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META-COGNITIVE SKILLS AND LEARNING & THINKING STYLE: PREDICTING ACADEMIC ACHIEVEMENT AMONG SCHOOL STUDENTS

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Abstract: *In the present study an endeavor has been made to study meta-cognitive skills and learning & thinking style of secondary school students as predictors of their academic achievement. The objectives of study are to find out the relationship meta-cognitive skills, learning & thinking style with their academic achievement and to predict academic achievement among school students on the basis of their meta-cognitive skills and learning & thinking style. In this descriptive study, meta-cognitive skills and learning & thinking style have been treated as independent variables whereas academic achievement has been treated as dependent variable. The sample selected through multi-stage random sampling technique consists of 500 students of 9th class studying in private schools affiliated to Central Board of Secondary Education located in urban and rural area. Academic achievement had been measured through previous class i.e. 8th class scores obtained by students. Meta-Cognitive Skills Scale (MCSS) developed by Gupta and Suman (2017) [10] and Style of Learning and Thinking (SOLAT) tool developed by Venkataraman (2011) [31] were used to collect the data. Pearson's coefficients of correlation and stepwise multiple regression were employed as statistical techniques in the present study. A significant relationship between meta-cognitive skills of secondary school students and their academic achievement was found and the same conclusion was drawn in the case of learning & thinking style. From the result it was inferred that both the variables, meta-cognitive skills and learning & thinking style were the significant predictors of academic achievement of secondary school students. However, from t-values, it was further concluded that the variable meta-cognitive skills was the strongest predictor of academic achievement in comparison to learning & thinking style of secondary school students.*

Keywords: *Academic Achievement, Learning & Thinking style and Meta-cognitive Skills*

INTRODUCTION

Academic achievement has become an educational touchstone since the passage of the federal *No Child Left Behind Act in 2001*, requiring all educators - including school counselors

to formally define how their jobs and programs impact students' academic growth and contribute to overall school success. Academic achievement represents performance outcomes that indicate the extent to which a person has accomplished specific goals that were the focus of activities in instructional environments, specifically in school, college and university. School systems mostly define cognitive goals that either apply across multiple subject areas i. e. critical thinking or include the acquisition of knowledge and understanding in a specific intellectual domain i. e. numeracy, literacy, science, history etc. Therefore, academic achievement should be considered as a multifaceted construct that comprises different domains of learning because the field of academic achievement is very wide-ranging and covers a broad variety of educational outcomes.

Academic achievement plays an important role in one's life because it pushes an individual towards his/her goal. It is often a sign of a refined intellect, which can help students in all areas of their lives. It enables him/her to choose his/her vocation in the modern era of competition. It has also been noticed that an individual who performs academically high also attains a high status in the society. Academic achievement also helps in shaping the minds of students. Those who wish to enter the medical field need a thorough educational background in Biology, and engineering certification requires adequate educational credentials. Those looking to enter academia need strong academic achievements. Academic achievement of students at secondary school level is not only a pointer of the effectiveness of schools but also a major determinant of the welfare of youths in particular and the nation in general. There are various factors which have favorable impact on academic achievement of students. Meta-cognitive skills and learning & thinking style are the important ones which also affect academic achievement of school students.

Meta-cognitive skills are the abilities which are used to understand and analyze one's own learning especially influenced by educational background and previous experience. Meta-cognitive skills make one aware of one's own knowledge, the ability to understand, control and manipulate one's own cognitive process. In other words, we can say that meta-cognitive skills are the techniques that instill meta-cognition allow students a sense of control over their own learning, alleviate anxiety, enhance motivation, reduce incompetence and unwarranted confidence, and hopefully generate life-long learners. Meta-cognitive skills refer to an individual's awareness, evaluation and regulation of their own thinking activity.

Brown, Bransford, Ferrara and Campione (1983) [2] showed that one of the key traits of good problem-solvers is highly developed meta-cognitive skills. They know how to recognize flaws or gaps in their own thinking, articulate their thinking processes and revise their efforts.

