= Auditory, K=Kinesthetic, C_PRF= Confused in Preferred learning style, C_PLS= Confused in perceived learning style, MM= Multi-Model, RW= read and write, V= Visual)

The above table shows the result for Partial Covariance Analysis. Covariance measures how much two random variables change together. Covariance is said to be positive if the highest value corresponds to the highest value of the covariate and vice versa for smaller values. It is said to be negative if the highest value of one variable corresponds to the lowest value of the covariate. The sign of the covariance shows the tendency in the linear relationships between the variables. Table 1 shows that the only covariance of Visual, Auditory, Read/write and Kinesthetic variables with other VARK variables were statistically significant. For example, all variables for different learning styles Visual, Read/Write, Kinesthetic and Multi-Model variables were significant (as t-statistic for the above-mentioned variables was significant) but negatively correlated with variable Auditory, As determined by the tendency of the variables by SSCR, which is more reliable than simple covariance as it also incorporates for cross products. The results show that higher preference of the variable 'Auditory Learning Style' leads to a lower preference for other Visual, Read/Write, Kinesthetic and Multi-Model learning styles.

Similarly, Kinesthetic variable was significantly, negatively correlated with Auditory, Read/Write and Multi-Model variables, but no significant relationship existed with Visual learning style. Covariance of Visual style was also not statistically significant with Read/Write and Multi-Model styles. It could be because Visual was the least preferred style. The variables C_PRFL (confused in preferred learning style) and C_PLF (confused in perceived learning style) were not statistically significant in any of the partial covariances with VARK inventory or with each other. For this, one of the reasons could be that most students were confused about their preference and perception about learning style, therefore, a significant relationship with any VARK inventory was unlikely.

Regression Analysis

One of the purposes of regression is to find the proportion of variation of the dependent variable due to the regressors or independent variables. When data is in the form of qualitative variables (or dummy variables) such that they represent presence or absence of an attribute or quality, then ANOVA model for regression are used, however, when the regressors are a mix of quantitative and qualitative ANCOVA models for regressions are used for data analysis. ANCOVA models are the extension of the ANOVA model, as they provide a statistical method to control the effect of covariates or the quantitative regressors (Gujarati & Porter, 2004).

Table 2. Regression of Current GPA

Dependent Variable: CURRENT_GPA				
Included observations: 180				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.239372	0.364414	-0.656868	0.5121
A	0.010272	0.343561	0.029898	0.9762
K	0.067065	0.345625	0.194039	0.8464
MM	-0.020008	0.346227	-0.057789	0.9540
PREVIOUS_GPA	1.003605	0.049505	20.27291	0.0000
RW	0.110307	0.349730	0.315406	0.7528
V	-0.109493	0.368587	-0.297061	0.7668
R-squared	0.706079	Mean dependent var		2.7517
Adjusted R-squared	0.695885	S.D. dependent var		0.6182
S.E. of regression	0.340926	Akaike info criterion		0.7238
Sum squared resid	20.10793	Schwarz criterion		0.8479
Log likelihood	-58.14310	Hannan-Quinn criter.		0.7741
F-statistic	69.26548	Durbin-Watson stat		1.8737
Prob(F-statistic)	0.000000			

Interpretation of Table 2 (ANOVA Model)

In table 2, F-statistic is large (69.26), therefore, the H_{10} is rejected. All the variables are significant in the model as the probability of making a type 1 error is less than 1. Durbin-Watson test could also be rounded off to 2, so we can assume that heteroscedasticity is not present. The coefficient of determination R-squared explains that about 70.6% variation in current GPA is due to the regressors indicating goodness of the fit of the model.

