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Cognitive Development and Academic Achievement Extent of Association - A Review Report

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ABSTRACT

Education, cognition and learning have become integral part of every child's personality. These inseparable aspects are considerably vital in shaping the individual and helping him to achieve success. In the schools and educational institutes where education has been taken on priority, the cognitive abilities and excellence in mastering them mitigate the burdens and stress in educational system. In this context, it is assumed that when the children are taught as per their affinity and dominant multiple intelligence, they can learn better and turn into efficient learners. This review paper has been written in order to compile the augmented knowledge into systematic and scientific information to ensure that the educational processes can become lucid for masses. The valid studies related to cognitive development including intelligence quotient, focus factor, decision making ability, creative quotient and academic achievement in light of multiple intelligences were selected. The review studies have been taken on international basis for universal application. It was inferred after the review that the concept of teaching students through multiple intelligences approach should be adopted to make create a meaning and impactful teaching learning process.

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1.   INTRODUCTION

Academic achievement holds a great impact in student's further life emphasizes the relevance to probe into this factor with due care and sincerity. The traditional and

rigid methods of teaching ought to be replaced by flexible and multiple intelligence based learning systems in schools.

Implementation of multiple intelligences in classroom should be made practical to ameliorate the academic achievement among students. Customized instruction system based on the cognitive abilities i.e. intelligence quotient, multiple intelligence levels, learning style, dominant thinking pattern, focus factor, decision making ability and creative quotient of students should be developed. Moreover, the educational instructions ought to be developed in synchronization with the dominant multiple intelligence and natural learning style of the learners. Educational system should be made learner-centred rather than teacher centred to ensure higher literacy and holistic development of students. To develop the interest of students in academic domain, they should be exposed to multiple intelligence based learning so as to avail opportunities to explore themselves.

2. OBJECTIVE OF THE STUDY

To review the studies in order to find the extent of association between cognitive development and academic achievement.

3. SCOPE OF THE STUDY

The study was limited to the research studies previously conducted at national as well as international levels.

4. STUDIES REVIEWED

According to Rogers and Freiberg (1994) education is considered as one of the basic needs of every child and has always been considered as an essential aspect of human development. Dewey (2013) explained that knowledge can be acquired through education which has become the basic resource for development. Crow and Crow (1951) defined achievement as an extent to which students gain from instructions in the classroom. It describes the quantity and the quality of knowledge and skills acquired by students through the training and instructions imparted to them. The term 'academic achievement' is a combination of 'academic' and 'achievement' which means level of efficiency gained in academic tasks.

Sinha (1970) explored that intelligence, memory, good health, hard work, methods of study, financial security and interest affects the academic scores. As mentioned by Brody (1997) academic achievement is a unique responsibility of educational organizations to promote the development of learners. Poon Teng Fatt (2000) described academic achievement as abilities gained and the degree of competence gained by students in school in the subjects in which they have been imparted training. Academic achievement provides a measure of accomplishments as well as limitations of the students in the academic domain. In this context, Dewey (2004)

pointed out that development of the learners is possible only if proper individual attention is given to learners for enhancing their knowledge. Viljaranta, et al. (2014) examined and found that intelligence, physical health and socio economic status of the family affects academic achievement. The whole educational system revolves around the academic achievement of students. In perspective of Ary et al. (2018), students need opportunities to gain knowledge, asking refined questions, designing investigations, and interpreting information to deduce findings.

Pulaski (1971) has explained cognition as the utmost vital parameter which can lead every child towards success. Piaget (1977) explains cognitive ability as the capacity of the human brain to perform higher mental processes like thinking, remembering, understanding and problem solving. As per Tudge and Winterhoff (1993) cognitive processes use existing knowledge and generate new knowledge that leads to intelligence.

According to Salthouse and Davis (2006) high cognition is linked to positive psychological variables such as self-esteem and self-concept.

Blomberg (2011) believed that cognition is the process by which the sensory input is transformed, elaborated, reduced, stored, recovered and utilized.

Bechtel et al. (2017) believed that cognition is a term used to designate all processes involved in knowing.

As mentioned by Goldman (2018), cognitive performance is one of the highly individualistic character of a student, thus the measurement has to be done to cater to the individual characteristics.

Bloch (2018) explains the concept of cognition as the mental functions, mental thoughts and intelligence.

Conte et al. (2018) describes that cognition can be natural as well as artificial, conscious and unconscious.

Piaget (1936) explained the significance of cognition in his theory of cognitive development and described the series of events through which a child constructs mental model of the world around him.

Dickerman (1911) interprets intelligence as a growing reliance on internal representations. The intelligence is highly action oriented. As he grows, he starts knowing things symbolically and internally to create representations in his mind. Stern (1914) coined the concept of intelligence quotient which had been widely accepted.

Binet and Simon (1916) emphasized the abilities and skills required for performing tasks. Intelligence is referred to as the mental capacities and abilities enabling one to think rationally, learn readily, act purposefully, and deal effectively with his environment. It also includes verbal reasoning, quantitative thinking and abstract analysis.

Intelligence, as per Seashore et al. (1950) may be referred to as capacity and power of the mind for thinking and knowing in contrast to those mental faculties by which the individual acts. Intelligence is the ability to take up activities characterized by difficulty, abstractness, complexity, adaptability and to maintain these characteristics in different situations.

Bayley(1955) had recapitulated the various definitions of intelligence by dividing into three categories.

Guilford (1959) explained that the range of intelligence is portrayed by clarity of purpose, idea, thinking and performance. The first intelligence test was framed by Binet and Simon in 1905. However, in 1916, William Stem introduced the concept of intelligence quotient.

Binet and Simon (1961) defined intelligence as the general capacity of individuals to consciously adjust their thinking to new situations.

Neisser (1979) explained intelligence as the most usefully interpreted as an aspect of the total personality.