It is believed that meta-cognitive skills play an important role in much type of cognitive activities including comprehension, communication, attention, memory and problem solving to make self-regulated, positive, confident and mature learners who take responsibility for their learning experiences. Teachers are responsible for helping students to develop better meta-cognitive skills by incorporating active reflection throughout the learning process. The importance of personal reflection during and after learning experiences should be emphasized by the teacher. It is proposed that teachers can enhance students' meta-cognitive skills by giving directions and explaining to them how to think about what they do (White, 1992) [32]. Learners critically analyze their own assumptions and know how this may have influenced their learning. The collaborative efforts of teachers and students to plan a course of study can grow students as independent learner. It was asserted by Schraw and Graham (1997) [25] that meta-cognition is an important component of effective learning because it enables individuals to plan, monitor and regulate their cognitive performance. Thus, meta-cognitive skills instill meta-cognition enable learners to become aware of how they learn and to evaluate and adapt these skills to become increasingly effective at learning.

Various studies showed that there is the great importance of meta-cognitive skills in learning process. Ibe (2009) [12] revealed that the meta-cognitive strategies were most effective in enhancing the academic achievement. Sharei, Kazemi and Jafari (2012) [26] found a significant relationship between the general scores of meta-cognitive capabilities and emotional intelligence skills and some of their components with mathematical problem solving ability. Eluemuno and Azuka-Obieke (2013) [6] revealed a positive relationship between meta-cognitive skills and academic performance. Mizakhani, Bagheri, Sadeghi, Mizakhani and Modanloo (2014) [21] examined that meta-cognitive skills were more effective in academic achievement of female students. Control skill was the only variable that could predict the academic achievement of students. İsa Yücel İşgör (2016) [13] investigated that there was a positive significant relationship between meta-cognitive skills

and academic success average. The effective contribution of meta-cognitive skills and cognitive learning results in each learning strategy was less than fifty percent (Siswati and Corebima (2017) [28]. Thus, successful learners typically use meta-cognitive strategies whenever they learn but they may fail to use the best strategy for each type of learning situation.

A significant number of theorists and researchers have argued that learning styles are not determined by inherited characteristics but develop through experience. Styles are therefore not necessarily fixed, but can change overtime, even from one learning situation to the next. Some theorists, on the other hand are more interested in how learners tackle a specific learning task with their learning strategy than any habitual preference or style. Though learning styles are not stable and unchangeable elements, it takes some time for them to change. That is why, it seems as an easier and more effective way to select and organize methods and strategies, classroom environment and teaching materials according to learning styles rather than expecting the students to adapt to the existent organization. Styles are not fixed, but changeable. Some individuals may have one preferred style at one stage and another preferred style at another stage. We need to recognize the preferred styles of students and ourselves. The efforts to understand learning & thinking styles and to learn to use them flexibly require the identification of an individual's preferred style of learning & thinking. Therefore, it is important for the teachers to know the students preferred styles, so that the teachers can capitalize the opportunities for students learning. Styles like abilities are not formed by birth. They are partly developed due to environmental condition.

People are selected into various jobs mainly on the basis of their academic performance. Good memorizers who got high marks, ranks and grades are selected. But they need not necessarily think in ways that are compatible with the requirements of the job that a given field offers. At the same time, students who think in ways that are fully compatible with the job but not with the requirements of the selection may be derailed. Those who fit particularly well the demands of the career are thrown out and those who do not, are taken. This phenomenon can be addressed through an understanding of styles of thinking. Thinking styles help us understand why with given equal abilities, one person chooses one career and another person chooses another career.

Thinking styles might be the source of unexplained variations of ability tests about future performance. The style of thinking is a preferred way of thinking. It is not ability but rather a preferred way of using the abilities one has.

