SIGNIFICANCE OF COGNITIVE STYLE FOR ACADEMIC ACHIEVEMENT IN MATHEMATICS

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Abstract

Cognitive style is considered to be a personality dimension that influences attitudes, values and social interaction. Cognitive Style refers to two parts of the brain i.e. left hemisphere and right hemisphere of the brain. The left brain hemisphere includes sequence, Time Analysis, Abstraction, Causation, Uniform, objective and Reason. Whereas right brain hemisphere includes simultaneous, Space,Synthesis, Concrete and many ways. In this article cognitive Style has five dimensions i.e. Integrated style, Intuitive Style, Split Style, Systematic Style and Undifferentiated style. The ministry of education should cautioned teachers about the importance of cognitive styles during teaching and learning process. The mathematics teacher should take importance of cognitive styles during preparing their lesson plan and teaching aids.

Keywords: Cognitive Style, Hemisphere, Teachers.

Information processing is one of the important factors for understanding human behavior. Each individual has a way of gathering and processing information.**Barnard (1966)** suggested that understanding the success of everyday affairs of an individual requires the consideration of two types of mental processes; non logical and logical .The non - logical process is termed intuitive thinking, which uses insight in the most situations. The logical process uses reasoning in most situations. The existence of such mental processes has been proved by neurological research. **Sperry (1964)** found that left -brain is responsible for logical / rational functions and the right brain for intuitive /judgmental functions.**Taggart and Robey (1981)** based on researches pointed out that two halves of the brain differ in their function and these are popularly known as left/right hemisphere model of information processing in the human brain. Hemispheric dominance is also referred to as cognitive style. This involves how one processes information based on different capabilities of the left and right hemispheres of the brain **(Coleman &Zenhausern, 1979).** Cognitive style is the

underlying construct for information processing regardless of the situation in which it is applied **(Furnham, 1995).** Cognition is an act or process of knowing and a collection of mental processes that includes awareness, perception, reasoning, and judgment. The study of cognitive processes has its roots in the Gestalt psychology of Wertheimer, Kohler, and Koffka and in the studies of cognitive development in children by Piaget during the 19th century. At the beginning of the 20th century, it was considered that personality is comprised of three facets each with a continuum descriptor. The first facet, attitude, can range from extraversion, those personalities that are outgoing, to introversion, those personalities that are focused inward. The second facet, perception, deals with a person's method of understanding stimuli; an intuitive person is meaning-oriented while a sensory person is detail-oriented. Judgment is the final facet of personality and deals with a person's approach to making decisions; a thinking person tends to be analytical and logical while a feeling person tends to judge based on values**. Curry (1983)** regards cognitive style as the individual's approach to adapting and assimilating information, which does not interact directly with the environment, but is an underlying and relatively permanent personality dimension that is observed across many learning instances. Cognitive style is considered here as static, relatively in-built and fairly fixed characteristic of an individual. Individuals may vary their learning strategy or approach to learning as required, but the underlying cognitive style will remain fairly constant. Cognitive style is an aspect of overall personality and cognitive processes. It is a bridge between cognition or intelligence measures and personality measures **(Grigorenko & Sternberg, 1997; Cheema & Ridding, 1991).** Cognitive styles are constructs developed to describe perceptual traits of individuals, have their origins in studies of human cognition in the differential perspective **(Lemes, 1988). Cornett (1983)** described cognitive style as a predictable pattern of behavior within a range of individual variability. **Srinivas Kumar (2011)** defined that cognitive style has to be considered as a holistic process of cognition that begins with the perception, and mediated by information processing, and the resultant retrieval; it varies from person to person and it is affected by various personality factors, such as, previous information, heredity and environment, interest, thinking, attitude, value system, intelligence, creativity, social and economic status and so on.

Researches in the field of Cognitive Styles have shown Cognitive Styles as a main factor that effect on students' Achievement. It is evidenced by the conclusions of the studies conducted by

Verma and Swain (1991) studied the effect of cognitive style on scholastic achievement and showed that field independent cognitive style group obtained significantly higher mean

scores in English, Maths, General Science, Social Studies and Drawing separately and together than their field dependent counterparts. **Kirk (2000)** investigated the relationship of cognitive style to achievement in chemistry and found that field independence has significantly correlated with academic achievement in chemistry. **Kumar (2006)**found that tribal and non-tribal students of 12th grade differed significantly with respect to field independent and field dependent cognitive styles. Non-tribal students were found higher on field independent cognitive styles than tribal students. **Geetanjali (2006)** found that cognitive styles had a significant effect on a student's academic achievement. The more the field independence given to the students, the higher became the academic achievement.**Alomyan (2004)**investigated the effect of students' cognitive styles, achievement motivation, prior knowledge and attitudes on achievement in a web based environment and found that no differences between students' attitudes towards web-based learning and their field dependencies.**Tinajero and Paramo (2010), Linder (2011), Nicolaou and Xistouri, (2011) and Wei and Sazilah (2012)** which showed a significant effect of Cognitive Styles on Achievement. In controvertion results of the studies conducted by **Altun and Cakan (2006) and Ipek (2010)** did not find any significant effect of Cognitive Styles on Achievement.

 Kolb (1984) has given converger, diverger, assimilator and accommodator cognitive styles. Their characteristics are described as:

  Convergent style depends mainly on the dominant learning capacities of active experimentation and abstract conceptualization. This style has great advantages in decision making, problem solving, traditional intelligence tests, and practical applications of theories. Knowledge is organized in a way of hypothetical-deductive reasoning. Therefore, persons with this style are superior in technical tasks and problems and inferior in social and interpersonal matters.