The linear equation for regression of current GPA:

$$\text{Current GPA} = -0.239372 - 0.109493V + 0.010272A + 0.110307RW + 0.067065K$$

$$(\text{t-statistics}) = (-0.6568) (-0.2970) (0.0298) (0.3154) (0.1940) -0.020008MM + 1.003605$$

$$\text{Previous GPA } (-0.0577) \quad (20.27291)$$

$$R^2 = 0.706079$$

Where values in parenthesis are t statistic, R^2 is the coefficient of determination and;

V = 1, if the dominant Learning Style is Visual

= 0, otherwise

A = 1, if the dominant Learning Style is Auditory

= 0, otherwise

RW= 1, if the dominant Learning Style is Read and Write
 = 0, otherwise
 K = 1, if the dominant Learning Style is Kinesthetic
 = 0, otherwise

Current GPA is for the CGPA of the current semester (in which data was collected) and previous GPA is the CGPA of the previous semester.

The above regression indicates that learning styles do not affect current GPA. All variables except the previous GPA are statistically insignificant (as t-value less is than 2), this result shows if previous GPA is raised 1 point the current GPA increases on average by 1.003 points.

Table 3. Regression of Current GPA (using Interactional Effect of Dummy Variables)

Dependent Variable: CURRENT_GPA				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.370	0.340	6.975	0.000
A	-2.529	0.398	-6.352	0.000
A*PREVIOUS_GPA	0.980	0.069	14.155	0.000
K	-2.201	0.465	-4.735	0.000
K*PREVIOUS_GPA	0.886	0.107	8.276	0.000
MM	-3.293	0.517	-6.371	0.000
MM*PREVIOUS_GPA	1.221	0.126	9.669	0.000
RW	-2.826	0.594	-4.757	0.000
RW*PREVIOUS_GPA	1.115	0.164	6.790	0.000
V	-2.219	0.834	-2.660	0.009
V*PREVIOUS_GPA	0.832	0.256	3.247	0.001
R-squared	0.715	Mean dependent var		2.752
Adjusted R-squared	0.698	S.D. dependent var		0.618
S.E. of regression	0.340	Akaike info criterion		0.738
Sum squared resid	19.509	Schwarz criterion		0.933
Log likelihood	-55.423	Hannan-Quinn criter.		0.817
F-statistic	42.363	Durbin-Watson stat		1.948
Prob (F-statistic)	0.000			

Interpretation of Table 3

Table 3 shows remarkably interesting results as compared to table 2. In table 2 statistically insignificant relations existed between, Visual,

Auditory, Read/Write, Kinesthetic, Multi-model variables with current GPA. However, when the variable's effect is seen interactively with the previous semester's GPA, all variables show statistically significant results. It means the relation of VARK is not additive but multiplicative in determining the current GPA. F-statistic is 42.36269, which is large with the chance of type 1 error less than 1%. Durbin-Watson statistics could be rounded off to 2 (1.948377), meaning no heteroscedasticity. R² also explain 71.48% of total variation in regressand by the regressors.

The linear equation of the regression is:

$$\begin{aligned} \text{Current_GPA} = & 2.370000 - 2.218888V + 0.832477 V * \text{PREVIOUS_GPA} - 2.529083A + \\ & (\text{t-statistics}) = (6.9754) \quad (-2.6597) \quad (3.2465) \quad (-6.3519) \quad 0.979839A * \\ & \text{PREVIOUS_GPA} - 2.826426RW + 1.115294 \\ & RW * \text{PREVIOUS_GPA} \quad (14.155) \quad (-4.7571) \quad (6.7897) - 2.200659K + 0.886458 \\ & K * \text{PREVIOUS_GPA} - 3.292912MM \quad (-4.7352) \quad (8.2760) \quad (-6.3714) + 1.221002 \\ & MM * \text{PREVIOUS_GPA} \quad (9.6693) \end{aligned}$$

$$R^2 = 0.7148$$

Where values in parenthesis are t-statistics, R² is the coefficient of determination and;

V = 1, if the dominant Learning Style is Visual

= 0, otherwise

A = 1, if the dominant Learning Style is Auditory

= 0, otherwise

RW = 1, if the dominant Learning Style is Read and Write

= 0, otherwise

K = 1, if the dominant Learning Style is Kinesthetic

= 0, otherwise

CURRENT_GPA is for the CGPA of the current semester (in which data was collected) and PREVIOUS_GPA is the CGPA of the previous semester.

