TITLE PAGE

EFFECTS OF MIND MAPPING AND SYNECTICS ON THE WHOLE BRAIN LEARNING AND CREATIVE PRODUCTION OF HIGH ABILITY PUPILS

BY

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CERTIFICATION PAGE

I wish to certify that Agbo Okechukwu Emmanuel, a postgraduate student in the Department of Educational Foundations, University of Nigeria Nsukka, bearing registration number (PG/Ph.D/09/50887) has satisfactorily completed the requirements for the award of Doctor of Philosophy in Special Education.

The work embodied in this thesis is original and has not been submitted in part or in full for any diploma or degree of this or any other university.

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DEDICATION

This thesis is dedicated to the future of all underachieving gifted and talented high ability children in Nigerian regular schools, whose potential abilities are today largely under harnessed.

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ABSTRACT

The scientific and technological transformation of any nation depends largely on the maximization of the whole brain potentials of the citizenry; particularly, special education of the high ability persons. Studies have shown that many high ability children under achieve their potentials due to the use of inappropriate learning strategies and method of instruction often based on the left brain processing style. Therefore, this study investigated the effects of training in mind mapping and synectics techniques on whole brain learning and creative production of high ability pupils. The study was guided by nine specific purposes, seven research questions, and eight null hypotheses. The study was a quasi-experimental research, with a non-equivalent pretest–posttest control group design involving two treatment groups, and one control group. One hundred and sixty-nine high ability pupils identified in 34 government approved primary schools in Nsukka urban area using validated Test Score and Teacher Nomination identification instruments composed the population for the Study. Three sample schools with large number of high ability pupils were selected through purposive sampling technique, and assigned to treatment conditions using simple random sampling technique of simple toss of the coin. In all, twenty-one high ability pupils in the three sample schools constituted the sample for the study. The independent variables studied were mind mapping and synectics, while the dependent measures were whole brain learning and creative production. Three primary six regular teachers and three class assistants at the sample schools implemented the validated training programmes on mind mapping, synectics and conventional instructional method. Instruments for data collection were adapted versions of Creative Productivity Test Battery and Whole Brain Self-Report Questionnaire used as pretest, and the reshuffled versions used as posttest. The internal consistency reliability coefficients of the instruments were determined using the Cronbach Procedure. Extraneous variables capable of affecting the experiment and the external validity of the study were controlled. Data collected from the study were analyzed using percentage, mean, and standard deviation to answer the research questions; while the hypotheses were tested using Analysis of Covariance (ANCOVA) statistic. Major findings of the study revealed that effects of training in mind mapping and synectics on high ability pupils' whole brain learning were not significant; that training in mind mapping and synectics had significant effects on creative production. Gender had no significant influence on neither whole brain learning nor on creative production; and that there was no significant interaction effect of treatments (mind mapping and synectics) and gender on high ability pupils' whole brain learning; and that there was no significant interaction effect of treatments and gender on high ability pupils' creative production. The findings of the study imply that the brain's cognitive and creative potentials of high ability pupils were not optimized; since, most of them remained left brain dominant irrespective of training in mind mapping and synectics. It was recommended that regular teachers, special educators, curriculum planners, parents, guardians/counselors and other allied professionals should be trained in the use of mind mapping and synectics strategies in order to foster whole brain development and harness the rare creative potentials of high ability pupils in the Nigerian regular school system. And that a period of training longer than eight weeks will be requisite if whole brain learning state will be attained. The limitations of the study and suggestions for further studies were equally highlighted.

CHAPTER ONE
INTRODUCTION

Background of the Study

The Nigerian school children manifest varying exceptional abilities. Some show below average learning ability, while others with high abilities over achieve so much that they need differentiated and individualized instructional programmes in order to benefit from regular educational programme and then maximize their vast human potentials. The United States Department of Education describes high ability as exceptionally advanced performance or the potential for outstanding performance in intellectual, creative, leadership, artistic, or specific academic fields (Callahan, 2009). In a specific sense, Renzulli and Reis (1997) view high ability as natural talent or superior aptitude for the four major content areas; such as: English Language, Social Studies, Maths, and Science; and other less traditional subject areas.

High ability could be classified under several categories. The Blue Print on Education for the Gifted and Talented Persons (1986) differentiated between high intellectual ability as defined above and talent, which is explained as evidences of positive exceptionality and creativity manifested in the process of doing things. Gardner (1983) in his Theory of Multiple Intelligences identified eight separate kinds of intelligibility; Guilford (1988) in his Structure of the Intellect claims that there are 180 intelligences, while Renzulli in Woolfolk (1995) distinguished between academic high ability and creative/productive high ability. Pupils with academic high ability learn lessons very easily and quickly; and generally score well on tests of intelligence, while those with creative/productive high ability tend to excel in situations that require the application of information to solve problems in new and effective ways.

Furthermore, Renzulli and Reis (1997) explained that high ability is a combination of three basic characteristics: above-average general ability, a high level of creativity, and a high level of task commitment or motivation to achieve in certain areas. On the other hand, the Blue Print on Education for the Gifted and Talented Persons (1986) states that characteristics of high ability children include very high degrees of creativity, memory, motivation, physical dexterity or psychomotor ability, social adeptness, leadership ability, aesthetic sensitivity, pronounced ability in visual and performing art, or demonstrated potential ability in any of these areas. It also described high ability pupils as children whose cognitive prowess result in high level innovation, problem solving, leadership and creativity in the society. The Federal Ministry of Education (FGN, 2004) defined high ability children as category of special needs persons who show evidence of high performance capability in areas such as intellectual, creative, artistic, leadership

or specific academic fields; and require differentiated educational programmes, experiences and services that are not ordinarily provided by regular education to fully develop such capacities. Thus, the researcher defines high ability pupils as learners with potential or demonstrated outstanding academic abilities that could sublimate to creative activities or productions if properly harnessed.

Notwithstanding the indispensability of high ability children in fostering scientific and technological development, there is a growing recognition worldwide that they are poorly served by most schools. A United States national survey reported by Tomlinson-Keasey (1990) revealed that more than one-half of all high ability children in the US do not achieve in school at a level equal to their ability. In the Nigerian context, Kalu (2002) equally noted that high ability children wrestle with opportunities in order to develop their potentials; many underachieve or may creatively develop antisocial maladaptive traits or drop out of schooling. Likewise, Adesokan (1990) and McGrail (2005) agree that the high ability children are the largest group of underachievers in education.

The reasons for this dismal outcome are not far-fetched since most regular classroom teachers are inexperienced in providing the instructional needs of high ability children, others lack training in modification of curriculum, and tend to stick to left brain method of instruction. In the same vein, many research scholars (Kalu, 2002; Onu, 2008; Irele, 2009; & Junaid, 2008) have identified other factors inhibiting the education of high ability children in Nigeria; such as lapses in parenting, lack of individualized education plan, no exposure to education based on curriculum and instructional models for the gifted (such as: the Renzulli Enrichment Triad Model, 1977 and Feldhusenôs Three Stage Enrichment Model, 1980). Others include no exposure to problem solving projects and skill acquisition through consistent working in other settings outside the school premises; lack of in-depth knowledge of the gifted, and inadequate teaching strategies and materials for effective implementation of the instructional programmes for high ability children. Irele (2009) reported that teachers lacked information in the processes of developing and applying developed individualized programme design for high ability children. The teachersô inexperience reflects in their reverting to conventional methods of teaching. In other culture, Sesadeba (2008) also observed that the present day classroom system provides little opportunity for creative work. The materials presented to the pupils are finished products, providing very little scope for high ability pupils to think critically and creatively.

More so, the researcher observed through informal interview of teachers that most primary schools in Nigeria lack appropriate educational programmes, special learning materials and

instructional techniques for the large number of special need learners mainstreamed in primary education. And that the regular teachers made most of the decisions during teaching, while the pupils simply observed and answer the teachersô questions. In the same vein, Eleweke (2002) explained lucidly that the Universal Basic Education (UBE) programme reintroduced by President Olusegun Obasanjo in 1999 is not satisfactorily implemented due to the absence of relevant materials and support services for the special needs persons in the Nigerian regular schools. In line with Eleweke (2002), Aminu in Onu (2007b) reported that the Nigerian school, by its traditional nature seems committed to curriculum that is intellectually based; formal oriented and directed toward examination. Nwazuoke in Onu (2007) adds that the Nigerian type of educational system does not seem to accommodate creative thinkers due to its conformist values and expectancies, which inhibits creative behaviours.

Therefore, it could be concluded that inappropriate instructional programmes, lack of relevant learning materials and learning strategies made schooling boring, and unchallenging to high ability pupils in Nigeria. It also marginalizes their creative potentials due to the focus of educational pedagogy on the left brain cognitive domain. Needless to say that nationôs economic, scientific and technological transformations become imminent only when the creative potentials of any nations human resources are properly identified and nurtured through integrated school curricula. Hence Nigeria is anxious to take off technologically, revamp her economy and improve the overall standards of living of her citizenry, the need to identify and develop creativity of high ability children is imperative.

Creativity has been generally defined as the innovation of original solutions, the creation of novel products, or the process of devising alternative ways of solving problems. Onu (2006) defined creativity as that inner drive to explore and produce; an energy driven force reflecting itself in awareness of problems, deficiencies and gaps until a novel solution is found. Nwazuoke (in Onu, 2007b) defined creativity as a complex behaviour in which an individual utilizes his mental resources in such a unique way that a novel product, which is adaptive to reality, emerges. Moreover, Animasahun (2002) explained that creativity is a conscious cognitive process, guided by interests, which results in the generation of statistically infrequent variable, appropriate ideas useful in turning challenges of life into fruitful, beneficial and profitable outcomes. Inferring from these definitions, creativity could be defined as a series of mental activities in a problem solving process resulting to profitable and novel ideas or products.

Creative Products are the artifacts of thoughts, the tangible result of the creative process. Creative product may be a physical object, an article, patent, a theoretical system, an equation, or

a new technique. It is not uniquely bound up within the life of an individual. Following the Osborn-Parnes model, they are the action or the solution, which is incomplete until implementation has taken place (Osborn-Parnes in Renzulli & Reis, 1997). Likewise, Torrance in Onu (2008) emphasized that the product of ability to generate alternatives to a given problem, produce variation in ideas, develop and generate inconspicuous solutions to problem must provide or be a solution to an existing problem. When appropriate creative techniques are applied, it culminates in creative production and eventual enhancement of creativity in people. Onu (2007b) explained creative production as the capacity to produce products, ideas or compositions of any sort, which are unique, satisfactory, novel and previously unknown to the producer. Rothenberg in Onu (2008) described creative production as the capacity or state which brings forth creation. Rothenberg stressed that creations are products, which must be both new and valuable. As applied in this study, creative production is the process by which an unusual or infrequent profitable product in a universe of products is generated by pupils in a similar grade and ability levels.

Creative production is often characterized by the nature of human thought and action. It involves divergent thinking, critical thinking and other problem solving skills. It manifests in the presence of problems that need to be solved; and result in novel and valuable solutions or alternatives. Traditionally, Leslie (2003) underscored fluency, flexibility, elaboration, originality, risk-taking, imagination, complexities and curiosity that are commonly thought as inherent elements of creative production, as well as attributes associated with creative problem solving abilities. Treffinger (1991) also identified four factors that interact to influence creativity. These are characteristics of a person, operations one knows and can employ or perform, context in which one is productive, and outcomes of oneôs productivity. Other important factors affecting creative production by Rhodes (1961) are: person, process, press, and product. Thus, creative production results from a systematic interaction of these interlocking variables streamlined above by Leslie, Treffinger, and Rhodes.

Since creative production is the result of interactions among components of creativity, the challenge then is how to harness the creative potentials of the right brain and the intellectual capacity of the left brain within regular school set up. The development of appropriate learning programmes and strategies that could harness the diverse brain potentials represents the core aspect of education practice. Adesokan (1990) opined that high ability children should be given special learning methods that would enable them fulfill their educational needs, challenge and optimize their learning characteristics and creative potentials. In the same vein, Mitchell (1984)

recommended that teaching methods for high ability pupils should encourage abstract thinking, creativity, and independent learning. A variety of learning experiences different from what obtains in regular education should be made available to high ability children at all levels of education. Teaching and learning programmes that integrate the right brain creativity and left brain cognitive skills would be apt in harnessing the vast potentials of high ability children.

Researches have shown that teachers who integrate the right and left brain hemisphere by using appropriate curriculum and teaching strategies affect positively learning outcome and optimize learnersô brain potentials. Naiman (2007) and James (2009) explained that actively engaging the capacities of the right and left brain hemispheres provide basis on which to create due to cross-fertilization between neural synapses, which leads to original ideas, and unprecedented discoveries. Hannaford (1995) found that higher functioning, especially achievements of the highest order emerge from the interplay of left and right brains. Other empirical research evidences show that the use of whole brain learning activities improves the behaviour of students and enhance their learning abilities. Campbell (2008) study concerned with determining whether the application of Ned Herrmannôs whole-brainò model would affect violin teaching in any way found a significant change in the playing of the majority of learners (three of the five). The learners, where significant changes were not apparent in their playing, indicated that their understanding of their practicing methods and playing had increased. Also, Dejager (2008) evaluated brain gym as a technique for promoting whole brain learning and found that the learners have improved on physical, emotional and social levels in terms of sensory integration, confidence, attitude, concentration and motivation.