Style of learning & thinking is cerebral dominance of an individual in retaining and processing modes of information. It identifies hemisphericity dominance by way of studying the hemisphere functions and indicates a student's learning strategy and brain hemisphere preference in problem solving. Kolb (1979) [17] and McCarthy (1996) [20] have suggested that brain hemisphericity is associated with different occupations and academic majors. Academic subjects such as science, engineering and language emphasize logic and verbal analysis, which make them a better fit for left-brain dominant students. Whereas other subjects such as arts, the humanities and architecture are believed by several researchers to require a more global, synthetic and spatial orientation which make them more suitable for right-brain dominant student (Katz, 1983) [14]. Lavach (1991) [19] examined brain hemisphericity of students with different majors. He reported natural science students demonstrated a left-hemispheric mode. Humanities students showed preference for the right-hemispheric dominance, while social science majors showed preference for left-hemispheric dominance.

Serious mismatches may occur between the learning styles of students in a class and the teaching style of the instructor with unfortunate potential consequences. Knowledge of learning style provides information to the student as to why she/he has learnt in a different way than others. It helps to control the process of learning. It is vital because one of the most important signals in learning is to learn to be autonomous, that is, for the individual to take responsibility for his/her own learning. Discovering this learning style will allow the student to determine his or her own personal strengths and weaknesses and learn from them. Teachers can incorporate learning styles into their classroom by identifying the learning styles of each of their students, matching teaching style to learning style for difficult tasks, strengthening weaker learning styles through easier tasks and drill, and teaching students, learning style selection strategies. It is important for students to have multiple learning opportunities and learning style-shift and teachers should achieve a match between teaching strategies and the students' unique learning styles. Accommodating teaching to learning styles improves students' overall learning results, increases both

motivation & efficiency and enables a positive attitude towards the language being learned. The purpose of using learning styles is to find the best ways for both students to learn effectively and teachers to teach efficiently.

Various studies have been conducted on learning & thinking style with different variables. One of the researches has demonstrated that if students are taught through instructional methods that complement their hemispheric preference, then they are more capable of mastering new skills (Boyle & Dunn, 1998) [1]. Cano-Garcia, Hughes (2010) [3] reported that students' academic achievement was significantly related to students' learning & thinking style. Sharma and Neetu (2012) [27] observed that students' learning & thinking style and academic achievement were positively and significantly related to each other. Finding of the study conducted by Vengopal and Mridula (2013) [30] revealed a significant difference in the right hemisphere and left (brain) hemisphere preference for information processing among students. It was also found that there was significant difference between right and left hemisphere preference for information processing in boys and girls. Kaur and Lal (2014) [15] explored that there was a significant difference between that high and low achievement of school children on style of learning and thinking scale. Humera (2015) [11] revealed in the study that majority of the students had right hemispheric dominant style of learning & thinking. Garima (2016) [8] found no significant effect of learning and thinking style on academic achievement of senior secondary schools students. Khan and Unnisa (2017) [16] revealed a significant difference in academic achievement of students learned by right & left hemisphere, but no significant difference was found between academic achievement of boys & girls students learned either by right hemisphere or left hemisphere.

Despite the fact that these academic-related variables have received a considerable degree of attention within the educational literature over the past two decades, not much was done to find out the meta-cognitive skills and learning & thinking style of secondary school students and the influence they may have on their academic achievement. Academic achievement has been predicted by a number of variables. However, a very few studies have been conducted on prediction of academic achievement among school students in relation to their meta-cognitive skills and learning & thinking style. Thus, this area of research was selected because it has not been investigated before and so contributes to the

existing wealth of knowledge on meta-cognitive skills and learning & thinking style in relation to academic success. It is against this backdrop that this study was conducted.

OBJECTIVES OF THE STUDY

1. To find out the relationship of meta-cognitive skills, learning & thinking style with the academic achievement of school students.
2. To predict academic achievement among school students on the basis of their meta-cognitive skills and learning & thinking style.

DESIGN OF THE STUDY

Descriptive method was used in the present study. The study was dealt in two phases, namely correlation phase and prediction phase. In correlation phase, the relationship of academic achievement with meta-cognitive skills and learning & thinking style among secondary school students was studied whereas in prediction phase, prediction of academic achievement among school students was made on the basis of their meta-cognitive skills and learning & thinking style.