Divergent cognitive style has the opposite learning advantages over converger. This style depends mainly on concrete experience and reflective observation. It has great advantages in imaginative abilities and awareness of meaning and values. Therefore, persons with this style tend to organize concrete situations from different perspectives and to structure their relationships into a meaningful whole; they focus on adaptation by observation instead of by action; they are superior in generating alternative hypothesis and ideas and tend to be imaginative people or feeling-oriented; they tend to choose to specialize in liberal arts and humanities.

Assimilative style depends mainly on abstract conceptualization and reflective observation. This style has great advantages in inductive reasoning, creating theoretical models, and

assimilating different observations into an integrative entity. Similar to converger, persons with this style tend to be more concerned about abstract concepts and ideas, and less concerned about people. However, persons with this style tend to focus more on the logical soundness and preciseness of the ideas, rather than their practical values; they tend to choose to work in research and planning units.

  Accommodative style has the opposite learning advantages over assimilation. This style depends mainly on active experimentation and concrete experience. It has great advantages in doing things, implementing plans, and engaging in new tasks. Therefore, persons with this style focus on risk taking, opportunity seeking, and action. They tend to be superior in adapting themselves to changing immediate solutions in which the plan or theory does not fit the facts. They also tend to intuitively solve problems in a trial- and –error manner, depending mainly on other people for information rather than on their own thinking. Therefore, persons with this style tend to deal with people easily. They tend to specialize in action-oriented jobs, such as marketing and sales.

Dimensions of cognitive style:

Systematic Style: An individual who typically operates with a systematic style uses a well defined step-by-step approach while solving a problem; looks for an overall method or pragmatic approach; and then makes wholistic plan for problem solving.

Intuitive Style: An individual with intuitive style uses an unpredictable ordering of analytical steps when solving a problem, depends on experience pattern characterized by universalized areas or hunches and explores and abandons alternatives quickly.

Integrated Style: A person with an integrated style is able to change styles quickly and easily. Such style changes seem to be unconscious and take place in a matter of seconds. The result of this 'rapid fire' ability is that it appears to generate energy and a proactive approach to problem-solving. In fact, integrated people are often referred to as 'problem-seekers' because they consistently attempt to identify potential problems as well as opportunities in order to find better ways of doing things.

Undifferentiated Style: A person with such style appears not to distinguish or differentiate between the two style extremes, that is, systematic and intuitive, and therefore, appears not to display a style. In a problem-solving situation, he/she looks for instructions or guidelines from outside sources. Undifferentiated individuals tend to be withdrawn, passive and reflective and often look to others for problem-solving strategies.

 Split Style: A person with split style shows fairly equal degrees of systematic and intuitive characteristics. However, persons with split-style do not possess an integrated behavioral

response; instead they exhibit each separate dimension in completely different settings using only one style at a time based on the nature of the tasks. In other words, they consciously respond to problem-solving by selecting the most appropriate style.

Cognitive styles and achievement in mathematics

A number of studies have investigated the relationship between cognitive styles and mathematical achievement **(van Gardener, 2006; Kozhevnikov et al., 2002; Presmeg, 1986a).** Some studies have shown that visual-spatial imagery is beneficial for mathematics and that spatial imagery is an important factor of high mathematical achievement **(van Garderen, 2006; Kozhevnikov et al. 2002).** On the other hand, other studies showed that students classified as visualisers do not tend to be among the most successful performers in mathematics **(Presmeg, 1986a),** and a probable explanation for this result is the fact that they considered visualisers as one group without distinguishing between the two types of visualisers mentioned above. Moreover, findings from such studies revealed also certain areas of mathematics for which spatial imagery is important Students with object imagery style interpreted the graphs as pictures while students with spatial imagery style constructed more schematic images and manipulated them spatially. It is obvious that students with object imagery style will clearly have difficulty solving mathematics problems that involve graphs **(Kozhevnikov et al., 2002).** Also, the results of a research on mathematical creativity and cognitive styles, which was conducted by **Pitta-Pantazi and Christou (2009),** indicated that spatial-imagery cognitive style is related to mathematical fluency, flexibility and originality. In another study of **Anderson et al. (2008),** on geometry problems with geometry clues matched to cognitive styles, both spatial imagery and verbal cognitive styles were important for solving geometry problems, whereas object imagery was not.

Conclusion

 Each style preference offers significant strengths in learning and working. As a result, if students can recognize their strengths, they can take advantage of ways they learn best. Moreover, by being aware of the style areas they do not use, then developing them, students can enhance their learning and working power. Knowledge and awareness of cognitive style may be useful to individuals for purposes of self management. By knowing one's own style, one can expand on its strengths and learn techniques for mitigating the negative aspects or weaknesses. If one knows that one has a tendency toward extreme field dependence, one can learn methods for structuring one's environment with such devices as outlines, time lines, and questioning techniques. Practicing library media specialists and classroom teachers may use tests to identify personal cognitive style, which may foster insight into the general reasons for

certain behaviors among staff members and contribute to mutual respect. Finally, schools of higher education- colleges both of education and of library science-might use cognitive-style instruments in general and career counseling. If cognitive style truly affects perceived instructional interactions, knowledge of personal style might be of real benefit in making initial career choices.

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