Perkins et al. (1991) believed intelligence as an aggregate and overall capacity of an individual to act purposefully, think rationally and deal efficiently with environment. Intelligence is thus the ability to understand and deal with persons, things and symbols.

Further, Jensen (1998) narrated intelligence as a systematic collection of abilities to process information.

Melchior and Hebebrand (2018) viewed intelligence as the ability to comprehend the world and its resourcefulness to cope with every situation.

According to Saklofske et al. (2018), intelligence is an aspect of mental ability which consolidates learning as well as experience and its retrieval in relevant novel situations.

According to Cattell (1971), intelligence of an individual is his capacity to understand and comprehend situations to deal through them effectively. The

unitary theory is also known as monarchial theory which was proposed by Stern and Kluver (1925). This theory was supported by Binert and Terman. It represents that there exists single ability intelligence beneath various intelligent behaviors that people reveal and possess. The two-factor theory of intelligence was introduced by the British psychologist Spearman (1904). He mentioned that all mental tasks require two types of abilities, a general ability 'g' and a specific ability 's'. The general ability is common for all intellectual tasks while the specific ability 's' is always specific to a particular work. This theory is also known as Spearman's G-factor.

Thurstone (1938) had identified factors known as primary mental abilities. These included verbal ability, number ability, spatial ability, perceptual ability, reasoning, memory, reasoning and word fluency. He thought regarding mental organization in terms of group factors and corroborated that there are mental operations having a primary factor in common that gives them psychological and functional unity thereby differentiating them from other mental operations. Hegave a multifactor theory having identified factors termed as primary mental abilities.

Cattell (1950) explored individual differences in intelligence. In his preview, there are two main types of intelligence, crystallized intelligence and fluid intelligence. Fluid intelligence is an ability for getting insight into complex relationships and acquiring new concepts to adapt in novel situations. In contrast, crystallized intelligence is the combination of acquired knowledge and developed intellectual skills.

Vernon (1950) framed a Vernon's hierarchical theory and proposed that elements of G-factor theory and the multifactor theories can be combined to form a hierarchical theory. He depicted intelligence as a sort of pyramid at the top of which rests the general intelligence 'g', which is evident in all intellectual activities. Beyond it are moderately specific ability factors.

Carroll proposed the three stratum theory in 1964 which forms a hierarchical model of intellectual functioning (Carroll, 1997). The strata contain three levels of general factors over the domain of cognitive capabilities. Bottom is the first stratum which is represented by narrow and specified abilities like induction. The second stratum holds broad abilities having moderate specialization. Carroll had identified eight second stratum factors which include fluid intelligence, crystallized intelligence, general memory and learning, broad visual perception, broad auditory perception, broad retrieval ability, broad cognitive speediness, and processing speed.

Guilford (1967) explained that there are four categories of content, five kinds of operations, and six types of products thereby, resulting in 120 unique intellectual

abilities. The four basic categories of content are figural, symbolic, semantic and behavioural. Operations can be divided into five categories; cognition, memory, convergent production, divergent production and evaluation. Products can be divided into six types - units, classes, relations, systems, transformations and implications.

Gardner (1983) had proposed a unique theory of intelligence better known as the theory of multiple intelligences in his renowned book 'Frames of mind' and 'Intelligence reframed'. Sternberg (1984) distinguished between information processing and meta components. Similar finding was recorded by Vartanian (2009), Kaya (2008), McClellan, Conti (2008), Xie and Lin (2009), Pour-Mohammadi et al. (2012), Modecki et al. (2017), Caemmereret al. (2018)and Garba et al. (2018).

According to him, components are the steps to solve a problem whereas meta components accounts to the knowledge regarding how to solve the problem, quite similar to the general intelligence. According to Thiele (2003), the multiple intelligence theory is an advanced model of intelligence. Multiple intelligence level gives us an important insight about our natural strengths. The multiple intelligence theory claims that all humans have nine intelligences, to a lesser or greater extent, and that we each have a different intelligence profile as mentioned by Gardner (2008).

Hillman et al. (2014) explained focus and attention as the basic cognitive skill which determines higher order mental processes. Moschis and Moore (1979) defined decision as an action by which individuals undertake to perform a particular activity. Decision refers to a choice between alternative lines of action at a particular period of time.

Stronge (2018) mentioned decision making as the blend of thinking and taking an action. Creativity holds motivation, intelligence, knowledge, personality and environment.

According to Guilford and Hoepfner (1971), creativity is the function of intellectual abilities. As per Torrance (1977), creativity is a product of originality, fluency and flexibility.

Dehaene et al. (2004) had conducted a study and published clinical evidences on differential thought processes based on hemispheric dominance.

According to Gunzelmann and Connell (2006), every individual possesses a right or left brain preference which influences his thinking style. According to Sousa (2016) brain based education paves an insight into what neuroscience says about

teaching and learning of the brain and educational techniques that are meant to help the brain to learn and remember things and events.

The findings were supported by Temur (2007), Chen and Gardner (2012), Abdi et al. (2013), Ayalew et al. (2016), Luo (2018), Pratiwi et al. (2018), Sternberg (2018), Kasof (1997), Benedek et al. (2014), Gajda et al. (2017), Tessier (2018), Friedman et al. (2003), Memmert (2011), Akkuzu and Akcay (2011). However, Klein (1997) found the contradictory results. Sellah et al. (2018)mentioned a unique idea regarding hemispheric specialization and conveys that the individual can benefit from the integration of the processing done by both hemispheres and is therefore afforded greater comprehension of whatever situation initiated the processing. According to Dunning et al.(2003) before performing any task, the ability and capacity of a person to take up that task depends on his self-cognitive estimation level.

Cognition and Academic achievement

There are numerous studies that suggest positive associations between cognition and academic achievement. Fuchs et al. (2006) found that cognition and intelligence were related to self-confidence and academic achievement of school students. The results further reported that there was a significant relationship between cognition, intelligence and academic achievement among school students. There existed a significant difference between boys and girls in terms of cognitive abilities.