In other words, isolating certain parts of the brain does not promote the harnessing of the whole brain potentials or address diversity of learning preferences (Shaun, 2002; Kim and Michael, 1995). Shaun (2002) found that educational system neglects the needs of right-brain dominant individuals. Shaun equally noted that 50% of this population is dubbed "functionally illiterate" by some educators. The researcher envisages that this percentage may be much more if the out of school population is considered. In the same vein, Ananga (2009) observed that 60% of people in developed world are dominant in left hemispheric style of thinking, which connotes a greater percentage for the developing nations. Summers (2009) observed that most children think using their whole brain, and rank highly creative before entering into the educational systems. Ten percent of these children rank highly creative by age 7; and at adulthood, high creativity remains in two percent of the same population due to high value placed on left brain style of instruction. Thus, there is urgent need for the use of integrative learning strategies in the

Nigerian education system in order to optimize the whole brain potentials of her high ability children.

Whole brain learning has been conceptualized differently by many researchers. Dejager (2008) defined whole brain learning as the process of receiving input through sight, hearing and active participation, processing the sensory input simultaneously with the left and right brain, while filtering perceptions through emotions for appropriate and accurate verbal or active output. Herrmann (2009) defined it as the science of cultivating the ability of individuals to act outside of their own preferred thinking styles**.** These assertions imply that whole brain learning is the result of integrative engagement of the dormant processing skills (i.e., learning styles) of the brain and unpreferred recessive processing skills in interpreting problem, and proffering profitable solutions. Lazear (1999) viewed whole brain learning as the joining of the logical, rational, and analytical thinking with spatial, intuitive, and aesthetic thinking in a deeper and richer learning experience. The left-brain processing is linear, sequential, symbolic, logical, verbal, and reality-based, while the right brain processing is holistic, random, concrete, intuitive, nonverbal, and fantasy-oriented. However, the researcher defines whole brain learning as the use of appropriate learning strategies in engaging simultaneously the right and left brain processing skills during learning activities; thereby harnessing brain cognitive and creative potentials into a more balanced, enriched and productive learning outcome.

Thus, the whole brain learning strategies of interest to this study are mind mapping and synectics. They were selected due to empirical evidences that attest to their efficacy in boosting higher intellectual functioning and creativity. In respect of mind mapping, Nsikak-Abasi (1995) examined its differential effectiveness as a method of note taking on Physics achievement and found that mind map students performed significantly better than the conventional notes students. The superiority of mind map over conventional note was traced to its ability to supply recognition cue during informational storage, which facilitates understanding, recall and greater achievement. In support, Farrand, Hussain, and Hennessy (2002) observed that the mind map technique had a limited but significant impact on memory recall in undergraduate students as compared to preferred study methods. A recent scholarly research by Abi-El-Mona & Adb-El-Khalick (2008) found that mind mapping generally affects eighth graders' science achievement significantly, improves childrenôs conceptual understandings by engaging the right and left brain hemispheric activities, facilitate the processes of visual coordination and integration with other cognitive operations, which are essential to knowledge construction.

Mind mapping according to Buzan & Buzan (1996) is a presentation form of radiant thinking, utilizing lines, colors, characters, numbers, symbols, images, pictures or keywords to associate, integrate and visualize the learned concept, and maximize brain potentials. Buzan (2009) defined mind mapping as a technique that makes use of cognitive skills to improve thinking skills, memory and creativity. It is a graphic technique, which provides a universal key to unlock and harness the potential of the brain cortical skills - word, image, number, logic, rhythm, colour and spatial awareness - in a single representation. As applied in this study, mind map is a graphic organizer that utilizes cortical processing capacities of the right and left brain hemispheres such as: lines, colors, letters, numbers, symbols, images, pictures or keywords in learnersô construction of knowledge.

The Mind Map has four essential characteristics. A lesson topic represented by a central image. Main themes of a lesson topic radiating from central image as branches. And each branch comprising a key image or word printed on an associated line. Topics of lesser importance are also represented as lower level branches attached to higher-level branches, connected to a nodal structure. Mind maps are enriched with color, pictures, codes and dimension to add interest, beauty and individuality. The use of abundant colors, images, keywords or short sentences integrate functions of right brain and left-brain, and facilitate thinking, memorizing, analyzing, triggering inspiration and allowing young children to learn via picture (for clarity see Appendix Q, pages 173 - 199). Mind mapping is deeply rooted in constructivist theory. It facilitates linking of visual and verbal intelligences in the context of Howard Gardner's theory of multiple intelligences and Kline's notion of integrative learning; and help in the assimilation and long-term retention of information. It supports strategies that enable students to process information through building conceptual links, discern patterns among concepts, and develop the capacity for viewing situations from multiple perspectives. Mind maps support student-created representations of knowledge as compared to those imposed by other visual tools like concept maps, vee maps, and flow maps (Gowin in Abi-El-Mona and Adb-El-Khalick, 2008).

The second variable of interest in this study is synectics. Empirical researches (Gendrop, 1996; Shreyashi, 2008; Sesadeba, 2008) and constructivist model of learning lend credence to the effectiveness of synectics in enhancing classroom creativity. Gendrop (1996) investigated the effect of synectics on the creative thinking of nurses and found no significant differences in their critical thinking, fluency, and flexibility; although, significant differences were found in originality. In the same vein, Shreyashi (2008) also studied the impact of synectics model of teaching in life science to develop in students. It was concluded that there is significant

difference between effects of synectics model and traditional method of teaching life science in development of creative thinking ability of students. Likewise, Sesadeba (2008) studied the effectiveness of synectics model of teaching in enhancing creativity, academic achievement and achievement motivation of learners. Making Familiar Strange approach of synectics model of teaching was found to be effective in enhancing the creative thinking ability of the learners.

Synectics, Gordon (1961) approach to creativity, emphasizes the use of metaphor and analogy for connection making or joining of different and apparently irrelevant elements. Clemons (2005) described synectics as a metaphor/analogy-based technique for bringing different elements together in a search for new ideas or solutions. Tami (2007) defined it as a system of problem stating and problem solving based on creative thinking that involves free use of metaphor and analogy in informal interchange within a carefully selected group of individuals of diverse personality and areas of specialization. Synectics is applied in this study to mean a creative process, which involves breaking limited thought pattern or mental block by comparing known or unknown concept with seemingly unrelated or related ones in order to create novel pattern, product or solution.

There are two fundamental principles that provide the operational framework for synectics approach. According to Gordon (1961), they are *Making the Familiar Strange,* and *Making the Strange Familiar*. Creative ideas frequently arise from these principles as metaphor and analogy are used to translate the two principles into practical strategies. Trevor (2009) explained that synectics also involves three analogical techniques: direct analogy, personal analogy, and compressed conflict. Direct analogy is the comparison of two or more different, and seemingly unrelated, objects or ideas using qualifiers. Personal analogy involves ascribing human qualities to things that are no human using similes and metaphors. Symbolic analogy or compressed conflict involves formulating two word description using opposites, or conflicting elements. Synectics excursion begins with description of a topic, direct analogy, personal analogy, compressed conflict, direct analogy based on a compressed conflict and re-examination of an original task.

Besides mind mapping and synectics strategies, another factor that could influence whole brain learning and creative production is gender. Gender refers to judgments about masculinity and feminity, influenced by socio-cultural context, while sex refers to biological differences between male and female (Deaux, 1993). There seems to be sex differences in both brain anatomy and function during some activities. A meta-analysis of sex differences in thousands of brains for more than twenty years (1990 - 2013) of Neuroscience research conducted by a team

of researchers from Cambridge University, led by Amber Ruigrok, John Suckling, and Simon Baron-Cohen revealed that certain areas were larger in men, while some areas were larger in women; and that a lot of these differences originate from the limbic system. However, the researcher does not draw any direct links between brain structure and function; and stress that the difference in volume does not have direct implications for gender bias in conditions studied (Vincent, 2014).

Conversely, Behavioural Sciences (1995) notes that women use both halves of their brain in processing language; whereas men use the left brain only. Men used only Broca's area in the task, whereas women used Broca's area plus an area on the right side of the brain. Toga (2009) equally reported that men and women may use their brain differently when thinking; though, from infancy through the preschool years, most studies find few differences between boys and girls in overall mental and motor development, or in specific abilities. The difference in brain functions could be due to sex roles and social expectancies stemming from such psychosocial stereotype as gender bias. Oko and Nwazuoke in Onu (2007c) noted that in some parts of Nigeria certain activities like nursing, cooking, music are for female folk, while engineering, armed forces, politics are for males. In the same vein, Helson (1990) opined that men have dominated access to many fields of human endeavour and controlled the standard of judging an individualôs accomplishment. When professions are gender biased, it inhibits the course of creativity, and culminates in persevering challenges to developing creativity.

In addition, empirical evidences suggest that influence of gender on creativity test scores in particular is inconclusive. Many studies have looked for gender differences in scores on tests designed to measure and predict creativity; but, few found such differences, and no consistent pattern has also emerged. Ai (1999) studied Spanish studentsô relation between creativity and academic achievement. The results indicate that some differences exist between males and females on aspects of creativity related to academic achievement. Detterman (2009) reported that although there are no gender differences in overall IQ test performance, there do seem to be differences in some abilities. For instance, men on average seem to perform better in tests of spatial ability, albeit the reason for this difference is still unknown. Also, Onu, Eze, and Onuigbo (2008) examined the effect of training on ideational fluency in increasing creativity of students in Nigeria and found that gender has no significant influence on ideational fluency of schooling adolescents. Considering these inconclusive and unpredictable research findings among others reviewed in literature, the researcher deems it pertinent to investigate further gender influence in relation to whole brain learning and creative production.

In a nutshell, empirical researches reviewed and informal interview of regular teachers revealed a lack of differentiated programmes, and use of inappropriate instructional and learning methods in educating high ability children in Nigerian regular schools despite many exceptional children mainstreamed. Although literature abound in successful use of mind mapping and synectics strategies in enhancing creativity and whole brain learning in developed countries; yet, the researcher could not find such studies conducted in Nigeria. Hence they were conducted in a foreign culture and educational context; the findings lack external validity on learners in Nigeria. This assertion is in line with Ohuche and Otaala in Eze (1998) and Yamato in Hunt and Begler (2005) who explained that no development takes place independent of the cultural context in which it occurs, and that strategy use may vary based on ethnic, educational background and learning styles. Thus, the need to investigate the effects of mind mapping and synectics strategies on whole brain learning and creative production in the Nigerian culture and educational context is necessitated.

Statement of the Problem

High ability pupils are poorly served by most schools. As a result, many of them wrestle with opportunities in order to develop their potentials; some others underachieve creatively, develop antisocial maladaptive traits and may eventually drop out of schooling. In the Nigerian context, it was reported in literature reviewed that high ability children are the largest group of underachievers in education due to insufficient academic challenges, and inadequate materials for effective implementation of the instructional programmes. They lack exposure to problem solving projects, skill acquisition through working in other settings outside the school premises, and use of inappropriate learning strategies. Also, teachers lack in-depth knowledge of high ability pupils, and their exposure to education based on curriculum and instructional models for the gifted.

These problems compound as regular classroom teachers do not modify appropriately the existing curriculum, use relevant teaching and learning strategies that integrate the whole brain, and engage special support services. As a result, the inclusion programmes advocated by Universal Basic Education in Nigeria do not satisfactorily serve the high ability pupils. Moreover, the Nigerian regular school by its traditional nature seems to be committed to curriculum that is intellectually based; formal oriented and directed toward examination. It offers little opportunity for creative work. The materials presented to the pupils are finished products,

providing very little scope for high ability children to think critically, creatively, and develop their whole potentials.

The foregoing problems necessitate the development of appropriate learning strategies that will harness the whole brain potentials of high ability children, encourage abstract thinking, creativity, and independent learning at all levels of education. Since learning styles match thinking styles, isolating the right or left brain hemispheres during instruction will not promote creativity nor address the diversity of learning preferences. Therefore, learning programmes based on the right and left brain hemispheres would be apt for high ability pupils, diverse learners and regular teachers in the Nigerian regular school set up.

Given that the empirical literature reviewed show synectics and mind mapping as efficacious learning strategies in boosting whole brain activities, creative approach to problem solving, and learnersô knowledge construction; therefore, the researcher sought to examine if strategy training on mind mapping and synectics could enhance whole brain learning and creative production among high ability pupils in Nigeria. With the cultural advantage of males over females, the differential treatment that limit females to certain careers and rights, the on - going agitation of females for leadership roles, and many contradictory and inconclusive research findings on gender and creativity, what would be the influence of gender on whole brain learning and creative production of high ability pupils?

Purpose of the Study

The general purpose of this study is to investigate the effects of mind mapping strategy and synectics technique on whole brain learning and creative production of high ability pupils. Specifically, the study intends to determine the:

1. Effect of mind mapping on whole brain learning of high ability pupils.
2. Effect of synectics technique on whole brain learning of high ability pupils.
3 Effect of mind mapping strategy on creative production of high ability pupils.
4 Effect of synectics technique on creative production of high ability pupils
5 Influence of gender on creative production of high ability pupils.
6 Influence of gender on whole brain learning of high ability pupils.
7 Interaction effect of mind mapping, synectics and gender on creative production of high ability pupils.
8 Interaction effect of mind mapping, synectics and gender on whole brain learning of high ability pupils.
9 Effects of mind mapping and synectics on brain dominance

Significance of the Study

Generally, this study would be relevant to high ability children, diverse learners, special educators, allied professionals, regular teachers, curriculum planners, parents, book publishers and writers, government agencies, teacher training institutions, policy makers, business managers, and leaders of developing nations.

Basically, the results of this study would be empowering high ability children mainstreamed in the Nigerian regular schools to increase creative learning outcomes, improve studentsô behaviour and learning ability. Thus, the high ability children would be identified early and equipped with effective learning strategies that would harness their whole brain potentials, boost academic achievement and classroom creativity; at large, make them contributive toward national scientific and technological transformation.

The findings of this study would also provide effective approaches to breaking out of limited thinking and developing consistent fresh thinking patterns for diverse learners in the Nigerian UBE schools as they learn to construct their own knowledge through independent thinking, creative production and optimize brain potentials.