SAMPLE

For the present study, a sample of 500 secondary school students studying in private school affiliated to C.B.S.E was selected through multi-stage random sampling technique on the basis of meta-cognitive skills and learning & thinking style.

TOOLS USED

- Meta-Cognitive Skills Scale (MCSS-$_{GMS}$) developed by Gupta and Suman (2017) [10] was used to assess the level of meta-cognitive skills of secondary school students. It is a Likert type five-point scale with 42 items under four dimensions i.e. Planning Skill, Implementation Skill, Monitoring Skill and Evaluation Skill. Reliability through Test-Retest method and Split-Half method was found to be 0.763 and 0.949. The construct validity of the scale was ranged from 0.709 to 0.924.
- In the present study, the Indian version of the SOLAT test developed by Venkataraman (2011) [31] was used to measure learning & thinking style of school students in terms of hemisphericity functions of their brain. In this tool, 1 to 25 items measure learning styles and 26 to 50 items measure thinking styles. Therefore, this tool containing 50 items was administered to school students to collect the data

pertaining to their learning styles as well as thinking styles. The reliability coefficient of correlation for the right hemisphere function was found to be 0.89. For the left hemisphere function the coefficient of correlation was found to be 0.65. The coefficient of correlation for the integrated score was 0.71. The validity coefficient of correlation was 0.842 for the right hemisphere part; 0.621 for the left hemisphere part and 0.678 for the integrated part. The correlation coefficients reveal that the SOLAT tool possesses reasonable level of concurrent validity.

STATISTICAL TECHNIQUES USED

Pearson's coefficient of correlation was used to study the relationship of meta-cognitive skills and learning & thinking style among secondary school students with their academic achievement whereas stepwise multiple regression was used to predict the academic achievement among school students on the basis of their meta-cognitive skills and learning & thinking style.

RESULT AND INTERPRETATION

The relationship of meta-cognitive skills and learning & thinking style among secondary school students with their academic achievement has been studied. The study has also been attributed to the prediction of academic achievement among school students on the basis of their meta-cognitive skills and learning & thinking style.

- **Relationship of Meta-cognitive Skills and Learning & Thinking Style among Secondary School Students with their Academic Achievement**

The Table-1 gives the correlation coefficients of meta-cognitive skills and learning & thinking style with academic achievement among secondary school students.

Table-1 Correlation Coefficients for Academic Achievement among Secondary School Students on the basis of their Meta-cognitive Skills and Learning & Thinking Style

Variables	Pearson's Correlation Coefficients
Meta-cognitive Skills	**0.401****
Learning & Thinking Style	**0.289****

**** Significant at 0.01 level**

Table-1 shows a positive correlation (r = 0.401) between scores on meta-cognitive skills of students and their academic achievement. The same table also shows a positive correlation (r = 0.289) between scores on learning & thinking style of students and their academic achievement. Although, the coefficients of correlation for both the variables i.e. meta-

cognitive skills and learning & thinking style with academic achievement of secondary school students have been explored positive and significantly high, but in order to identify the best predictors between two variables, stepwise multiple regression analysis has been carried out.

- **Prediction of Academic Achievement among School Students on the basis of their Meta-cognitive Skills and Learning & Thinking Style**

This section deals with the prediction of academic achievement among school students on the basis of their meta-cognitive skills and learning & thinking style. Prediction results of stepwise multiple regression analysis, wherein academic achievement has been treated as criterion variable and meta-cognitive skills and learning & thinking style have been treated as independent variables are given in the Table-2.