Similar studies had been carried on by Ayres and Paas (2009) and Kenth (2009) who traced the relationship between cognitive style, gender, IQ and academic achievement of high school students and recorded a significant correlation between cognitive abilities and academic achievement.

Cognitive ability predicts academic achievement which has also been established by Chandra and Azimmudin (2013). It was suggested that children with higher cognitive abilities excel in academics. The study confirmed that the children with high IQ and cognitive abilities have better grasping power, retention, recall and higher understandability as compared to an average child. It was further revealed that the high IQ child will score better than the low IQ child. Low IQ child will most probably be a slow learner whereas a child with high IQ has a higher probability of being a fast learner.

Dhall (2014) found that examination mastery along with cognitive abilities and imaginative style was found to be a good predictor of academic achievement. The study conducted by Donnelly et al. (2016) has laid down sufficient evidence to imply that there is a positive influence of cognition as well as brain structure and function on academic achievement. It has been portrayed that the children with

high IQ and cognitive abilities have better academic achievement than the children with average IQ and lower cognition. Rosenthal and Jacobson (1968), Reiss et al. (1996), Bas (2010), Ehrlinger et al. (2016), Sternberg and Sternberg (2016) and Eysenck (2018) found the same results.

Intelligence and Academic achievement

Intelligence is the ability to plan and structure behavior in an effective manner for attainment of goals. It is inevitable that students having high IQ would have better performance in academics. IQ provides a standardized method for measuring intellectual abilities and is widely used within education, employment and clinical practice. Snow (1986) illustrated that the score of IQ test is used as a good predictor of students' academic achievement in schools, work performance, work achievement, income, and any other aspects affecting the success in life.

Detterman and Daniel (1989) have confirmed that the correlation between IQ score and academic achievement varies depending on the policy used. Students who have high academic achievement also have high IQ scores. Similar results have been found by Neisser et al. (1996).

Deary et al. (2000) observed that the people who had low intelligence were more likely to feel frustrated in the process of education and become aggressive and impulsive. An individual's abilities and capacities to learn can be partly uncovered by the use of verbal and non-verbal intelligence tests.

Wajiha (2002) indicated that there were differences in the pace of brain development of boys and girls. Girls develop at a fast pace and generally perform better in academics as compared to boys.

Diseth (2003) examined the IQ of the boys and girls studying in 11th standard and traced that the intelligence test scores of boys were quite higher than those of girls.

Adey and Shayer (2006) found that there existed significant relationship between intelligence and academic achievement of secondary school students. In addition, there was a significant difference between boys and girls in terms of intelligence. Likewise, there existed significant difference between boys and girls as far as their academic achievement was concerned.

Deary et al. (2007) found that there existed an insignificant difference in the IQ and academic achievement between boys and girls.
Nuthana (2007) found that IQ was not different among boys and girls. However, gender was witnessed to be the far important variable than IQ in determining their academic performance.

Rohde and Thompson (2007) explored the differences between the genders in terms of their general intelligence. It was revealed that such differences could not be identified. The results further indicated that girls tend to excel on verbal types of problems whereas boys on quantitative and spatial.

Watkins et al. (2007) indicated that there were insignificant differences between math and verbal abilities among men and women.

Subramanyam and Rao (2008) suggested that there was a significant difference in regard to the effect of gender on and academic achievement of students belonging to same age group.

Kornilova et al. (2009) found gender difference as one of the major demographic factor affecting academic achievement and explored that it also affected the IQ. It was revealed that girls were better in academics while boys performed better than girls in reasoning.

Deary and Johnson (2010) implied that gender is a significant aspect that influences the speed and perception of the factors which determine their decisions.

Flinders (2012) found that children who have higher intelligence have higher grade in school and the results are further supported by another study conducted by Ahmed et al.(2014) who found that there was no significant difference in gender in their MI whereas there was a significant difference between the genders in terms of academic achievements, female students having outperformed their male counterparts.

Soares et al. (2015) suggested that there was a significant association between intelligence and academic achievement and it was noticed that the IQ scores of students were proportional to their academic scores.

Tias et al. (2015) found that academic achievement can be used as an indicator of learning success.

Newman and Newman (2017) found that intellectual and cognitive development is significantly related to each other and that higher intelligence foster scholastic achievement.

Coleman (2018) investigated gender differences and academic achievement of male and female students. Results indicated that no significant difference was recorded between male and female students in the experimental and control groups. It was further explained that gender had no significant role to play on academic achievement of students.

Focus Factor i.e. Focused attention and Academic achievement

Focus has a great impact on understanding and retention of tasks and events. Doyle (1988) found that the students with high focus and attention excelled in mathematics whereas those with low focus did not perform better in solving sums.

Diamond et al. (2007) found that in a larger classroom context, data on the development and trainability of attention raises important considerations for supporting selective attention skills of students. Some children may need more cues to support their ability to selectively attend. This may, for some children, involve limiting distractors or presenting a longer opportunity to orient so that a child is prepared to deal with distractions. The results further indicate that the students who have higher focus factor i.e. focused attention score significantly high in academics.

Phillipson and Phillipson (2012) stated that indeed, the history of teaching children how to learn through training attention, self-discipline, and memory has significantly influenced the learning outcomes. Cognitive processes refer to the mental processes that are involved in getting knowledge about the world and perceiving this knowledge for efficient problem solving. Focused attention has always been an important aspect of educational and academic achievement. Stevens and Bavelier (2012) traced that selective attention skills are relevant for academic foundations and amenable to training, they represent an important focus for the field of education. It is argued that developmental differences in selective attention are related to the neural systems important for deploying selective attention and managing response conflict. In contrast, once effectively deployed, selective attention acts through very similar neural mechanisms across ages.