The findings of this study would be useful to special educators (particularly to gifted educators), and regular teachers in the Nigerian Universal Basic Education schools to increase classroomsô right-brain learning activities by incorporating more patterning, metaphors, analogies, role-playing, visuals, and movement into their reading, calculation, and analytical activities. It will result in the development of a more accurate whole-brained evaluation of student learning, based on new forms of assessment that honor right-brained talents and skills.

Differential educational programmes are required to harness the rare potentials of high ability children, in order to circumvent out of school syndrome due to insufficient, unchallenging learning tasks provided in regular school programmes. The finding of this study provides such extra stimulating materials and experiential learning that galvanize active participation of the whole brain in the education of high ability children.

The findings of this study will be of much importance to curriculum planners, school administrators and examination bodies such as West African Examination Council and National Examination council in informing a paradigm shift from pedagogical practices, which are often based on the left brain scholastic activities to a more enriching, encompassing whole brain learning approach. It would necessitate the revision of school curricula, content, design, delivery of learning goals, and intellectually based measurement that marginalizes diverse learning and thinking styles of heterogeneous group of learners.

The findings of this study will equip parents, guidance/counselors, and other allied professionals with effective techniques for facilitating an easy identification, placement, and training of children with learning preferences both at home and in school. More so, it will provide resource for building the capacities of classroom teachers, educators in teachers training institutions, relevant government agencies, and in-service trainers through empowerment seminars, conferences, and workshops designed to improve teaching and learning practices.

The findiings of this study will equally contribute immensely to ongoing research in the influence of gender on creativity and content achievement. It will provide very effective tools for explaining and changing societal attitudes, stereotypes and bias toward femininity, and proffer encompassing gender free solutions to academic problems and to quest for creative transformation in Nigerian society. It will also be informative for authors, publishers, and stakeholders in production of childrenôs educational textbooks, instructional materials, and activity books as they infuse creativity, and other graphic tools (such as mind mapping) in designs and presentation of ideas and activities. This study will significantly contribute to the body of academic research on the human brain, creativity, and academic achievement.

Theoretically, training programmes in mind mapping and synectics provide learners with strategies for improved learning and creative activities in regular school, and are consistent with Enrichment Triad Model for educating high ability children. According to Renzulli and Reis (1997), this model was designed to encourage the creative productivity of young people by exposing them to various topics, areas of interest, and fields of study; and to further train them to apply advanced content, process-training skills, and methodology training to self-selected areas of interest. Also, the enrichment triad is based on the precept that all learners are unique, so all learning experiences must take into account their abilities, interest and learning styles. Since, Type II enrichment is consistent with training in areas such as creative thinking and problem solving, learning-how-to-learn skills such as classifying and analyzing data, advanced reference, and communication skills; the findings of this study would enable high ability children of diverse learning preferences to acquire strategies for integrating the left-brain processing skills (linear, sequential, symbolic, logical, verbal, and reality-based) with the right brain processing skills (holistic, random, concrete, intuitive, nonverbal, and fantasy-oriented) culminating in a more deeper learning and creative products.

Scope of the Study

The study was carried out in Nsukka town of Nsukka education zone. Nsukka town is the headquaters of Nsukka Local Government Area (one of the 17 LGAs in Enugu State), situated at

Enugu North Senatorial Zone of South-East Geo-political Zone of Nigeria. The study covered high ability pupils in primary six classes of three government-approved primary schools in Nsukka urban area. The choice of primary school for the study was informed by its foundational nature to subsequent educational levels. The choice of primary six pupils is justified by the assumption that they have acquired cognitive skills, a sound basis for scientific, reflective and creative thinking, which enables learner construction of knowledge. Primary six is the last class in primary education, the onset of formal operational thought characterized by thinking that involves deductive logic and abstract reasoning during the adolescent period of development. Thus, these pupils need opportunities to develop their creative capacity, which will in turn enable them to solve emerging personal/societal problems. Moreover, the identification of high ability children at this grade was eased by long period of teacher observation, and continuous assessment records.

The independent variables in this study are mind mapping, synectics and gender; while the dependent measures are whole brain learning and creative production. Thus, the researcher focused on the effect of mind mapping and synectics on whole brain learning and creative production of high ability pupils. This research work is restricted to application of mind mapping and synectics, and was evaluated using the Creative Productivity Test Battery (visual synthesis, product improvement task, unusual uses task, imaginative stories and poem composition), and Whole Brain Self-Report Questionnaire. On the other hand, the training programmes were infused into English Composition content area of primary six English Studies curriculum. This is because English Composition requires creative and essay writings, and are adaptable to the independent variables under study.

Research Questions

The following research questions were formulated to guide this study:

1. What is the difference in the whole brain learning mean scores of high ability pupils exposed to training in mind mapping and those not exposed?
2. What is the difference in the whole brain learning mean scores of high ability pupils exposed to training in synectics and those not exposed?
3. What is the difference in the creative production mean scores of high ability pupils exposed to training in mind mapping and those not exposed?
4. What is the difference in the creative production mean scores of high ability pupils exposed to training in synectics and those not exposed?

5. What is the influence of gender on the whole brain learning mean scores of high ability pupils?
6. What is the influence of gender on the creative production mean scores of high ability pupils?
7. What is the difference in the brain dominance percentage scores of high ability pupils?

Hypotheses

The following hypotheses formulated to guide the study were tested at 0.05 probability level.

Ho1 Training in mind mapping strategy has no significant effect on high ability pupilsô whole brain learning as measured by their mean scores on Whole Brain Self-Report Questionnaire.

Ho2 Training in synectics technique has no significant effect on high ability pupilsô whole brain learning as measured by their mean scores on Whole Brain Self-Report Questionnaire.

Ho3 Training in mind mapping strategy has no significant effect on high ability pupilsô creative production as measured by their mean scores on Creative Productivity Test Battery (CPTB).

Ho4 Training in synectics technique has no significant effect on high ability pupilsô creative production as measured by their mean scores on Creative Productivity Test Battery (CPTB).

Ho5 Gender has no significant influence on whole brain learning of high ability pupils as measured by their mean scores on Whole Brain Self-Report Questionnaire.

Ho6 Gender has no significant influence on creative production of high ability pupils as measured by their mean scores on Creative Productivity Test Battery.

Ho7 There is no significant interaction effect of mind mapping, synectics and gender on whole brain learning of high ability pupils as measured by their mean scores on Whole Brain Self-Report Questionnaire.

Ho8 There is no significant interaction effect of mind mapping, synectics and gender on creative production of high ability pupils as measured by their mean scores on Creative Productivity Test Battery.

CHAPTER TWO

REVIEW OF LITERATURE

This chapter reviewed literature pertinent to the study under the following headings and subheadings:

Conceptual Framework

- Concept of Ability
- High ability children
- Concept of Creativity
- Creative Production
- Whole Brain Learning
- Whole Brain Creativity
- Mind-Mapping
- Concept of Synectics
- Schematic Diagram of Conceptual Framework

Theoretical Framework

- Theory of Brain Hemisphericity
- Ned Herrmann's Whole Brain Model
- Theory of Multiple Intelligences
- Enrichment Triad Model
- Synectics Theory
- Cognitive Constructivism
- Strategy Integration Model

Related Empirical Studies

- Studies on Whole Brain Learning
- Creative Production
- Studies on Mind Mapping
- Studies on Synectics
- Studies on High Ability
- Gender Differences in Creativity

Summary of Literature Review

CONCEPTUAL FRAMEWORK

Concept of Ability

Ability refers to developed skill competence or power to do something, especially existing capacity to perform some function, whether physical, mental, or a combination of the two, without further education or training; contrasted with capacity, which is latent ability (Colman, 2003). This assertion was explained better in The Encyclopedia Americana International Edition (1996), which defined ability as a general term used to refer to any characteristic of a person that makes it possible for him to carry out some sort of activity successfully. The term covers broad traits such as intelligence as well as narrow traits such as manual dexterity. It refers to learned skills such as aptitudes presumed to exist prior to learning.

Abilities are determined in complex ways. Heredity always plays a part but practice and training usually seem to be involved as well. The structure and condition of various parts of the body help to determine the level of functioning of some abilities, but mental qualities are even more important. For example, an individualôs brain is more influential than his eye muscles in determining his level of reading ability. Up to some usually unattained physiological limit, any ability can be increased through training.

Ability is the quality of being able to perform; permit or facilitate achievement or accomplishment. It is possession of the qualities (especially mental qualities) required to do something or get something done. Microsoft Encarta (2009) defines ability as a natural tendency to do something successfully or well; a high degree of intelligence or competence, or a particular gift for doing something well. According to Hyperdictionary (2009), when ability is applied to the higher intellectual powers, it makes reference to the active exercise of faculties. It implies not only native vigor of mind, but that ease and promptitude of execution which arise from mental training. In its higher exercises, it supposes great quickness of apprehension and breadth of intellect, with an uncommon aptitude for acquiring and retaining knowledge. Hence, it carries with it the idea of resources and undeveloped power. The word abilities, in plural, embrace both qualities, and denote high mental endowments.

Ability according to Renzulli and Reis (1997) refer to a pupilôs natural talent or aptitude for particular content areas. Traditionally, educators think of the four major content areas ï Language Art/Literature, Social Studies/History, Mathematics, and Sciences. Pupilsô abilities can also be displayed in less traditional areas such as Vocational Art, Visual and Performing Arts, and Computer Science. Within this study, the researcher views ability as predisposed or acquired cognitive, psychomotor and affective skills that prepares an individual for proficient performance

in academics and other vocational areas. Maximum performance indicators for abilities are tests (standardized and teacher made), course grades, teacher ratings. Others are: product evaluation (such as written, oral, visual, musical, constructed), level of participation in learning activities, and degree of interaction with others.

Furthermore, Renzulli and Reis explains above average ability in two ways; such as, general ability and specific ability. General ability consists of the capacity to process information, integrate experiences that result in appropriate and adaptive responses in new situations, and engage in abstract thinking. Examples of general ability are verbal and numerical reasoning, spatial relations, memory, and word fluency. These abilities are usually measured by tests of general aptitude or intelligence and are broadly applicable to a variety of traditional learning situations.

Specific ability consists of the capacity to acquire knowledge and skill or the ability to perform in one or more activities of a specialized kind and within a restricted range. These abilities are defined in a manner that represents the way in which human beings express themselves in real life (i.e., non test) situations. The individual could have specific abilities in Chemistry, Ballet, Mathematics, musical composition, sculpture, and photography. Each specific ability can be further subdivided into even more specific areas (e.g., portrait photography, astrophotography, photo journalism). Specific abilities in certain areas such as Mathematics and Chemistry have a strong relationship with general ability; therefore, some indication of potential in these areas can be determined from tests of general aptitude and intelligence. They can also be measured by achievement tests and tests of specific aptitude. Many specific abilities, however, cannot be easily measured by tests and must be evaluated through one or more performance-based assessment techniques.

The term above average ability was used in this study to describe both general and specific abilities. It is interpreted to mean the upper range of potential within any given area. Although it is difficult to assign numerical values to many specific areas of ability, persons with well above average ability are individuals who are capable of performance or the potential for performance that is representative of the top 10 to 15 percent of any given area of human endeavour.

High Ability Children

Children in school setting manifest varying abilities. Some show average learning abilities, which require more attention to enable them benefit from educational programmes. However, there are those who achieve so much that they need extra work to enable them benefit

maximally from schooling. This latter category could be described as high ability children (Onu, 2007a). Right from ancient times to the present, people have always recognized that the progress and advancement of society depended on the genius, creativity and contributions of few of her high ability children (Obani cited in Okeke, 2001). Okeke (2001) described a high ability child as a gifted/talented person who demonstrates above average intelligence; possesses creativity, leadership qualities or ability in the performing or visual arts. Moreover, they may show other evidence of talents and abilities highly prized in any given culture, and require special education provision not provided by the regular school to maximally develop their potentials.

The National Policy on Education (FME, 1982; FRN, 2004), which commented on educating exceptional children, refer to those who achieve better than others as high ability children. The ability of this special class of children is not restricted to intellectual ability, but encompasses all aspects of their personality, to include manifestations in creativity and talents. High ability pupils are children who can be classified as talented or gifted; they are intellectually precocious, creative or talented. They find themselves insufficiently challenged by the regular programmes of general schooling. As a result, may take to apathy and stubbornness. Morelock and Feidman (1992) defined high ability pupils as children who show signs of precocity or potentials for being acclaimed performers. High ability children include children and adults who possess very high intelligent quotient and are naturally endowed with special traits (in art, creativity, music, leadership, intellectual precocity).

High ability children can be characterized by different abilities in different ages at the same time. This therefore makes it necessary for those working with them not to use the usual chronological age categories and timetable; as this may not be suitable to them. Specifically, these children have advanced cognition in early childhood, smile early, recognize care-givers early, react with intensity to noise, frustrations, stimulation; and are difficult to put to sleep. High ability children have the ability traits involved in high intellectual functioning, divergent or convergent thinking, elaboration, transformation and evaluation (Hagen & Clark cited in Onu, 2001).

In a related study, Kalu (1996) observed that high ability children differ from already achieving ones, who are studious, intelligent, have keen interest in high grades, appreciate education and are precise in carrying out instruction and executing assignments. The high ability child could be highly skilled in the performance of a task either in academic or non-academic orientation. This establishes the fact that a child may achieve high grades and still be far from

being rated as possessing high cognitive ability or talented. High ability means a rare combination of major intellectual or cognitive characteristics. It also includes superior ability in areas of major academic endeavours, with creativity as a major feature (Onu, 2001). High ability children tend to prefer the company of older playmates and may be bored if kept with children of their own age. Thus, skipping grades may not be the best solution for some students, but contribute to the gifted social and emotional adjustment (Jones & Southern, 1991; Richardson & Benbow, 1990). An alternative to skipping grades is to accelerate students in one or two particular subjects but kept with peers for most classes (Reynolds & Birch, 1988). For students who are extremely advanced intellectually, the only practical solution may be to accelerate their education (Gross, 1992; Abang, 2005).