As we can see from table 3, all the t-statistics of all regressors are highly significant statistically with a probability of type 1 error less than 1. The intercept term 2.37 is also statistically significant with t-value 6.975 with 100% confidence level, showing if other regressors are held constant the current GPA is affected by 2.37 points by all the values that were assigned 0, i.e. when any of the learning styles is not dominant. Therefore, H₂₀ is rejected and all the coefficient are significant in the model.

It is also very interesting to note that in table 3 all Visual, Auditory, Read/Write, Kinesthetic and Multi-model variable's slope coefficients are negative, but with the interactive effect of previous semester's GPA the

interactive slope coefficient of Visual and Previous GPA, Auditory and Previous GPA, Read/Writing and Previous GPA, Kinesthetic and Previous GPA and Multi-model and Previous GPA are all positive. It shows learning style's variables improve current GPA only when they are seen as a multiplicative effect with previous GPA.

DISCUSSION

The result of partial covariance analysis (table1) and ANOVA model (table 2), show that any of the learning style (VARK inventory) does not show that it has any significant effect on learning outcomes i.e. Current GPA. There could be many reasons for this, firstly Rassool and Rawaf (2008), research work also suggests that many studies do not show direct link of learning styles with GPA, they write, "Overall, the studies suggest that the relationship of learning style with academic performance appears to be determined by the way learning is assessed". It means there are many determinants like how students are assessed, or like in this study, a total lack of awareness of the learning styles, that could hamper the relation of learning styles with learning outcomes. Therefore, a multidimensional assessment of the student is required for fairly evaluating the learning outcomes (Rassool & Rawaf, 2008). Another reason why learning style become ineffective is that teachers have inadequate knowledge of learning styles and fail to incorporate it into their teaching strategy (Othman & Amiruddin, 2010).

Since few students knew about their learning style, and as the study variables were the dummy, the zero answers were too many that may have distorted the relation of learning style with learning outcomes. Therefore, knowledge of learning style will help learners build interest in studies and also facilitate the learning process, as academic performance is also influenced by perceived academic control (Howard-Jones, 2009). Therefore the awareness of learning styles will foster self-development (Coffield, Moseley, Hall, & Ecclestone, 2004b).

CONCLUSION AND RECOMMENDATIONS

The knowledge of how one learns best can make the learning experience more prudent, effective, and enjoyable; It will help the students to capitalize on their strengths; It will also help in designing the courseware, curriculum, and medium of delivering will become more effective (Pritchard, 2005).

Knowledge of one's learning styles can be a potent tool to increase self-

awareness about their strength and shortfalls as learners. For effective e-learning to take place it should also be focused around preferred learning styles (Othman & Amiruddin, 2010). The results of this study indicate to further investigate the reasons why learning styles did not affect learning outcomes. The results may improve if the data is taken for 2-3 semesters consecutively. The cross-sectional data was one of the limitations of the study. The other limitation was time restraints as in only 15-minute session students were educated about the learning strategies based on VARK framework. Therefore, consecutive sessions are needed to educate students about their learning style.

Although the research on learning style as the predictor of learning outcome is debatable, still most researchers agree that learners have distinct learning styles and the teaching methods should be based on learning styles (Lujan & DiCarlo, 2006). Therefore, it is recommended that the teaching course work should be based on students' learning style. Furthermore, teachers should incorporate the learning style, and use multiple methods of assessment to favor all the learning styles. For future research, it is recommended that more studies in different settings should be carried as the literature on learning styles and learning outcomes are still scarce (Koch, Salamonson, Rolley, & Davidson, 2011; Coffield et al., 2004b;).

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