Decision Making Ability and Academic achievement

Decision making is an art which enables an individual to take up right alternative and choice at the right time so as to enhance the output. Mann et al. (1989) revealed that many adolescents at the age of 15 years show a reliable level of competence in understanding of decision making. Wood and Bandura (1989), studied decision making among children and found that decision making under condition of risk and under condition of uncertainty was found to be quite different and that the children made choices as if they were attempting to maximize expected utility. Suresh and Rajendran (1995) reported that there existed a positive correlation between risk taking and vigilant decision making. Devine (1999) indicated that decision making skills can be taught and successfully learnt in a school educational environment. Furnham et al. (2003) suggested that there was a significant difference between male and female students in their decision making abilities. Frederick (2005) found that schooling is a socializing force for the development of children as well as it enhances the decision making ability among

children. Balague et al. (2012) suggested that the respondents gained decision-making skills as a result of learning. In addition, all demographic categories, particularly gender was the main determiner of decision making, girls scored higher than boys in decision making. Bala et al. (2017) reported that girls think more while taking decisions whereas boys take less time for taking decisions.

Creativity and Academic achievement

The word ' creativity' has been derived from the latin word 'crea' means to 'create'. Creativity is the ability to bring into existence, to create, to produce something worth use through imaginative skill. Creativity is a process that results in a novel work accepted as useful and satisfying. Philosophical approaches explore an explanation for casual aspects of creativity and examine the metaphysical and cosmological nature of the process of creation. Psychological theories have major concern with creative potential while social theories are concerned with an account of creative achievement. Creativity can become a boon for innovative thinking and leads to expressiveness. High creative quotient paves the path to success. Murray (1959) defined creation as the output of a composition which is new and valuable in many contexts of the present discourse. 'New' refers to as the entity being marketed by more than a certain degree of originality and valuable refers to intrinsically or extrinsically valuable and generative of valuable compositions in the near future. Bowers (1969) has described creativity as the spark that ignites new ideas. Marjoribanks (1976) had explored the relationship between academic achievement, creativity and intelligence and the findings indicated that for certain subjects areas creativity is related to academic achievement up to a threshold level of intelligence, but after a certain level creativity is not associated with further surge in academic achievements. Awasthy (1979) reported that science students were significantly better than arts students in fluency and flexibility areas of creativity. Asha (1980) depicted that there was a significantly positive relationship between creativity and academic performance scores of students. Jarial and Sharma (1980) investigated and evaluated the relationship between creativity and academic performance of students of Secondary schools of Indore city. Test of creative thinking and marks of annual examination of students were considered to measure their performance. Results indicated that academic performance was significantly and positively related to creativity. Kaur and Sansanwal (1980) found that creativity was significantly and positively related with academic achievement. Ramachandra and Katiyar (1986) observed that science students were significantly better than arts students in terms of creativity, fluency, flexibility and originality. Kundu (1987) found that science students were more creative than arts students. Nwazuoke (1989) concluded that environment where a child finds himself could foster or inhibit creativity. Though a child may have the innate or genetic ability for creativity, yet parents and teachers have roles to play to enhance and foster the creative traits, which in turn, has direct role to play in establishing academic success. Runco (1991) found no correlation between creativity and academic

performance of students. Nwazuoke and Okechukwu (1992) indicated that creativity scores were not different for boys and girls. Penick (1992) described creativity as a process of becoming sensitive to problems, deficiencies, gaps in knowledge, missing elements and disharmonies as well as identifying, searching for solutions, making guesses or formulation of hypotheses, and possibly modifying and restating them, and experimenting to find results and finally scoring high in academics. Yeap and Kaur (1998) found positive and significant correlation between measure of creativity and academic performance. In the same context, Ai (1999) suggested that there existed a significant difference between creative abilities of boys and girls, and that the relationship between creativity and academic achievement also came out to be significant. A canonical correlation analysis found that when operationalized by their grades, creativity was related to academic achievement for both boys and girls. Cropley (1999) narrated that novelty, effectiveness and ethicality ought to be three characteristics of a creative product. 'Novelty' refers to a creative product, course of action, or idea necessarily departs from the familiar. 'Effectiveness' means that it achieves a desired end.'Ethicality' includes humane element in the creative product. Baker et al. (2001) did not find any significant relationship between creativity and intelligence. Dingledine (2003) asserted that high creativity among students catalyze their academic performance. Results further indicated that if teaching, assessment and social environment support creative thinking, the innate tendency among learners to achieve higher in academics can be enhanced. Creativity is fundamental to self-reliance although much research has been done in the field of creativity. Significant studies have endorsed creativity as a catalyst to success. Delis et al. (2007) suggested traditional exams that focus on examining students' memorizing mathematics and reading skills has a negative relationship with creativity thinking. Baer and Kaufman (2008) observed that arts and commerce students did not differ significantly in terms of creativity. Basantia and Panda (2010) found significantly positive correlation between creativity and academic performance. Beghetto (2010) described creativity as the process of sensing problems, identifying gaps in information and formulating relevant hypotheses about these issues followed by evaluating and testing these hypotheses before finally communicating the findings. Gras et al. (2010) studied the creative competence of a specific sample of secondary school students taking into consideration their intellectual abilities, response style and academic performance. The results indicated that there were significant relationship among creativity, intellectual abilities, the academic performance and the creativity. In corroboration with these results, Kusuma (2010) suggested that creativity of students was positively related to their academic performance. Phipps (2010)studied factors affecting academic achievement of IX standard students in mathematics and found that factors like mathematical creativity and attitude towards mathematics influenced the academic achievement in mathematics and recommend the inclusion of curricular and co-curricular programs to improve performance in mathematics. Ward and Kolomyts (2010) found a very low,

negative and insignificant relationship between creativity and academic performance. Afzalkhani et al. (2011) found that there existed a positive relationship between creativity and academic performance. Bikar and Talip (2011) indicated that there was a strong correlation between creativity and academic performance. In terms of maths, Hawthorne et al. (2014) examined the correlation between creativity and IQ and their impact on academic achievement and the findings indicated an insignificant relationship between creativity and performance. Rampersad and Patel (2014) found significant relationship between creativity and academic performance. Roke and Kalis (2015) investigated the differences between the creativity of students with high and low academic achievements. Findings suggested that there was no apparent difference among high achievers and low achievers in their creative thinking abilities. Barbot et al. (2016) revealed that creativity was significantly related to the academic performance in english, mathematics, science and social studies.