Giftedness as a term has been defined variously to mean many things to different people. Factors responsible for this include the individuals learning - politically, economically, and technologically (Onu, 1999). It is not strange therefore to say that giftedness is culturally determined, as what may be seen as gifted in one culture may not be in another. However, giftedness as a trait includes such positive traits as exceptional brilliance, creativity, and precociousness. This is why nations with visions pay close attention to high ability children (Anih, 2001). In other words, high ability children manifest essential traits of giftedness.

On the other hand, there remains no agreement on what should constitute giftedness because individuals can have many different gifts. Gardner identified eight separate kinds of intelligences, and Guilford claims there are 180 intelligences. J. S Renzulli in Woolfolk (1995) suggests that there is need to distinguish between academic giftedness and creative/productive giftedness. The academically gifted (or high ability children) learn lessons very easily and quickly; and generally score well on tests of intelligence. However, Renzulli adjudged that these indicators do not necessarily predict success in later life. The creatively gifted tend to excel in situations that require the application of information to solve problems in new and effective ways. These characteristics are more likely to be associated with success in adulthood. Using these ideas, Renzulli and Reis (1991) have defined giftedness as a combination of three basic characteristics: above-average general ability, a high level of creativity, and a high level of task commitment or motivation to achieve in certain areas. Renzulli and Reis in Woolfolk (1995) assert that high ability children are not just students who simply learn quickly with little effort. The work of gifted high ability children is original, extremely advanced for their age, and potentially of lasting importance.

The Blue Prints on Education for the Gifted and Talented Persons (1986) gave a clearer description of high ability children as children whose cognitive prowess when developed will result in high-level innovation, problem solving, leadership and creativity in the society. On the other hand, Abang (2005) opined that the talented ones are such persons who in the process of doing things show evidences of positive exceptionality and creativity. Most countries of the world deliberately and systematically identify and nurture such children with high intellectual ability that shows evidences of exceptional performance. They may demonstrate very high degree of creativity, memory, motivation, physical dexterity or psychomotor ability, social adeptness, leadership ability, aesthetic sensitivity, pronounced ability in visual and performing art; or who demonstrate potential ability in any of those areas, if they are not achieving already (Onu, 2007a; Collangelo and Davis, 1997; Maxwell in Onu, 2007a).

Educators believe that gifted or high ability children require Special Education services because their learning needs differ significantly from those of the general population. They learn more rapidly and are able to understand more abstract and complex ideas. They are also able to transform existing knowledge into new and useful forms, and to create new knowledge recognized for its originality, complexity, and elegance. Special education services and facilities for gifted children may enhance these abilities (Callahan, 2009; Onu, 2001). A carefully planned scheme of activities and programme is specifically designed to enrich and supplement the school activities.

There are at least two issues in making educational plans for high ability children. One is how students should be grouped and paced; the other is what teaching methods are most effective. Woolfolk (1995) reported that educators disagree about grouping and pacing. Some believe that high ability children should be accelerated ï moved quickly through the grades or through particular subjects. Other educators prefer enrichment ï giving the students additional, more sophisticated, and more thought-provoking work, but keeping them with their age mates in school. Actually, both may be appropriate. Many educators object to acceleration, but most studies indicate that high ability children who begin preprimary, elementary, junior high, high school, college, or even graduate school early do as well and usually better than non-gifted students who are progressing at the normal pace (Torrance, 1986; Onu, 2008; Abang, 2005).

While there are a good number of children with high ability in Nigerian regular schools, considerable evidence suggests that regular classroom teachers do not receive the training and support to modify appropriately the curriculum to meet their needs. Also, many economically disadvantaged children are underrepresented in educational programmes for gifted students. At

the same time, limited funding for education in general restricts efforts to nurture the talents of all gifted children (Callahan, 2009). Onu (2007a) sums by asserting that high ability children, talented or creative children must undoubtedly need different kinds of educational programme to meet their need, wishes and aspiration. They require a different content or process in their educational endeavours, so that they make optimal attainment for overall development of selves and of society. High ability children will need strategies for instructional processes that will sufficiently challenge them toward unlimited maximization of their potentials.

Thus, government has directed (evident in education policies) that special arrangements to be put in place to harness the rare potentials of this class of exceptionality, in order to circumvent the possibility of out of school syndrome (Onu, 2007b; Kalu, 2002). The out of school population, which has been on the rise in Nigeria, would have been reduced if the high ability children were provided with sufficient challenging task. This in turn will substantially reduce the apathy or stubbornness originally caused by insufficient learning challenges in normal school programme (Onu, 2007b; FME, 1982).

Teaching and learning methods represent the core aspect of education practice. In the words of Akinlaye (1996), the value of instructional strategies in facilitating and motivating learning has never been in dispute. In teaching high ability children, appropriate instructional method that will challenge their learning characteristics is prerequisite for effective learning. Adesokan (1990) is of the opinion that high ability children should be given special instructional method so that they remain gifted and fulfill their educational needs and propensities. Irele (2009) asserts that it is necessary to provide the high ability children with experiences appropriate to their level of mental development and learning style. Consequently, a variety of learning experiences different from what obtains in regular school should be made available to the gifted at all level of education.

In addition, teaching methods for high ability children should encourage abstract thinking (formal operational thought), creativity, and independence in learning, not just the learning of greater quantities of facts. In working with gifted or high ability children, a teacher must be imaginative, flexible and unthreatened by the capacities of these students. Strategies may be as simple as letting the child do math with the grades. Increasingly, programmes that are more flexible are being devised for gifted students; such as: summer institutes, course at nearby colleges, classes with local artists, musicians, or dancers; independent research projects; selected classes in high school for younger students; honour classes; and special ï interest clubs

(Mitchell, 1984). These are options for offering gifted or high ability children appropriate learning experiences.

On the contrary, limitation and restriction in educational development of high ability children often times make them bored, frustrated and angry. McGrail (2005) observed that educators are not quite experienced in serving the instructional needs of children with disabilities, much more the instructional needs of high ability children. In another study, Adesokan (1990) stressed that the high ability children are the largest group of underachievers in education because of the inappropriate methods of instruction used. He opined optimistically that whenever their needs are considered, and proper educational programmes designed, then they would make significant gains and achievement academically.

Unfortunately, these special educational practices are still far-fetched in Nigeriaôs education for high ability children. Irele (2009) evaluated the administrative and instructional procedures of Federal Government Academy Suleja, and revealed that studentsô academic performance in English and Mathematics was not impressive. The teaching strategies and materials in the school were inadequate for effective implementation of the school administrative and instructional programmes. On that note, scholars such as Akinlaye & Bruner in Irele (2009) stressed that it is professionally required that teachers of high ability children should employ effective and conducive approach in stimulating their learning and creative faculties in the classroom.

As discussed in literature, it could be summed that high ability refers to talent or superior performance in content areas (major or minor), while high ability pupils are academically gifted or talented children who are insufficiently challenged by the programme of the normal school; and require differentiated educational programme in order to optimize their whole brain potentials. This study is directed at identifying such pupils with potential or outstanding abilities in academics who could be trained to maximize their creative/productive giftedness.

Concept of Creativity

Creativity is the third cluster of traits that characterize gifted or high ability persons. Creativity could be defined as the process of devising alternative ways of solving problems. Also, creativity can be likened to a driving force that drives human behaviour to shape their lives. It is necessary that individuals be given opportunities for the actualization of their creative potentials or talents for meaningful existence, growth and development in all facets of human endeavours. Thus, as new and useful things are developed, human lives and existence improved,

and contributions made to the world of knowledge (Onu, 2006). Effiong (2006) conceived creativity as a universal human attribute, an inherent quality within each of living beings that only needs to be recognized or discovered, encouraged, and developed. It is a practical expression in every day human activities ï from the seemingly mundane to the technically most intricate.

Creativity refers to the capacity to produce work that is both original, and adapted to the constraints of a situation (Sternberg & Lubart, 1995). In agreement, Nicholls in Renzulli and Reis (1997) conceptualized creativity as the ability to produce something original, of high quality or to device effective new ways of solving a problem. Creativity necessarily involves the ability to recognize and develop a novel approach; the ability to consider a problem from multiple angles and to change points of view repeatedly; and the ability to develop simple ideas in different ways. Creative thought can be applied to practical problems, intellectual tasks, or artistic work (Kosslyn & Rosenberg, 2001). Creativity is a natural tendency in every individual, which expresses it to varying degrees. They further noted that creativity depends on several different components. This multivariate approach proposes that intellectual abilities, knowledge, cognitive style, personality traits, motivation and a favorable environment are important factors for creativity. The presence of each of these components and their interaction allows the emergence of creativity.

Creativity is an innate propensity of man, which simply need to be developed. In that light, Nwazuoke defined creativity as a complex behaviour in which an individual utilizes his mental resources in such a unique way that a novel product, which is adaptive to reality emerges (Nwazuoke in Onu, 2007b). This novel product could be ideas or materials, which could meet the need of the moment. Onu (2001) defined creativity as that inner drive to explore and produce, an energy driven force reflecting itself in awareness of the presence of problems, deficiencies and gaps, and not stopping till a novel solution is found. This definition describes creativity as highly motivated ability to develop ideas that are unique, useful and worthy of further elaborations. In the same vein, Animasahun (2002) viewed creativity as a conscious cognitive process, guided by interests, which results in the generation of statistically infrequent variable and appropriate ideas useful in turning challenges of life into fruitful beneficial and profitable outcomes.

From cognitive perspective, De-Bono (2001) viewed creativity as the ability to think, perceive, memorize, ideate, make remote associations and symbolize. Onu (2007b) explained that creativity is a deliberate process undertaken by an individual to produce new ideas, concepts,

designs as well as processing information in such away that the new result is original, meaningful; therefore, relevant to problem solving. This definition points to the fact that creativity is not a one shot action, but rather a chain of actions and reactions. Although other definitions of creativity views it as a power trait of the mind and as a tool (Harris, 1998; Akinboye, 2001); yet creativity as a cognitive activity is currently gaining ground, making creativity training possible and acceptable. Since creativity is developed through the process of solving problems, then children must learn to generate ideas, defer judgment, combine ideas generated, and evaluate the generated ideas. Furthermore, bottlenecks in bureaucracy must be eliminated if children will engage their unique abilities and see themselves as participating and contributing members in their community.

Creativity is a basic tool for progress in situations, undertakings, in families, communities or societies such as Nigeria. Ozioko (2006) highlighting the importance of creativity in society stated that the conditions of modern day living characterized by complexities of hardships and interdependence call for increased level of creativity. Ozioko opined that creativity is the only answer or solution to a societyôs problem like Nigeriaôs; bewildered with widespread and growing poverty, unemployment, hunger, crime and related crises. In the same note, Effiong (2006) adds that in order to resolve the mounting challenges facing Africa, achieve the laudable and vitally important economic and social revitalization objectives of the new partnership for Africaôs development, launch and sustain an African renaissance as envisaged by African heads of state and government and translate the dream of an African century into reality, the creativity and ingenuity of the African people will be critical and will need to be accorded the highest priority at all levels and in all sectors of the African society.

The benefits that accrue from creativity are enormous. They include increase in individualôs ability to analyze problems, carry out research, innovate, develop self and society, increase information management, architecture, communication, increase in invention, discoveries, and production of unusual ideations (De-Bono, 2001); Csikszentmihalji, 2001; Adeyanju, 2002; Onu, 2008). Knowledge is exploding and its rate of expansion is growing as well; thus, creativity helps people to deal effectively with rapid changes in a complex world. It is impossible for any person to succeed by relying exclusively on learning and remembering information. To be successful in our world, students must learn processes that will help them deal with situations they have never experienced, and learn how to find, generate, and use information creatively. Todayôs problems and challenges cannot be solved merely by applying

existing knowledge. Creativity is needed to help formulate and solve these problems and carry out solutions to improve the quality of life for oneself and others.

The National Curriculum Handbook cited in National Curriculum in Action (2008) outlined the importance of creativity. National Curriculum in Action (http://f:/nationalcurriculuminaction-creativity-why/iscreativitysoimportant) states that creativity improves pupilsô self-esteem, motivation and achievement. Pupils who are encouraged to think creatively and independently become more interested in discovering things for themselves, more open to new ideas, keen to work with others to explore ideas, willing to work beyond lesson time when pursuing an idea or vision. Consequently, their pace of learning, levels of achievement and self-esteem increase.

Creativity enriches and prepares pupils for life. By providing rich and varied contexts for pupils to acquire, develop and apply a broad range of knowledge, understanding and skills, the curriculum should enable pupils to think creatively and critically, to solve problems and to make a difference for the better. It should give them the opportunity to become creative, innovative, enterprising and capable of leadership, to equip them for their future lives as workers and citizens. Creative thinking and behaviour can be promoted in all subjects and in religious education. By promoting creativity, teachers can give all pupils the opportunity to discover and pursue their particular interest and talents, since all can be creative to some degrees. Creative pupils lead richer lives, and in the end make valuable contributions to society. Pupils who are creative will be prepared for a rapidly changing world, where they may have to adapt to several careers in a lifetime. (http://f:/nationalcurriculuminaction-creativity-why/iscreativitysoimportant). It then behooves the Nigerian educational sector to devise means of infusing creativity into their curricula, and enhance thereby integrative learning approach.