Table-2 Prediction Results of Academic Achievement among School Students on the basis of their Meta-cognitive Skills and Learning & Thinking Style

Models	Predictors	R	R^2	Adjusted R^2	Standard Errors of the Estimates	F-values
1.	**Constant, MCS**	0.401	0.161**	0.159	14.305	95.426**
2.	**Constant, MCS & LTS**	0.417	0.174**	0.171	14.208	52.296**

**** Significant at 0.01 level**

MCS=Meta-Cognitive Skills **LTS=Learning & Thinking Style**

As can be seen in Table-2 the obtained F-value (52.296) is significant (P<0.01); therefore it can be concluded that the predictive variables (meta-cognitive skills and learning & thinking style) have the ability to predict the criterion variable (academic achievement). From the analysis of stepwise multiple regression, it can be understood that the values of R and R^2 obtained for the model (R =0.417; R^2 = 0.174), the variation in the criterion measure (academic achievement) explained by the model is found to be 17.4%. The fact that academic achievement is explained only by meta-cognitive skills and learning & thinking style with a rate of 17.4% gave an idea about how important students' meta-cognitive skills and learning & thinking style are for their academic achievement. The remaining (82.6%) of the variation is explained by the other factors.

In order to find out the strongest predictor of academic achievement among school students on the basis of their meta-cognitive skills and learning & thinking style, the partial regression coefficients, standard errors and corresponding t-values are given in the Table-3.

Table-3 Partial Regression Coefficients for the Prediction of Academic Achievement among School Students on the basis of their Meta-cognitive Skills and Learning & Thinking Style

Sr. No.	Predictors (Variables)	Partial Regression Coefficients	Standard Errors	t-values
1.	Constant	52.863	2.985	17.710**
2.	MCS	0.133	0.018	7.378**
3.	LTS	0.304	0.108	2.802**

**** Significant at 0.01 level**

MCS=Meta-Cognitive Skills **LTS=Learning & Thinking Style**

In the Table-3 stepwise multiple regression analysis show that unstandardised coefficients (β-values) and their significance are important statistics to find out the strongest predictor among variables. As can be seen in Table-3, the best model was obtained in the second step, and further the Table-3 discloses that the t-values for the predictor variables were calculated to be lower than P<0.01. It can be inferred that both the variables, meta-cognitive skills (β=0.133), followed by learning & thinking style (β=0.304) are the significant predictors of academic achievement. From t-values, it can be concluded that the variable meta-cognitive skills is the strongest predictor of academic achievement in comparison to learning & thinking style. This result is in congruence with the result of (Dunning, Johnson, Ehrlinger & Kruger, 2003; [5] and Kruger and Dunning, 1999) [18] who found that meta-cognition was the strongest predictor of academic success. This result is in tune with the result of Ghiasvand (2010) [9] who revealed that meta-cognitive strategies better predict academic achievement. Mozafari, Safari, Zohrehabasifard, Safari, and Sharafi (2016) [22] showed that control and supervision among meta-cognitive components could explain the variance of academic achievement. Owo and Ikwut (2015) [24] reported that meta-cognition predict slightly the academic achievement of students. The findings of Cano-Garcia & Hughes (2010) [3], Sternberg & Zhang (2001) [29] revealed that thinking styles were predictors of learning and academic success. The findings of the study conducted by O' Neale & Harrison (2013) [23] and Fayombo (2015) [7] revealed that learning style was the highest contributor of academic achievement. However, DeTure (2004) [4] found that learning styles were poor predictors of academic success.

EDUCATIONAL IMPLICATIONS

From the results of the study, it was found that both the variables i.e. meta-cognitive skills and learning & thinking style were significantly contributing towards prediction of academic

achievement of school students. From the comparison of t-values, it was concluded that the variable meta-cognitive skills was the strongest predictor of academic achievement of school students in comparison to learning & thinking style. Thus, the findings of the present study will be beneficial for educational thinkers, psychologists, teachers and others who are concerned with the sphere of education. The more emphasize on development of meta-cognitive skills in the school curriculum is considered important because of its impact in improving academic performance of students. In context of learning & thinking style, teachers should find out the dominant part of their students' brains first and then use the appropriate classroom techniques, methods and tools according to them only then better and greater learning can be accomplished.

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