Cognition, Academic Achievement and Self Estimation Level

There is a direct relation between self estimation level and achievement of an individual. In an ideal situation, if one has perfect estimation of himself, his achievements are above expected. In contrast, those who underestimate or overestimate themselves, they generally lag behind. Du Plessis et al. (2001) revealed that the self estimation is positively related to the achievement of learners in classroom. Kobal and Musek (2001) illustrated that there was a significant relationship between academic achievement and self estimation level of students. Acharya (2002) investigated the impact of self estimation and academic achievement in primary students. Results indicated that there existed a close relationship between academic self estimation and measures of academic performance. Woodman and Hardy (2003) suggested that self estimation is a vital factor in establishing higher achievements. Spinath et al. (2006) investigated the impact of self estimation on achievement and the results indicated that there was no significant relationship between the self estimation and achievement. Kardkall (2007) conducted a research study to validate the importance of self estimation and performance. Results verified that there self estimation level is a key indicator of creativity, achievement and performance. Alias and Hafir (2009) indicated that there existed a statistically significant and positive relationship between both the factors. Carroll et al. (2009) conducted a research study to find out the relationship between self estimation and achievement. It was found that the performance of students in academics was significantly related to their estimation level through self. Those having perfect self estimation levels excelled in academics whereas those with low as well as over estimation of self lagged behind. Zahra (2010) explored the relationship between self estimation and academic achievement of female bachelor degree students. It was recorded that an insignificant relationship existed between the academic self estimation and academic achievement of students. Zahra et al. (2010) suggested that there existed a positive and significant

relationship between their self estimation and academic achievement. Matovu (2012) found that the estimation of students regarding themselves had a positive impact on the academic achievement. Parmar (2012) traced that self estimation level of urban group of students was significantly higher and more positive than rural group of students but they were found to be insignificantly different in terms of their academic achievement. Das and Pattanaik (2013) revealed that self esteem, perfect estimation and locus of control play a major role in the academic achievement of students. Putwain et al. (2013) examined the relationship between creativity and self estimation and it was found that creativity and self estimation were positively related. Nami et al. (2014) found that there existed a moderate relationship between the two. Acharya et al. (2015) found that a positive and significant correlation exists between positive-self males and their academic achievement. Arshadet al.(2015) assessed the self-esteem and academic performance among university students after arising of several behavioral and educational problems. It was found that there was a significant relationship existed between self-esteem and academic performance. Bedewy and Gabriel (2015) investigated the impact of self-efficacy perceptions and self estimation on performance of students and found that the self estimation had a significant effect on performance. Further, self-efficacy perceptions were found to fully mediate the self-leadership and performance relationship. Deshmukh (2015) revealed that high and low self-concept groups intelligence did not differ significantly on academic achievement. Nawaz et al. (2015) indicated that the self estimation level of students and their school achievement were positively related. Maria and Jebaraj (2017) found that there is significant difference of self esteem in relation to academic achievement among the selected higher secondary school students. Those who have a realistic and perfect self estimation level have consistently higher academic achievement, while those who underestimate or overestimate themselves refrain from attempting tasks confidently and therefore show lower performance.

Primary Natural Intelligence and Academic achievement
Education ought to become student centered so as to ensure the better understanding of the content. Kirby and Das (1977) indicated that mathematics information processing skill, decision making skill and attitude towards mathematics had a significant contribution towards the academic achievement in mathematics. Das and Cummins (1978) suggested that there was significant positive correlation between MI and academic achievement of the respondents. Similar findings were notified and suggested by Clark (1979). Intelligence is not a unitary factor but rather comprises of nine MI each of which is a distinct module in the brain and operates more independently of others. All students are intelligent in varied ways. Teachers ought to recognize, understand, and nurture the dominant intelligence profile of students so that they can explore academic achievement up to their potential. Armstrong (1987) examined about the MI and

found ways of helping students to learn intelligently. He had given various methods and techniques to teach children efficiently based on the concepts of MI and found that these methods improved academic achievement. Gardner and Hatch (1989) mentioned important educational implications of the theory of MI. In this concern, they opposed the traditional education practices which merely have a strong emphasis on the use of verbal and logical intelligences. They emphasized that educators and teachers should understand and teach through broad range of skills and talents. Blythe and Gardner (1990) proposed a systemized process to implement MI theory oriented instructional strategies for the schools. They stressed on the urgency and significance of implementing this new method in classrooms and challenged the issues in the conventional methods generally adopted in classrooms. The results suggested the significance of the implementation of MI theory oriented instructional strategies in schools to ameliorate the academic achievement among students. Mandi (1992) examined MI theory as an effective platform for modern education and found that when the instructions are given through MI methodology, they excelled in their academics. Haggerty (1995) studied the relationship between MI and achievement among engineering students. The results revealed that logical-mathematical intelligence was not necessarily the best predictor for their achievements and that no significant relation was found between MI and achievement among students. McClaskey (1995) highlighted the importance of MI in the classroom and assessing student learning. The results indicated that there were quite higher chances of high grades when the instructions were given based on the learning nature of children. Smagorinsky (1995) revealed that the introduction of MI and related activities must be the major part of teaching and instructions in the classroom. Even though every student has each of these intelligences, but the quantum is different. It was therefore suggested that the teaching must be based on the dominating intelligence to elucidate the learning process. The results indicated towards the need of reframing of the curriculum on the basis of MI enabling students to develop thought and thereby enhancing their learning capacities. Christison (1996) illustrated that the utilization of MI theory strategies widens teacher's awareness regarding the knowledge and skills of students which would enable them to look at each student from the perspective of potential and strengths. The findings also added that the efficient use of MI improves the academic achievement of students. Erb (1996) conducted a research study with an aim to surge students' responsibilities of their own learning and to increase the academic output. Prior to the program, students were lacking intrinsic motivation and had very low interest in science. Besides, they had low self estimation. However, after the program, the students scored good marks and there was higher self estimation. Hoerr (1996) illustrated that every child possesses each of the MI. However the extent to which each one carries these intelligences is different. The study concluded that on implementation of the MI theory in schools, the students excel in their study areas. The study had also revealed that students perform far above average as the