Many employers, on the other hand, want people who see connections, have bright ideas, are innovative, communicative, work well with others, and are able to solve problems. In other words, they need creative people. Creativity is an important component of the ñnew basicsò for education increasingly being recognized and valued in the world of work and careers. To be employable, todayôs students must learn and be able to apply strategies and methods for creative thinking, critical thinking, problem solving, and decision-making. Furthermore, basic skills no longer refer only to content skills, but to evaluation and analysis skills, critical thinking skill, problem solving strategies, organization and reference skills, synthesis, application, creativity, decision-making and communication skills (Education Commission of the State, 1982).

In the same vein, surveys of employees, such as the Workplace Basics report or the 1991 Secretaryôs Commission on Achieving Necessary Skills (SCANS) report indicate clearly the importance and need for creativity. Workplace Basics were identified as follows: the foundation, competence, communication, adaptability, personal management, group effectiveness and influence. While SCANS report streamlined basic skills, thinking skills, personal qualities, resources, interpersonal skills, information, systems, and technology. Adaptability comprises creative thinking and problem solving, thinking skills encompasses thinking creatively, making decisions, solving problems, seeing things in the mindôs eye, knowing how to learn, and reasoning. Thus, creativity contributes to personal and group performance by providing a foundation for personal growth and a sense of satisfaction, reward, and accomplishment in life. It enhances the effectiveness of group participation and performance in solving problems and dealing with new opportunities and challenges.

Sternberg (1985) suggests that creativity comes from using the knowledge-acquisition components in an insightful way. Having a rich store of knowledge in an area is the basis for creativity, but something more is needed. For many problems, that something more is the ability to break set ï restructuring the problem to see things in a new way, which leads to a sudden insight. Often this happens when a person has struggled with a problem or project, and then set it aside for a while. These sudden solutions could be attributed to the process of incubation, a kind of unconscious working through the problem while being away from it. But it is more likely that leaving the problem for a time interrupts rigid ways of thinking, such as functional fixedness and response set. Howard Gardnerôs description of Charles Darwinôs creativity downplays sudden, dramatic insight but still highlights the role of knowledge restructuring. So it seems that creativity requires extensive knowledge, flexibility, and the continual reorganizing of ideas. Darwinôs work also shows that motivation and persistence play important roles in creative problem solving (Gleitman in Woolfolk, 1995).

Specialized programmes of creativity usually centre on teaching of creative thinking skills. Either infused or taught in strands, the sole purpose is that students learn to generate many ideas. Training in creativity can help the individual view problems from different perspectives. It is also useful in generating unique solutions (Onu, Eze and Onuigbo, 2008; VanGundy, 1992). The need for training in creativity can be explained based on recent technological advances, short production cycles, global trade possibilities and fluctuating labour force. Allegro, Chifari and Ottariano (2001) stated that schools and teachers could stimulate their students in the acquisition of creative thinking. They argued further that the achievement of insight is the result

of a process that involves didactic procedures, which allows each student to develop his own individuality. The implication is that creativity can no longer be regarded as being only genetically endowed in individual. It would require identification methods and techniques for its application in Nigeria classrooms (Onu, 2007c).

To foster creativity in students, both parents and teachers should learn to respect childrenôs ideas, not only welcoming them, but also encouraging and motivating them always. Onu (2007c) concluded by recommending that teachers have to challenge themselves on daily basis to ignite creative spirit in their students. They have to work to put greater emphasis on recognizing and advocating the use of creative thinking in the classroom. The students ability and effort to think divergently, to question the seemingly unquestionable, to take initiatives, to remain brave enough and take risks are exactly what teachers should invite, and nurture in order to develop creativity in their students. Deciphering from literature reviewed, creativity is an essential characteristics of high ability children, and is harnessed when appropriate strategies are used by teachers in fostering creative problem solving.

Creative Production

The use of the human brains to fashion new products, develop an economic order and new machines rest solely on the individualôs ability to think creatively and at a greater speed than is presently witnessed in the developing world. The discrepancy between the developed and developing world might not be associated with colour, race or creed; but, solely on premise of those who neither think creatively nor utilize their brains economically as they delve into solving problems and creating entrepreneurial activities for the future generation. Industries and government agencies are beginning to awaken to the need to promote greater exhibition of creativity in workplace. The recent happenings in the Nigerian labour market is evident that employers demand for labourer who are generally informed and technically trained to either innovate or produce more original ideas at accelerated pace (Onu, 2006; Anyakoha, 2006).

However, psychologists suggest that creative production is not a personality trait but a skill or process that produces a creative product, such as a painting, invention, computer programme, or solution to a problem. Howard Gardner (1993) defines the creatively productive individual as a person who regularly solves problems, fashions products, or defines new questions in a domain in a way that is initially considered novel but that ultimately becomes accepted in a particular cultural setting. This conception suggests that there is no such thing as all purpose creativity; people are productive creatively in a particular area. But to be creative,

invention must be intended (Woolfolk, 1995). Mouchiroud & Bernoussi (2008) referred to creative production as a combination of interacting individual and environmental resources leading to the production of valuable solutions. Likewise, Hennessey and Amabile (2010) defined it as the generation of products or ideas that are both novel and appropriate.

The work of De-Bono (2001) and Harris (1998) confirm that the use of creative techniques would definitely contribute to Creative Production and eventual enhancement of creativity in people. Heister (1982), Basadon (2006) and Morgan (2006) reported that training in ideational fluency (that is, speed at which ideas are generated) help students produce many responses to given tasks. It equally produced adaptability and flexibility of thought and these entire traits when applied result in equipping of the future productive generation, with no question as to the acceleration of development. Onu (2007b) viewed creative productivity as products, ideas or compositions of any sort, which are unique, satisfactory and are essentially new or novel and previously unknown to the producer. It involves divergent thinking, critical thinking and other problem solving skills. It is made manifest in the presence of problems that need to be solved; and it results in novel and valuable solutions and alternatives.

In the same vein, Leslie (2003) added that creative production is often characterized by the divergent nature of human thought and action. Divergence is usually indicated by the ability to generate many, or more complex or complicated ideas from one idea or from simple ideas or triggers. Traditionally, fluency, flexibility, elaboration, originality, risk-taking, imagination, complexities and curiosity are commonly thought as inherent elements of creative production, as well as attributes associated with creative problem solving abilities. Creative product refers to physical object, articles, patent or a theoretical system. It may be an equation or a new technique, not uniquely bound up with the life of an individual.

Terrance in Onu (2008) emphasized that the product of ability to generate alternatives to a given problem, produce variation in ideas, develop and generate inconspicuous solutions to problem must provide or be a solution to an existing problem. Onu further explained creativity as the process of producing ideas that are novel, useful and that meet the need of people. It then makes sense that if a product is not outstandingly useful, then it cannot be said to be a creative product. A creative product must be new. Rothenberg in Onu (2008) described creativity as the capacity or state, which brings forth creation. In addition, he stressed that creations are products, which are both new and valuable. Creative products or outcomes come in various sizes, shapes and from many different contexts. In other words, they are not limited to either arts or the sciences.

Many important factors contributing to creative production have been identified. Rhodes identified four factors in understanding creativity as follows: person, process, product and press. Thus, an objective investigation could process only in the direction from product to person to press. Metaphorically, the creative product may be thought of as a manifest ñbrain-childò. Products are the artifacts of thoughts. Products are the tangible result of the creative process. Following Osborn-Parnes model, they are the ñActionò, or the solution, which is incomplete until implementation, has taken place. Treffinger (1991) also identified four factors (C-O-C-O) that interact to influence creativity, these are *characteristics* of a person, *operations* they know and can employ or perform, *context* in which they are productive and *outcomes* of their productivity. The evaluation of a creative product gives a means for establishing referents for the concept of creativity. Approaching the study of creativity through the analysis of the creative product would come closest to solving the criterion problem.

The creativity of products is typically the focus of experimental paradigms that vary the conditions under which one or more individualôs creativity is assessed. Here creativity is seen as a fleeting and largely situation-dependent state (rather than a relatively stable and enduring personality trait). Although Runco maintained in his 2004 Annual Review article that in assessment of product creativity is rarely used with noneminent individuals, this approach was expressly developed for and is particularly useful in the study of everyday creativity. In the contemporary literature, the identification and assessment of creative products, such as: poems, paintings, scientific theories, or technological breakthroughs, rests largely on a consensual assessment process. Researchers wishing to assess the creativity of tangible products have long relied on the consensual assessment of experts, formalized for nearly 30 years in the Consensual Assessment Technique, because of its relative simplicity and the consistently high levels of interrater agreements reached. In recent years, consensual assessment methodologies have also been extended to real-world classroom and workplace environments, including cross-cultural contexts (Hennessey & Amabile, 2010).

Many theories have suggested that creative production involves multiple stages. Initially, Wallas proposed a four ï stage process theory of creativity, namely: preparation stage in which the problem is investigated, incubation stage in which the problem is thought about unconsciously, illumination stage in which ideas come together to form a possible solution and verification stage in which result is evaluated and deemed acceptable. Support is strongest for a simpler two stage process (Sapp in Kosslyn & Rosenberg, 2001). While the first stage entails generating a variety of possible solutions to a problem; the second involves interpreting and

selecting among them (Martindale in Kosslyn & Rosenberg, 2001; Simonton, 1997). The two-stage technique is a key aspect of an approach called creative cognition, in which the processes of normal cognition, such as memory and imagery function to produce novel solutions to problems. Much research in creative cognition has grown out of the experiment on visual synthesis. Finke and Slayton (1988) gave participants a set of simple shapes and asked them to combine the shapes mentally and create a recognizable form or object. In these studies, the first stage involved ómental playô with images of the forms by rotation, size adjustment, and repositioning. The second stage involved recognizing what combination of the forms could represent. Finke and colleagues in Kosslyn & Rosenberg (2001) found that participants were more creative if they combined shapes without particular goal in mind at the outset, attempting an interpretation only after producing novel combinations.

It is possible that either stage of creativity can occur unconsciously, each stage can be approached with different forms of thinking, and optimal creativity probably involves a mixture of both. Guilford in Kosslyn & Rosenberg (2001) distinguishes between convergent thinking and divergent thinking. Convergent thinking requires staying focused on one particular approach to a problem and work through a series of steps to arrive at a solution; all lines of thought converge on a single correct solution. Routine problems with straight forward solutions, such as those amenable to logical reasoning, often rely on convergent thinking. Divergent thinking approaches a problem from a number of different angles, exploring a variety of approaches to a solution before setting on one (Kosslyn & Rosenberg, 2001). Creativity appears to be enhanced by using divergent thinking in either stage, to produce possibilities or to consider alternative interpretations of the possibilities (in the second stage). Convergent thinking still has important role in creativity ï in setting up a problem in the first place and moderating the surge of idea generated by divergent thinking.

However, a major issue that has been raised by several investigation deals with whether or not tests of divergent thinking actually measure ótrueò creativity. According to Renzulli and Reis (1997), although some validation studies have reported limited relationships between measures of divergent thinking and creative performance criteria, the research evidence for the predictive validity of such tests has been limited. Unfortunately, very few tests have been validated against real-life criteria of creative accomplishment; however, future longitudinal studies using these relatively new instruments might show promise of establishing higher levels of predictive validity.

Many techniques focusing on ways to find novel effective solutions to problems have been developed in effort to enhance creative production. When designing an object for example, listing its attributes, and then considering how to combine attributes to improve the object. Another useful technique is to consider how to combine attributes in new ways (Davis in Kosslyn & Rosenberg, 2001). Some techniques for enhancing creative production rely on interactions among people. Probably the most well known of these techniques is brainstorming, in which members of a group say the first thing that comes to mind, volunteering ideas almost at random, this triggering new ideas from one another. For this technique to be productive, the members of the group must suspend judgment and agree not to criticize one anotherôs ideas at this stage. Research findings suggest that relying on a group discussion to find creative solutions may not be productive. People actually produce fewer ideas in groups than when they work alone, perhaps because they are more inhibited with others than in the private recesses of their own minds (Dennehy in Kosslyn & Rosenberg, 2001).

However, whether in group or done alone, creative activities yield productive ideas when assessed using appropriate tests. Given the inherent limitations of creativity tests, a number of experts has focused on alternative methods of assessing creativity. Nicholls in Renzulli and Reis (1997) suggests that an analysis of creative products is preferable to the trait-based approach in making predictions about creative potential. Moreover, Wallach (1976) in Renzulli and Reis (1997) proposes that student self-reports about creative production are sufficiently accurate to provide a usable source of data. Creative production is the only means of substantiating the concept of creativity. A product must be novel, original and relevant to an existing problem to be creative, However, originality, novelty and relevance as applied in this study is relative to the rarity of product comparable to a given mental age group. Thus, creative production was evaluated in this study in terms of unusual or infrequently generated product in a universe of products, made by pupils in a similar grade level or ability.

Whole Brain Learning

Perhaps, the most popular and widely known finding of brain research in the twentieth century is that human brains have at least two very different ways of processing information, which are related to the two hemispheres of the brain - the left and the right - and to the corpus callosum (the part that connects the two hemispheres). Although some of the earlier information about the left and right brain is outdated, yet the brain is not nearly as split as was originally proposed. Thus, both the left and right brain are involved in every human activity (Lazear, 1999).

Precisely, the left-brain processes sequentially and in parts. It tends to be more analytical, linear, and systematic. Research conducted at the California Institute of Technology during the 1950s, shows that the left side of the brain gives us the ability to analyze, use words, and work with numbers (Shaun, 2002). In other words, the left-brain processes information verbally, rationally, analytically, and logically. It is more aware of and responsive to positive emotions. The left-brain tends to organize new information into preexisting knowledge patterns, categories, and schemes. This is like a very meticulous person who is forever putting things into little boxes on shelves so that his or her world makes sense, and the house stays tidy (Lazear, 1999). The left-brain hemisphere assists in scrutiny; help analyze critically the patterns generated in order to test their reality.

Conversely, the right brain processes simultaneously and all at once. It processes information visually, spatially, symbolically, and aesthetically. It is more aware of and responsive to negative emotions. The right side of the brain is responsible for ability to unify concepts, putting details together, resulting in the formulation of a complete picture and creativity (Ananga, 2009). The right brain facilitates wonderful abilities such as flexibility of thinking, intuitive problem solving, creative planning, considering values, spotting new possibilities, and interacting sensitively and positively with others. The right brain can create leaps in knowing; because it has a panoramic view. It can see the larger patterns. It invents ideas that do not fit into preexisting categories and for which there are non-previous reference or experience. Artists and science fiction writers use the right brain to create worlds and universe that no one has ever seen but exist in their dreams or active imagination (Lazear, 1999; Summers, 2009).

According to International Culinary Schools (retrieved from http://www.wherecreativitygoestoschool.com/vancouver/left_right/rb_test.htm), the symbolic processing is a left brain cortical skill used in processing pictorial information, symbols (such as letters, words), and mathematical notations. Verbal processing is a method used in processing thoughts and ideas with words. With verbal processing, exact, logical directions are given in a sequential manner compared to a right-brained person who, in giving the same directions, would use more visual landmarks. Sequential processing is a method used for processing information in order from first to last; in a systematic, logical manner. Through linear processing, the left-brain takes pieces of information, lines them up, and proceeds to arrange them into an order from which it may draw a conclusion, from parts to a whole in a straight, forward, and logical progression. Logical processing has to do with taking information piece by piece and putting it

all together to form a logical answer or conclusion. Reality-based processing focuses on rules and regulations, and enables a person to easily adjust to changes in the society.

Random processing is a method used by the right hemisphere for processing information without priority, making a right-brained person to jump from one task to another. Random processing is the opposite of sequential processing. Concrete processing is a method used in processing information received from real objects. As a concrete person visualizes or touches, it is easier to understand. A right-brained person, through holistic processing, process information from whole to parts, is able to see the big picture first, and engage auditory, visual, and spatial memory modalities. Through the intuitive processing, information is judged based on right or wrong feelings, and entails working backwards in order to see and understand the parts and process that create a whole/answer. Fantasy-oriented processing focuses much less on rules and regulations. A right-brained person do not adjust well to or adapt easily to change in the environment, but attempts to change it back to the way they liked it. Nonverbal processing processes thoughts with illustrations, and visualizations in order to understand information received better.

The current edge of the so-called split-brain research is the integration of the two sides of the brain into a unified whole ï the whole brain. The two sides of the brain are connected by the corpus callosum, a large group of neural connectors. The corpus callosum allows the two sides of the brain to communicate and collaborate when faced with complex issues and tasks of everyday life. Lazear (1999) described it as an inter-hemispheric freeway that allows each side of the brain to freely exchange information. However, the path to future development lies in the adequate training of both sides of the brain. Onu (2005b) adduced that teaching children critical thinking (an activity of the left-brain) without creative and intuitive insights, and search for new patterns leaves the educational system sterile, and doomed. Children need training of both sides of their brain to solve complex problems and in changing circumstances.

This implies that humans are all left and right-brained. Both the left and right hemispheres of the brain are involved in every activity performance; although certain tasks and experiences tend to stimulate more activity in one hemisphere than the other. The whole brain creates a balance in knowing. It allows one to experience and participate in a greatly amplified approach to living. The whole brain joins the so-called hardheaded, rational, analytical thinking with intuitive, symbolic, and aesthetic thinking, giving a deeper, richer experience of being (Lazear, 1999).

Using whole-brain learning activities in a class will improve the behavior of students and enhance their learning ability (Dennison and Dennison, 1989). Unfortunately, many learners start school at a disadvantage and stay disadvantaged, which results in increasing number of learners needing extra support in order to benefit from schooling, obtain a qualification and become independent and part of an agile workforce. Failure to learn at school results in dependent adults with low self-esteem and low employability. Reasons for learning failure, often are attributed to diversity in: socioeconomic milieu, levels of sensory stimulation and sensory integration, thinking, language and learning styles (DeJager, 2008). DeJager further notes that diversity in learnerôsô needs necessitate identifying a common denominator amongst all learners, which when stimulated results in greater learning effectiveness for all learners.

Whole brain learning is the common denominator that integrates the functionality of the two sides of the brain into a unified whole. The whole brain learning, according to Dejager (2008) could be defined as the process of receiving input through sight, hearing and active participation, processing the sensory input simultaneously with the left and right brain, while filtering perceptions through emotions for appropriate and accurate verbal or active output. If the whole brain is involved in learning, then retention of information, understanding and subsequent performance will be greatly enhanced. Onu (2005) adds that training of both sides of the brain is essential to the completeness of human reason. In her opinion, the important functions of the whole brain are also to be raised to the highest and finest working power if education of the child will not be imperfect and one sided.

Brain hemispheric laterisation does not mean that a side of the brain is in complete control, depending on the task. For people who have normal intact brains, both hemispheres are involved in all learning tasks, even if one side may be more or less involved at any given moment (Bjorklund cited in Woolfolk, 1989). Nonetheless, at birth the brain is without developed preferences, and is therefore, essentially whole. However, the developing brain is an evolving coalition of many different preferences. As the brain matures, it acquires preferences because of the individualôs life experiences.

Herrmann (2000) explained that the human body, internally and externally, is made up largely of paired structures (arms, legs, face, eyes, lungs and kidneys), most of which are not perfectly matched. It is in reality an array of asymmetrical parts. Fundamental asymmetry leads to the concept of dominance. Of major importance are the paired structures that exist in the brain that are different physically, chemically and function differently. The preference to think in particular ways results in more frequent use of that particular brain part (one hemisphere or one

limbic half) with the resulting development of greater competency for that set of mental activities that are located in those parts. Just as the less developed non-dominant hand assists the stronger, more skillful dominant hand, the less developed brain structures collaborate with the more preferred (and therefore dominant) thought processes of the brain in order to fully apply the best mental ability to everyday tasks and activities. Therefore, it is natural for the brain to form a coalition of the structures in order to deal with complex situations (Herrmann, 2000).

Most individuals have distinct preference for one style of thinking. Some others, however, are more whole-brained and equally adept at both modes. In general, schooling tends to favor left-brain mode of thinking, while downplaying the right-brained one (Shaun, 2002). Left-brain scholastic subjects focus on logical thinking, analysis, and accuracy. Right-brained subjects, on the other hand, focuses on aesthetics, feeling, and creativity. In order to be more ñwhole-brainedò in orientation, Funderstanding (2008a) suggests that schools need to give equal weight to the arts, creativity, and the skills of imagination and synthesis. Also, to foster a more whole-brained scholastic experience, teachers should use instruction techniques that connect with both sides of the brain. Funderstanding explained that teachers could increase their classroomsô right-brain learning activities by incorporating more patterning, metaphors, analogies, role-playing, visuals, and movement into their reading, calculation, and analytical activities. Moreover, for a more accurate whole-brained evaluation of student learning, educators ought to develop new forms of assessment that honor right-brained talents and skills (Funderstanding, 2008a).

Well-intentioned, yet ill-informed teachers teach learners in ways that make learning difficult or impossible, as they are unaware of how to determine and use the preferred learning style of each learner (Ananga, 2009). Ananga (2009) further notes that when a learnerôs learning style is not matched with the method of instruction, the learnerôs discomfort level may be so great that it not only interferes with the learning process but also could ultimately prevent learning from taking place. People have different preferred modes of thinking and learning. Those preferences influence how to process and store information, retrieve, and make meaning out of it. All learning groups are made up of people with different thinking style preferences, different ways of knowing and different learning styles. Effective learning is ñwhole brainedò, taking advantage of all mental processes of the brain. Unfortunately, teachers and trainers typically design learning experiences that reflect their own thinking/learning preferences. This lopsided approach must give way to the whole brain teaching, which inherently addresses the eight ways of knowing or multiple intelligences (Sue, 2007; Lazear, 1999). In light of the above

assertions, there is need to re-examine the previous assumptions about teaching and learning. The content, design, and delivery of each learning goal must be whole-brained to meet the diverse learning and thinking styles of heterogeneous group of learners (Sue, 2007).

This implies that most people will never reach their maximum potential because of compromises that have been made between these two governing bodies. Sometimes, skills, which the right brain can perform better, are routinely handled, with less skill, by the left-brain. Ideally, both brains work together in people with optimum mental ability. This coordinating ability may be the key to superior intellectual abilities. In most people, however, the left-brain takes control, choosing logic, reasoning and details over imagination, holistic thinking and artistic talent. The ideal learning situation is in a whole brain state, when both the left and right brain are in communication (Lazear, 1999; Summers, 2009).

Whole-brain teaching is an instructional approach derived from neurolinguistic descriptions of the functions of the left and right brain hemispheres. According to Funderstanding (2008b), neurolinguistic findings about the brainôs language functions show that in the integrated brain, the functions of one hemisphere can immediately be available to the other, producing a more balanced use of language. Whole-brain teaching emphasizes active learning, in which the learner makes connections that tap both hemispheres. Another aspect of whole-brain teaching is managing the emotional climate, to reduce ñdownshiftingòï or primal thinkingï that occurs during distress. To relax learners, instructors may offer clear, realistic predictions of barriers (such as, ñadvancement may be sporadicò) and progress (such as, ñsooner or later, this will become easierò). Instructors may try enhancing the learning experience with music or soothing colors.

In whole brain learning, imaging is perceived as the basis for comprehension. For this reason, learners are encouraged to visualize, draw, and use drama as they develop new ideas, in order to retain them. A reading teacher, for instance, might present new vocabulary words by building a story or skit that uses them - but does not define them - in context. The teacher then might play music while reading the definitions, leaving time for listeners to draw images of the words. The teacher might use guided meditation to build a relaxed state containing memories of success before the listeners hear the definitions again. In addition, the learners might even act out the wordsô meanings or construct stories of their own (Funderstanding, 2008b).

Whole Brain Creativity

The human brain has many parts, but it seems the present educational system only addresses a small, narrow segment of the brain, located in the left portion of the cerebral cortex.

Shaun (2002) explained that isolating certain parts of the brain does not promote cohesion; since all parts of the brain should work together. The right side of the brain is responsible for the ability to unify concepts - to put details together resulting in the formulation of a complete picture - and to be creative. As much as people are right or left handed, most people are right or left-brain dominant. Left-brain dominant people are most successful in the current educational system, which limits creativity, and relies mostly upon words and numbers. The educational system neglects the needs of right-brain dominant individuals; the 50% of the population that is dubbed "functionally illiterate" by some educators.

Each brain has a unique personality, which is determined largely at the moment of conception. This uniqueness entails that every person will require a different educational experience. In most culture, however, these differences are not recognized, and most students are lumped into an educational system that caters for the needs of left-brain dominant individuals. Shaun (2002) noted that the society severely neglects the limbic system and the right cerebral hemisphere of the brain, which is very damaging to the development of mindfulness. Shaun further argues that when the limbic system is excluded from proper stimulation, subjects become dull and lifeless; emotions and their connection to thoughts are completely ignored; and the brain constantly given the message to stop feeling. Many people cope with the harshness of society by not showing emotion. When abuse, forced business, or control from external authorities is imposed upon a student, the result is anger, apathy, and an abandonment of the sense of self. As this becomes a habit, emotions are denied altogether (Shaun, 2002). Therefore, there is the need to device educational programmes capable of providing sufficient stimulation to the limbic system and addressing the right brain creative potentials.

Creativity is a core competency for leaders and managers, and a crucial component of the innovation equation. Creativity requires whole-brain thinking, right-brain imagination, artistry and intuition; plus left-brain logic and planning. Naiman (2007) believes that organizations led by creative leaders have a higher success rate in innovation, employee engagement, change and renewal. Naiman states that generating fresh solutions to problems, and the ability to create new products, processes or services for a changing market, are part of the intellectual capital that give a company its competitive edge. It also explores the strategic dimensions of whole brain thinking and provides practical tools and techniques that integrate right-brain imagination, artistry and intuition with left-brain logic, analysis, and planning.

The whole-brain thinking forms the basis for creativity skills development, strategic planning, team development, meeting facilitation and innovation. It provides organization with a

language and structure for innovation. Whole-brain thinking strategies based on Ned Herrmann's model provide how to generate, analyze, evaluate and implement ideas; develop a set of creative solutions to the organizationôs specific business challenges and strategies to implement. It formulates how to promote ideas, network, mobilize teams and implement innovation, conduct high performance brainstorming sessions and manage creativity in teams (Naiman, 2007).

Ambidexterity is whole-brain thinking, where the inherent capacities of both the left and the right brain are used. It is maximizing the brainpower. The versatility displayed in using both hands for all kinds of activities reflects a personôs ambidexterity. Some renowned ambidextrous persons are Michelangelo, Leonardo Vinci, Einstein, Fleming, Harry Truman, etc. While ambidexterity can be an inborn trait, sometime it develops over the years (Raj, 2007; Avezah, 2009). It is being ambidextrous that entails multi-tasking such as talking over the phone, while writing down information, watching TV. The difference is that instead of the hands, both the right and left hemispheres are used to successfully juggle tasks. Being 'right-brained' or 'left-brained' in essence means that the person displays more 'right' or 'left' integrating skills, although all the time integrating both hemispheres in daily activities (Raj, 2007). Ambidextrous mind optimizes the brainpower and injects a heightened level of awareness. Nurturing an ambidextrous mindset requires working on right-brain learning activities by including patterning, metaphors, analogies, role-playing, visuals, and movement into reading, calculation, and analytical activities. Concerted effort involving left and right brain activities, human consciousness studies, reflective thinking and meditation are excellent means to develop ambidexterity of the mind (Avezah, 2009).