learning process was facilitated among students when the MI concept was followed in the classroom. Jago et al. (1996) reviewed the theory of MI and witnessed highly appreciable response and improvements among students. Coleman et al. (1997) carried an action research project purely based on MI aiming at minimizing the gap between achievement levels between primary and secondary school students. The findings of the study revealed that MI approach minimize the discrepancy between the achievement levels. Daniel (1997) had reviewed the same book to address links between intelligence and creativity to discuss applications of the MI theory to schools and emphasized that educational implications of this theory make the educationists and psychologists infer the relevant teaching process and strategies so as to get the desired output. Dare et al. (1997) implemented and examined the MI program to enhance academic achievement. The results indicated that MI can aid in improvement of academics among students. Greenhawk (1997) narrated the implementation of MI at White Marsh Elementary School in Maryland. The findings suggested that the application of MI raised student performance on standardized tests and produced a universal culture of achievement. Mettetal et al. (1997) studied the influence of MI on curriculum in an elementary school. Parents, teachers, administrators and students were interviewed. Teachers and parents were very positive about the novel concept of MI. It was seen that after the implementation of the MI on curriculum, there was witnessed a significant improvement in their academic achievement. Sternberg (1997) examined if there was a significant impact of MI theory on the achievement of fourth grade social science students. He also investigated about the opinions of students and teachers about the implementation of MI theory in the classroom. The experimental group had social science lessons through MI theory, whereas the control group studied with traditional methods. The findings suggested that the students in the experimental group participated actively in the MI activities, produced creative and original thoughts. Results of the teacher interviews notified that MI theory activities affected students positively in terms of their logical thinking, establishing relations among cases, problem solving abilities. Snyder (1999) corroborated that majority of the students who possess good abilities in linguistic and logical intelligence have a higher probability of being successful at school level but may not excel in job world. There are some cases reported where the students had not been doing well in school but turned out to be very successful at their workplace. Geimer et al. (2000) used MI teaching strategies for increasing students achievement in language and arts. The sample included second, third and fifth grade students. The finding suggested that an increase in academic achievement was witnessed through the use of MI. There was also significant improvement recorded in terms of homework completion, quality of homework and interest in the activities. Goodnough (2000) investigated the correlates of academic achievement among students of high school students. The results suggested that intelligence was significantly related with academic achievement. Hopper and Hurry (2000) explained that teachers are responsible for helping all students to

discover and develop their talents and strengths. He concluded that teachers should apply MI theory in the way that they consider most appropriate for their students and school which will improve their academic performance. Mills (2000) noticed that the use of MI based instructions enabled the students to perform better in academics and securing higher grades in the school. Silver et al. (2000) revealed that MIplay a significant role on academic performance. It was established that it is necessary for students and educational institutions to understand learning style of each student to ensure that each one reaches his maximum potential to excel in scholastic achievement. George et al. (2001) took up a research study to MI activities to ameliorate academic achievement of students and their interest in social studies. Earlier, the students felt social studies boring but later on with the use of MI activities, achievement and interest of students in social studies was found to increase. Goodnough (2001) studied cognition and creativity in relation to academic achievement among students of senior secondary school and notified that cognition was significantly and positively correlated with scholastic achievement. Khandwalla (2001) compared the effectiveness of MI based teaching strategies and traditional teaching in the teaching of English and History and found that the use of MI in classroom was effective. Manner (2001) found that the MI based teaching and learning works best to enhance the achievement among students. Muehlbauer (2001) indicated that there was no significant effect of the art infused MI program on students' achievement in mathematics. Weiner (2001) investigated commonalities among elementary schools that have implemented the theory of MI. The commonalities led to the development of a set of guidelines that contain effective strategies for implementing the theory of MI in an educational setting. Among the most prevalent guidelines found were that the monthly in-service days for teacher collaboration on MI curricular ideas, usage of self-selected student projects, encouragement of students to recognize and identify their difference intelligences and incorporation of the eight Intelligences with understanding and depth. The results indicated that MI based teaching system enhances academic achievement. Furnham et al. (2002) studied the academic achievement among 12th grade students in regard to intelligence and inferred that intelligence was positively related to achievement. Gaines and Lehmann (2002) reported that the use of MI strategies improved the students reading comprehension abilities and it also enhanced the academic performance. Hanley et al. (2002) reported that the achievement and interest both increased when the instructions were given based on MI approach. Herbe et al. (2002) found increased achievement of students in geography, history, music and literature. MI -based techniques were developed and implemented in classroom. Five case studies revealed an incline in students' academic achievement. Nguyen (2002) had taken up a study of the differential impact of MI based curriculum on students' performance. The findings of the study revealed that there was no difference between MI curriculum and traditional teaching system. Nwazuoke et al. (2002) suggested that although MI theory lack