Some of the mental traits of a órightô brain qualities are imagination, risk taking, artistic abilities, philosophical, creative. óLeftô brain people, on the other hand, are said to be practical, conformist, systematic, and comprehend faster. Whatever mental traits and capacities inherited is actualized through use and application of the thinking mind. It is a fact that the innately right-brained traits such as creativity, imagination, curiosity, spontaneity, open-mindedness, and enthusiasm are lost due to social, cultural, educational, racial, and other influences. Children are innately right-brained, revealing great creativity, imagination, spontaneity, open-mindedness and enthusiasm; but ironically, with growth and maturity, social, cultural and racial influences constrain these natural traits. However, the mind could be trained to think along different lines and greatly improve mental abilities through constant application and practice (Raj, 2007; Avezah, 2009).

In sum, the brain is the source of creativity, and effective synergy of the right and left brain hemispheres contribute strongly to the creative process. Creative thought is the result of specialized mental processes. Researches (Shaun, 2002; Summer, 2008; Ananga, 2009) show that by actively engaging the brainôs capacities of both hemispheres provide more cross-fertilization between neural synapses, which leads to original ideas, and unprecedented discoveries. An approach to a new situation with habitual thinking makes it impossible to generate new ideas, visions, or solutions. Thus, thinking in novel ways and pattern breaking require new connections within the brain. Whole brain learning and creative production could be boosted among school children when appropriate teaching and learning strategies that facilitate interhemispheric brain functioning are applied. Such strategies include mind mapping and synectics.

Mind-Mapping

Mind mapping developed in 1960 by Tony Buzan is a presentation form of radiant thinking, utilizing lines, colors, characters, numbers, symbols, images, pictures or keywords. to associate and integrate, visualize the learned concept and maximize brain potential (Buzan & Buzan, 1996). In fact, some stakeholders have stated that this form of graphic organizer has helped them more clearly present and explain the impact and sustainability of their programmes (Mary & Skye, 2009). Through the process of mind mapping, capability of analyzing, comprehending and memorizing information is enhanced.

Mind maps help oneôs attention, coordinate ability, logic, reasoning, thinking, analyzing, creativity, imagination, memory, ability of planning and integration. Speed-reading, character, number, visuality, hearing, kinesthetic sense, and sensation are significantly enhanced because mind map organizes large amount of information systematically. It is a useful key adopting association skill and utilizing pictures to express the thoughts and maximize brain potential. As characters, images, numbers, logics, rhythm, colors and unique observation method are applied; providing limitless and free imaginary space to the development of the whole brain (Buzan & Buzan, 1996). Briefly, mind map is a map for the brain. Application of mind map is to construct ñdivergent thinkingò in the brain. While applying mind mapping, ability of logical analyzing and reasoning of left-brain, creative thinking and memory of right brain can be maximized.

Mind Mapping is a technique that facilitates the whole brain thinking process. It helps the mind in diffusion of thought and paves way for streamlining thoughts and associations. Association essentially is finding the links in logic and ideas, and when these are explored in full, it leads to insight, imagination and creativity. Colors, pictures, symbols. are valuable aids that

strengthen vividness, clarity of perception and easy dissemination (Avezah, 2009). An essential component of meaningful learning is the integration of new or target concepts into the learner's framework of relevant concepts. Building non-arbitrary and coordinated links between a learner's knowledge structures and a target concept or set of concepts could be facilitated, among other things, by visual organizers (Abi-El-Mona and Adb-El-Khalick, 2008). Raj (2007) further explained that Mind mapping technique employs all the processing skills of the brain, thus lending it power and dynamism. When mind map technique is used for learning, it undoubtedly becomes a highly effective and powerful way of gaining knowledge. It is the best means for developing an ambidextrous or whole brain thinking ability. Since it is based on the brain-working principles, it is also an effective tool for improving the cognitive abilities (Raj, 2007; Avezah, 2009).

Mind mapping is a revolutionary technique that makes use of cognitive skills to improve thinking skills, memory and creativity. Mind maps can be used for creative thinking, planning, creative writing, report writing, note making, presentations, individual studying, studying as a group, meetings, think tanks, alleviate writer's block, and remembering (Alibaba Group, 2009; Buzan, 2009). A mind map is a powerful graphic technique, which provides a universal key to unlock the potential of the brain. It harnesses the full range of cortical skills - word, image, number, logic, rhythm, colour and spatial awareness - in a single, uniquely powerful manner. In so doing, it gives freedom to roam the infinite expanse of the brain. The mind map can be applied to every aspect of life where improved learning and clearer thinking will enhance human performance (Buzan, 2009). A mind map is a graphical way to represent ideas and concepts. It is a visual thinking tool that helps in structuring information, helping to better analyze, comprehend, synthesize, recall and generate new ideas (Passuello, 2007).

Mind mapping is a tool for assisting and enhancing many of the styles of thinking and learning that are required in schooling and work. Though it has primarily been used as a learning skills tool, it was developed as an information-gathering tool, where ideas can be elicited and then utilized to further develop a community building solution focused process. Mind mapping is sometimes seen as a form of brainstorming. Both of these techniques work to encourage the generation of new materials, such as different interpretations and viewpoints. However, Mind mapping relies less on random input and more on providing opportunities for fitting ideas together. In this format, no idea takes precedence and all ideas are connected to the center (Leischner, 2003).

Mind mapping, in the words of Wang, Lee and Chu (2010), is a presentation form of radiant thinking, utilizing lines, colors, characters, numbers, symbols, image, pictures or keywords, etc. to associate, integrate and visualize the learned concept and evoke brain potential. ñPictureò is not limited by nationality and language and is the best tool for young children to explore new things and learning. Because pictorial representation is one of the most primal human traits and drawing ability is better than writing ability in young children, learning and expressing through mind mapping prevents difficulties of writing, grammar and long description in children.

Mind mapping could serve as a particularly useful tool for helping younger students with the process of building conceptual understandings of disciplinary content; consequently, promoting their achievement. Mind mapping is a historical forerunner in the development of dynamic visual tools and organizers. Similar to these latter tools, mind mapping promotes conceptual links between and among ideas in mostly non-linear, holistic ways and inspires the use of personal connections, experiences, and creativity as foundations for meaningful learning (Abi-El-Mona & Adb-El-Khalick, 2008).

However, unlike other visual tools, mind maps emphasize student-created representations of knowledge as compared to those representations being imposed by the visual tool itself (e.g., the hierarchy, branches, links, and cross-links in concept mapping). The approach involves brainstorming ideas, which are then diagrammed in a web-like structure rather than linear, uni-directional, two-dimensional (and sometimes hierarchical), sequential build up of ideas based on a specified format (Hyerle in Abi-El-Mona & Adb-El-Khalick, 2008). Various icons and other non-symbolic representations coupled with colouring are often used to further individualize mind maps in ways that enhance their utility and meaningfulness to learners who construct them.

Research supports the use of mind mapping in teaching and learning because it facilitates the essential processes of visual coordination and integration with other cognitive operations, which are essential to knowledge construction (Abi-El-Mona and Adb-El-Khalick, 2008). Also, the idiosyncratic nature of mind maps works in their favor because individualized perceptions play a significant role in assimilating, organizing, accommodating, and retaining information. The dynamic nature of mind maps, which allows for three-dimensional representations of knowledge structures, adds to their versatility and responsiveness to individual differences. Finally, mind mapping can greatly facilitate linking visual and verbal intelligences, in the context of Gardner's theory of multiple intelligences and Kline's notion of integrative learning, and help

in the assimilation and long-term retention of information (Rega; Gardner; Kline in Abi-El-Mona and Adb-El-Khalick, 2008).

Mind mapping facilitates note taking, brainstorming (individually or in groups), problem solving, studying and memorization, planning, researching and consolidating information from multiple sources, presenting information, gaining insight on complex subjects, jogging creativity. It is hard to make justice to the number of uses mind maps can have ï the truth is that they can help clarify thinking in anything, in many different contexts: personal, family, educational or business. Planning oneôs day or planning oneôs life, summarizing a book, launching a project, planning and creating presentations (Passuello, 2007).

The Mind Map has four essential characteristics: the subject of attention is magnified as the central image. The main themes of the subject radiate from the central image as branches. Branches comprise a key image or key word printed on an associated line. Topics of lesser importance are also represented as lower level branches attached to higher-level branches. The branches are connected to a nodal structure. Mind maps may be enhanced and enriched with color, pictures, codes and dimension to add interest, beauty and individuality. These in turn aid creativity, memory and specifically the recall of information. Mind maps help to make a distinction between mental storage capacity, which Mind Map will help demonstrate, and mental storage efficiency, which Mind Map will help achieve; since storing data efficiently multiplies the capacity. It is like the difference between a library with or without an organized system of retrieval (Buzan, 1993).

A mind map is a diagram used to represent words, ideas, tasks, or other items linked to and arranged around a central key word or idea. Mind maps are used to generate, visualize, structure, and classify ideas, and as an aid in study, organization, problem solving, decision making, and writing. The elements of a given mind map are arranged intuitively according to the importance of the concepts, and are classified into groupings, branches, or areas, with the goal of representing semantic or other connections between portions of information. Mind maps may also aid recall of existing memories. By presenting ideas in a radial, graphical, non-linear manner, mind maps encourage a brainstorming approach to planning and organizational tasks. Though the branches of a mind map represent hierarchical tree structures, their radial arrangement disrupts the prioritizing of concepts typically associated with hierarchies presented with more linear visual cues.

This orientation towards brainstorming encourages users to enumerate and connect concepts without a tendency to begin within a particular conceptual framework. The mind map can be

contrasted with the similar idea of concept mapping. The former is based on radial hierarchies and tree structures denoting relationships with a central governing concept, whereas concept maps are based on connections between concepts in more diverse patterns. Mind maps are, by definition, a graphical method of taking notes. Their visual basis helps one to distinguish words or ideas, often with colors and symbols. They generally take a hierarchical or tree branch format, with ideas branching into their subsections. Mind maps allow for greater creativity when recording ideas and information, as well as allowing the note-taker to associate words with visual representations. Mind maps and concept maps are different in that mind maps focus on only one word or idea, whereas Concept maps connect multiple words or ideas. The difference between concept maps and mind maps is that a mind map has only one main concept, while a concept map may have several. This strategy helps students quickly relate a central word or concept. The mind forms associations almost instantaneously and 'mapping' allows one write down ideas quicker, using only words or phrases (Wikipedia, 2009; Buzan, 2009).

The mind map is a vastly superior note taking method because it does not lead to a "semi-hypnotic trance" state induced by other note forms. Abi-El-Mona and Adb-El-Khalick (2008) cited Buzanôs argument that the mind map uses the full range of left and right human cortical skills, balances the brain, taps into the apocryphal 99% of the unused mental potential, as well as intuition (which he calls "superlogic"). However, scholarly research suggests that such claims may actually be marketing hype based on misconceptions about the brain and the cerebral hemispheres. Critics argue that hemispheric specialization theory has been identified as pseudoscientific when applied to mind mapping (Williams, 1986).

Summarily, mind mapping strategy integrates and utilizing the cortical functions of the right brain hemisphere; such as colors, images, or pictures (aesthetics) and the left brain cortical function such as lines, characters, numbers, symbols, or keywords in a learnerôs graphic construction of knowledge. These unique qualities make mind mapping a whole brain learning strategy, and an apt tool for developing creative/productive skills in high ability pupils since it involves constructivism.

Concept of Synectics

Synectics is system of problem stating and problem solving based on creative thinking that involves free use of metaphor and analogy in informal interchange within a carefully selected group of individuals of diverse personality and areas of specialization (Tami, 2007; Trevor, 2009). Synectics provides an approach to creative thinking that depend on looking at what appears on the surface as unrelated phenomenon and drawing relevant connections. Its

main tools are analogies or metaphors. The approach, often used in group work, can help students develop creative responses to problem solving, retain new information, assist in generating writing, and explore social and disciplinary problems. It helps users break existing mindsets and internalize abstract concepts. Although, Synectics works well with all ages as well as those who withdraw from traditional methods, yet it is based on the notion that traditional thought should be challenged (http://www.saskschools.ca/~bestpractice/synectics/index.html; Couch, 1993).

Since creativity involves the coordination of things into new structures, every creative thought or action draws on synectic thinking. Paul E Torrance stated that creative behaviour occurs in the process of becoming aware of problems, deficiencies, gaps in knowledge, missing elements, disharmonies, bringing together in new relationships available information; identifying the missing elements; searching for solutions, making guesses, or formulating hypotheses. Max Ernst, in the same vein, believes creativity is the marvelous capacity to grasp mutually distinct realities and draw a spark from their juxtaposition. A man becomes creative, whether he is an artist or scientist, when he finds a new unity in the variety of nature. He does so by finding a likeness between things, which were not thought alike before. Buckminster Fuller summed up the essence of synectics by asserting that all things regardless of their dissimilarity could somehow be linked together, either in a physical, psychological or symbolic way. Synectics thinking therefore is the process of discovering the links that unite seemingly disconnected elements. It is a way of mentally taking things apart and putting them together to furnish new insight for all types of problems (Jacob Bronowski in Roukes, 1997).

Gordon (in Tami, 2007) believes that creative capabilities can be developed; that creativity is an emotional process which aids intellectual processes, and understanding the irrational aids in problem solving success. Synectics incorporates metaphors and analogies to promote creativity. Trevor (2009) and Tami (2007) agree that two fundamental principles provide the operational starting point for the synectics approach. These are making the familiar strange and making the strange familiar. Gordon expressed his central principle as: "trust things that are alien, and alienate things that are trusted." Synectics holds that creative ideas frequently arise from these principles. Synectics uses metaphor and analogy to translate those two basic principles into practical strategies or methods. A new and strange challenge can be easier to deal with when it can be compared to an analogous problem or situation.