empirical evidence but it still has great utility in education by helping teachers to watch beyond the narrow boundaries of curriculum. Cluck and Hess (2003) found that the appropriate use of MI in class room led to significant improvement in the assignment completion, class participation and learning process. Gurcay (2003) indicated that the integration of MI strategies resulted in better performance in writing tests for students. Klein (2003) argued that the theory of MI is too broad to be useful for planning curriculum, and it gives a static view of student competence which cannot be used to classroom practice. Reidel et al. (2003) depicted that there was a significant difference in the achievement of students taught through traditional methods and MI approach. Barrington (2004) suggested that there came out to be the highest level of change in the area of student performance. Davis (2004) explored the effect of MI learning on the academic achievement of students and the findings suggested that the students test scores surged significantly from an average of 66.25% to 82.25%. Diaz (2004) revealed that students' achievement increased through this method and they performed in the academics much better than those students who were taught using the traditional teaching methods. Habraken(2004) in his study observed that there is a plurality of intelligences and therefore students learn in different ways. According to him, if the primary intelligence is identified and students are taught as per their primary intelligence, it would lead to improvement in the academic performance. Haley (2004) found that students of experimental group who were receiving MI based instruction witnessed the best performance than that of the control group who had received teacher centered instructions. Kornhaber (2004) found that students recorded improvements in test scores and this improvement was associated with MI techniques. Teele (2004) suggested that when each student's primary intelligence matched with his preferred activities, a significant increase in achievement was notified. In this regard, Willingham (2004) challenged the statistical base of these results, and criticized the missing loop of a control group in the research study and further mentioned the inappropriately attributing these improvements to MI. Brown Wright (2004) had studied the effectiveness of team teaching based on MI. The research was carried out for 8th standard students for the subject Marathi. It was found to be effective. Furnham et al. (2005) have endorsed that MI have nine forms of intelligences which are present in everyone. However, at least of these nine, one is prominent which is termed as the dominant of these and when the students are taught using the concept of primary dominant intelligence, the academic achievement surges. Hodge (2005) found that MIhelp educators to provide individualized instructions by considering students' individuality which in turn leads to a higher level of achievement at school. Marjoribanks (2005) found MI as an effective tool for improving the teaching and learning processes. The study also concluded that such improvements in learning had a positive impact in achieving the higher grades in academics. Dillihunt and Tyler (2006) observed the effect of MI on student achievement and it was found to be increased. Ucak et al. (2006) verified that the respondents who were exposed to

MI intervention had shown an uplift in their academic reading achievement. Bumen (2007) explored the differences between MI strategies and traditional teaching methods among students studying in 8th standard. The findings suggested that there was no significant difference noted in knowledge achievement between the students who were taught using MI strategies and those who were taught using conventional methods. Kaya et al. (2007) indicated that there was significant impact of the MI program on achievement of students in math. Olatoye and Oyundoyin (2007) explored academic achievement in context with intelligence of high school students in order to investigate the impact of intelligence on academic achievement of students. Results suggested that there was a significant and positive correlation between academic achievement and intelligence. It was recorded that high intelligence leads to higher academic achievement. Douglas et al. (2008) revealed that there was a significant relationship between academic achievement and self estimation of secondary school students. Besides, there existed a high correlation between intelligence and academic achievement. Ravi and Vedapriya (2008) studied different teaching strategies based on MI. The findings suggested that students ought to be exposed to different intelligences so that teachers can get a chance to uncover their strengths and interests which would eventually lead to a surge in academic achievement. Sellars (2008) found that the academic achievement improves by teaching according to the development of each intelligence area possessed by students. Alghazo et al. (2009) executed a study on the relationship between MI and academic achievement of students. The study notified that there was significant correlation between MI and academic achievement. Isik and Tarım (2009) investigated the impact of creativity on academic achievement and revealed that creativity was an essential factor for the high academic achievement of student. Naderi et al. (2009) traced the effects of the MI teaching strategy on the academic achievement of eighth grade math students. The results found that the performance of students who were exposed to MI techniques had shown considerable rise when compared to their counterparts who were taught through traditional teaching methods. Owolabi and Okebukola (2009) revealed that there was significant difference in performance of the groups taught using study groups and MI methods. The achievement among those taught through MI methods was significantly high. Rogers (2009) investigated the effectiveness of MI on the academic achievement of students to find out whether there was any significant relationship between the two aspects. The results traced that there existed a significant relationship between verbal and logical mathematical intelligence and academic achievement among students. Saeidi (2009) found that the objective of lesson plans based on MI with specific activities allow the learner to employ their ways of processing and communicating new information, thereby enhancing their academic achievement. Christensen et al. (2010) established that however small the effect on learning outcomes, it is accepted that learning styles can help students enhance their own learning and thus encourage self-directed learning. Hernandez

et al. (2010) believed that MI based curriculum helped students to solve their practical and real life problems and also helped them to perform better toward excellence. The results indicated that MI can enable students to become successful learners. MI based teaching increased student confidence, and academic performance. Hulme and Allocock (2010) indicated that the MI techniques are more effective than the traditional teaching strategies at secondary level. Ikiz and Cakar (2010) explained that students usually have preferences for the ways by which they learn or understand a subject and it is advisable for students to tailor these styles to suit their own learning needs. A similar research study was undertaken by Kim et al. (2010) in Science teaching. The MI based teaching was found to be effective over the traditional method. Morgan (2010) took up a research study on the curriculum of a learning home whose curriculum was based on MI theory. The findings suggested that the academic achievement rose following the MI based curriculum and that the students were more involved in curricular as well as extracurricular activities. Olatoye et al. (2010) indicated that the students exposed to MI showed highly significant increase as compared to those using traditional instruction methods. The components of MI precisely logical intelligence, spatial intelligence, naturalistic Intelligences and intrapersonal intelligences have significant correlation with science interest among students. Zabelina and Robinson (2010) investigated the relationship between the MI and the academic performance achievement levels of school students based on Gardner's MI theory. Findings revealed that moderate correlation existed between verbal-linguistic and visual-spatial intelligences and academic performance achievement. MI such as logical-mathematical, visual-spatial, verbal-linguistic, intrapersonal, bodily-kinesthetic, interpersonal and naturalistic had a significant positive relationship with academic performance achievement of students. It became clear that MI like visual-spatial, verbal-linguistic and interpersonal statistically significant and were able to predict academic performance achievement of students. Abidin et al. (2011) found that the relation between creativity and intelligence was positive but low while academic achievement influenced the relation between intelligence and creativity; a positive but low relation was notified between academic achievement and creativity and there was a linear relation between academic achievement and intelligence. Dung and Tuan (2011) recorded that learning through a MI curriculum, students become aware that they have different strengths and each person has a substantial contribution to make different intellectual functioning. Ghazi et al. (2011) explored the relationship between MI and academic achievement of students. It was found that there existed a significant correlation was found between self perceived linguistic, logical, intrapersonal, interpersonal, naturalistic intelligence and the academic achievement of students. John and KP (2011) found that there existed a significant relationship between MI and achievement in science among the subjects. Lin (2011) found that creativity can be nurtured through MI and that the natural talents of students can be enhanced by opting for simpler play-based and child centered activities designed

for nurturing students' MI. McFarlane (2011) revealed that intelligence had a significant relationship with academic achievement. Pfeiffer (2011) found that there was an insignificant relationship between intelligence and academic achievement of the subjects. Shahzada et al. (2011) found that there existed a significant correlation between mother's education and students' verbal and linguistic, logical and musical intelligence while an insignificant correlation existed between mother's education and students' visual/spatial, bodily/kinesthetic, interpersonal, intrapersonal intelligence. Al-Salameh (2012) reported that MI theory is seriously deficient because the grounds, on the basis of which these intelligences are taken, are subjective and arbitrary in nature. Altan (2012) reviewed Gardner's book titled 'Intelligence Reframed: MI for the 21st Century' and investigated that the theory of MI is very insightful for teachers because it allows them to examine their techniques and assessments in preview of individual differences. The lucid understanding of MI enhances curriculum design. Soleimani et al. (2012) found that there was better academic achievement when the students were taught through their respective natural intelligence and learning style. Vartak (2012) recorded positive results when MI strategies were used in teaching. Moreover, students' response to MI based teaching was highly positive. Batulayan (2013) suggested that the most dominant intelligences of the grade six pupils were logical-mathematical, musical, bodily kinesthetic, and intrapersonal and that logical mathematical and intrapersonal intelligences were highly related to the academic achievement. The other five intelligences, namely: verbal-linguistic, visual-spatial, musical, bodily-kinesthetic, and interpersonal did not have significant relationships to academic achievement. Das et al. (2013) observed that there was no relation between dimensions of MI and achievement in chemistry. Fazelian and Azimi (2013) revealed that significant correlation existed between MI and academic achievement of these students. Sulaiman et al. (2013) found that students' achievement scores in the experimental group students, who were taught through MI techniques, were significantly higher than the students in the control group who were taught through traditional methods. Teachers' interview results suggested that they had positive views on MI activities and materials which help in academic achievement. Capili (2014) studied the relation between MI and achievement in math of secondary school students. The findings suggested that all components of MIwere significantly and positively related to achievement in math. In a similar study conducted by Janssen et al. (2014) found that moderate inter-correlation exists between verbal/linguistic and logical-mathematical intelligences and academic achievement. Koura and Al-Hebaishi (2014) found that the strategies involving MI theory are more effective on the achievement in math at secondary level. Neisser (2014) suggested that the students' achievement ameliorated post the instructions. Pelley (2014) investigated the impact of MI based curriculum on the performance of students. The findings of the study depicted that there was no difference between MI curriculum and traditional teaching system. Bart et al. (2015) found that there existed a positive relationship

between MI, study skills and academic achievement. Dhandabani and Sukumaran (2015) endorsed the similar results. Ahvan and Pour (2016) investigated the relationship between the MI and the academic performance achievement levels of high school students based on Gardner's MI theory. It was ascertained that MI like visual-spatial, verbal-linguistic and interpersonal are statistically significant and are able to predict academic performance achievement. Bas (2016) investigated the opinion of students and teachers regarding the implementation of MI theory in classroom. The findings showed that the students in the experimental group participated actively in the MI based activities and produced creative ideas. These activities had a positive impact on students in context to their logical thinking and problem solving capacities. Moreover, there was a positive feedback from students as well as teachers. Villagonzalo (2016) found that there was no significant difference in the achievement level of the control group and the experimental group. It was also recorded that both the modes of instructions i.e. MI based as well as traditional method based, were effective in teaching the concepts. Amitha and Vijayalaxmi (2017) concluded that the MI approach is better than the traditional teaching methods. The study also indicated that MI approach is more beneficial than traditional approach in meeting the academic needs of children. MI approach also brings better academic achievement, appropriate student behaviour and efficient classroom management. Results pointed out towards the significance of teaching based on MI theory. It was revealed that MI teaching approach had improved the academic achievement among subjects. Bas and Beyhab (2017) revealed that these strategies are more effective than traditional ways of teaching. Cecily and Jebaraj (2017) had applied the theory of MI particularly useful for student projects that resulted in enhanced learning. Sener and Cokcaliskan (2018) found that there existed a positive but slightly significant relationship between the students' MI dimensions and their academic achievement.

5. CONCLUSION

Teachig-learning process must include use of all intelligences rather than only linguistic and logical intelligence based methods that have been used so far. In a nutshell, it can be inferred that owing to the varied dominant intelligence among students, when the instructions are imparted through their respective dominant intelligence, the educational system can become highly productive and conducive which would bestow inevitable amelioration in the development of cognitive abilities among students. In this context students will gain education in the most desired and scientific way which will in turn reduce problems like school dropouts and the stress level among students will minimise. Moreover, learning among students would be elucidated. This will develop the interest of students towards studies.

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