The three principal analogical or metaphorical techniques are direct analogy, personal analogy, and compressed conflict. Direct analogy is the comparison of two or more different, and

seemingly unrelated, objects or ideas. The comparison often involves using qualifiers. Personal analogy involves ascribing human qualities to things that are no human. Smiles and metaphors from language and writing are good examples. It is most powerful when undertaken with empathy and involvement, in first person, rather than using a detached, third person approach. Personal analogy enhances understanding when a participant is asked to become the topic, idea, object, etc. Symbolic analogy, now represented as compressed conflict is the third kind of creative connection making used in the synectics approach. The goal of this technique is to formulate two word description using opposites, or conflicting elements, within the pair. These are often described in literature as oxymorons. A full synectics approach would include a systematic process using each of these analogies in a particular pattern (Trevor, 2009; Tami, 2007; & Gordon, 1961).

These techniques encourage, on one hand, fundamental problem-analysis; and on the other hand, the alienation of the original problem through the creation of analogies. It is thus possible for new and surprising solutions to emerge. As an invention tool, Synectics involves a technique called "spring boarding" for getting creative beginning ideas. For the development of beginning ideas, the method incorporates brainstorming, deepens, and widens it with metaphor; it also adds an important evaluation process for idea development, which takes embryonic new ideas that are attractive but not feasible, and builds them into new courses of action, which have the commitment of the people who will implement them. Synectics is more demanding than brainstorming, as the steps involved mean that the process is more complicated and requires more time and effort. It is also much more rewarding because the product is action not just ideas (Wikipedia, 2010).

Thus, according to Syque (2010), although Synectics sessions are often very much like brainstorming, they are supercharged with additional techniques to assist in even greater success. Some of the methods are described as follows: Headlining simply requires the person giving the idea to state the idea up-front, adding clarification only if it is called for. This, of course, requires an environment of trust, which must be built before the session begins. The other method of ôin-out listeningô is for the listener, who, when they have an idea, write it down quickly so they can return to paying full attention to what is being said, rather than rehearsing their thoughts and trying to find a space in which to interrupt with their suggestion.

The problem owner: when brainstorming with a group of people, all of whom have some ownership of a problem, the trouble that often occurs is that they can all fall into judgment and evaluation at various times through the process. This is simplified and sorted out in synectics by

having a single problem owner, with all other people being there to help that person solve their problem. Where the other people also have some ownership of the problem, they can ótake turnsô at being the problem owner. This also overcomes the problem of being blinkered by the situation and the helpers should not know as much about the problem as the problem owner, since this might lead to their becoming blinkered also. This process encourages ówild ideasô, although on the face may appear ridiculous, and may trigger other valid thoughts. The problem owners want new options that could be implemented within their authority; helps in understanding the problem-owners' perceptions of the problem area; gives a feel for the number and quality of solutions needed; helps to ensure realistic expectations about results; and allows an agreement on team membership.

Spring boarding is a simple method of helping to trigger ideas through its wording. This is simply done by prefixing the statement with ó I wishé ô or óhow toé ô other words like ówouldnôt it be nice ifé ô could be used, although these are longer. ó I wishô and óhow toô can also be abbreviated when written down as óIWô and óH2ô. Wishing are used for more speculative ideas and óHow toô for more specific problems, although people also tend to have their own preferences. Notice the difference that these suggestions have on inclination to add to them versus adding one of an own ideas: óMake everyone understandô or ó I wish everyone understoodô. The ó I wishô probably leads one to think more about how that may be done. Wording ideas as springboards also acts as a psychological legitimization, as it is easier to say things like ó I wish the parcels delivered themselvesô rather than óThe parcels should deliver themselves.ô It is like being in a creative session where people do not seem to be paying much attention to other peopleôs ideas. Excursions are simply exercises that break up idea block in a creative session where the ideas have dried up.

Synectics can be found interwoven throughout the learning theories. Tami (2007) states that synectics process can be linked to multiple intelligences/learning styles, technology in the classroom, creativity in learning, critical thinking and higher order thinking, metacognition and reflection, and brain research and learning. Synectics also overlaps many other effective teaching models and strategies. Synectics shares several of the benefits also exhibited by direct instruction, concept development, cause-effect and creative problem solving, inductive thinking, memorization, case study, classroom discussion, and group investigation. Other benefits include, but are not limited to increased understanding about a particular topic or issue, enhances ability to apply knowledge, adaptable to a variety of teaching/learning situations, teacher becomes facilitator, and learners discover what they already know. It fosters new ideas, divergent thinking

& problem solving skills increased, promotes collaborative work, study skills, & camaraderie; helps to jump start the creative process, promotes positive youth development, promotes creativity, can be used for social-emotional lessons, redefines writing process, new insights into otherwise boring or uncomfortable topics. It also helps in retention of new information, explores social & disciplinary problems, internalizes abstract concepts, increased language acquisition, provides a 3-D view of the problem, promotes empathy, used to overcome mental blocks, works best with a diverse group of learners, promotes free thinking, new & surprising solutions to problems, mobilizes both sides of the brain, furnishes (new) insight into problem solving, all ideas have some good qualities, aids learners in finding novel approaches & alternative views to problem solving; and aids in drawing relevant connections between seemingly unrelated concept.

Synectics encourages the ability to live with complexity and apparent contradiction, stimulates creative thinking, mobilizes both sides of the brain (the right brain - the dreamer, and the left-brain - the reasoner), and provides a free-thinking state of consciousness (Roukes, 1997; Trevor, 2009). Just as all learning theories and teaching models are not without fault, synectics is found to contain some drawbacks as well. Syque (2010) stated that pitfalls to synectics include, but may not be limited to: multiple steps, process can be complicated, process can be cumbersome, requires more time than other brainstorming processes, and requires more effort than other processes.

In conclusion, synectics employs metaphor and analogies in breaking mental block and limited thinking; as familiar or strange concepts are related with strange or familiar ones respectively, new conceptual perspectives, meaning and products result. This characteristic feature of synectics connects the left brain knowledge/logical domain with the right brain innovative/creative domain into a unified productive whole. Synectics is a relevant tool for enhancing creative production and fostering whole brain learning of high ability pupils in Nigerian regular school system.

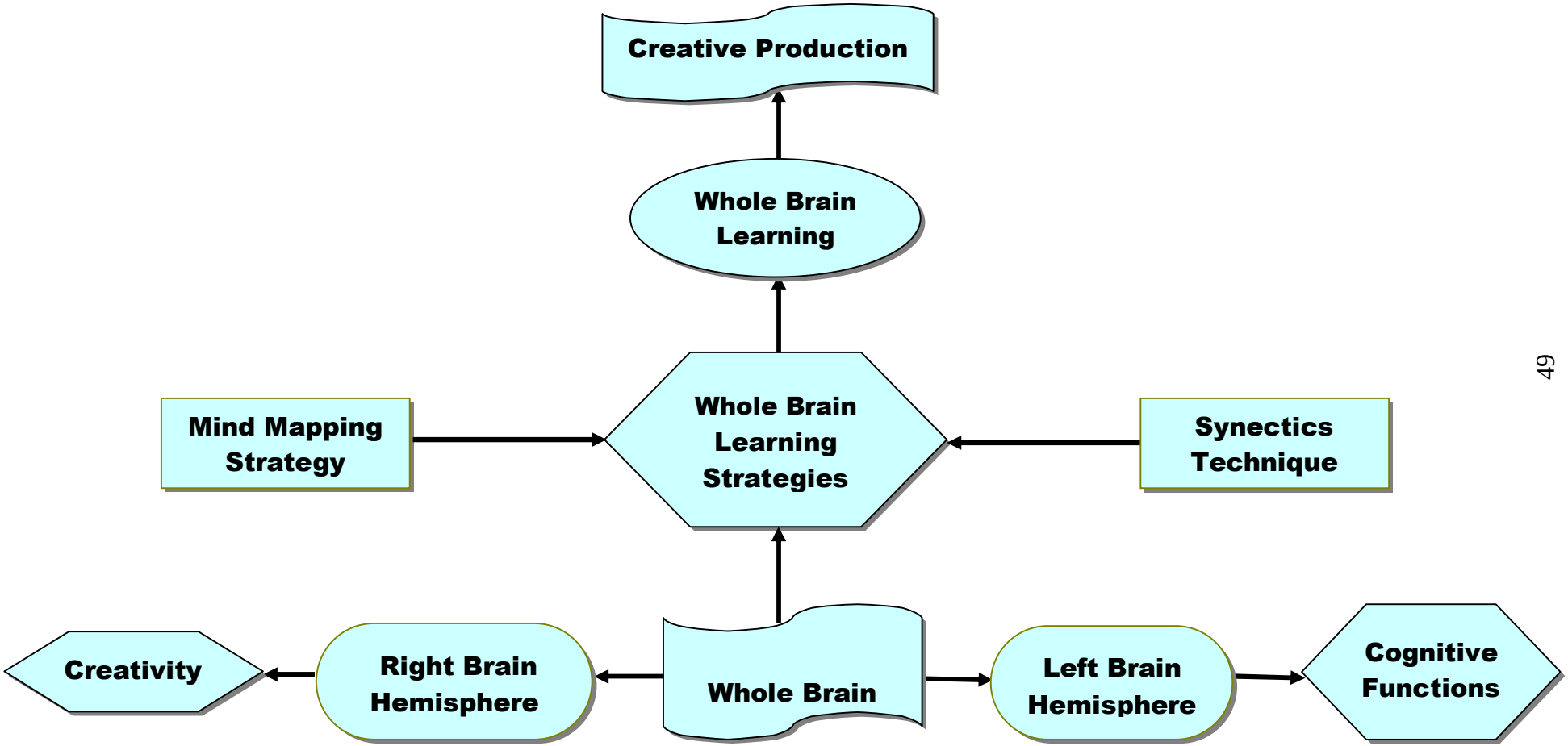


Figure 1: Schematic Diagram of Conceptual Framework Showing Relationship among Key Variables and Expected Outcome

THEORETICAL FRAMEWORK

Theory of Brain Hemisphericity

American neuropsychologist Roger Wolcott Sperry developed the right brain-left brain theory in 1960. Roger Sperry with his colleagues Philip Vogel and Joseph Bogen, and Michael Gazziniga performed a breakthrough split-brain surgery on three epileptic patients. They tested these patients and discovered that the two hemispheres control vastly different aspects of thought and action. They found the left (controlling the right side of the body) is dominant for language, speech, analytical and logical thought, while the right (controlling the left side of the body) excels at visualising, holistic and unstructured tasks (Sperry, 1961).

This theory of the structure and functions of the mind suggests that the two different sides of the brain control two different modes of thinking. It also suggests that each person prefers one mode to the other. The left brain/right brain theory proposes that the two hemispheres process information differently. According to this theory, the left hemisphere specializes in sequences, logic, language, and parts of a whole. Art, music, visuals, and the big picture stimulate the right hemisphere of the brain. Learners benefit when instruction engages both hemispheres.

In relation to this study, the Theory of Brain Hemisphericity explains the two hemispheres of the brain as responsible for specialize functions for creativity and intellectual potentials. Thus, using appropriate integrative teaching and learning programmes such as mind mapping and synectics are appropriate to harness and develop vast resources of the brain, and meet the needs of high ability children; unlike ones that addresses only a segment of the brain.

Ned Herrmann's Whole Brain Model

Ned Herrmann in 1976 researched the brain as the source of creativity and showed that by incorporating the research of Paul McLean of the Triune Brain and Roger Sperry's Left Brain/Right Brain function, a model of the human brain with two paired structures could be built (the two halves of the cerebral system and the two halves of the limbic system). This allows differentiating not only the more popular notions of left/right brain, but also the more sophisticated notions of cognitive/intellectual which describes the cerebral preference, and visceral structured/emotional which describes the limbic preference (Herrmann, cited in Hermann, 1996; 12manage, 2013).

At birth, the brain is without developed preferences, and, is therefore, essentially whole. As the brain matures, it acquires preferences because of the individualôs life experiences. The developing brain is; therefore, an evolving coalition of many different preferences (Hermann International, 2000). Whole brain learning theory explains that the brain processes information

through effective instruction. Whole brain learning theory divides the brain into four quadrants: the logical, fact-based brain; the sequential, detail-integrating brain; the conceptual big-picture brain; and the interpersonal, kinesthetic brain. Whole Brain Learning approach maximizes the correlation between instruction and brain types by offering instruction to meet as many different brain quadrants as possible. It results in learning solutions that provide real-world scenarios and problem-solving activities to engage the learner by stimulating all parts of the brain.

Another important concept to understanding Ned Herrmann's Whole Brain Model is dominance. The evidence of human dominance shows that wherever there is two of anything in the body, one is naturally dominant over the other. Dominance, such as handedness occurs between two parts of a physically living whole. Dominance is perfectly normal and natural. It is part of the human condition, and all human beings experience its consequences everyday. The human body is made up largely of paired structures, most of which are not perfectly matched. Stated differently, the apparent mirror image symmetry of the human body (arms, legs, face, eyes) is in reality an array of asymmetrical parts. This fundamental asymmetry leads to the concept of dominance (Hermann International, 2000).

In the case of hands, feet and eyes, these dominances are obvious. For example, the dominant hand is used more frequently than the non-dominant hand; therefore, it becomes stronger and more capable. In the case of the brain, the preference to think in particular ways results in more frequent use of that particular brain part (one hemisphere or one limbic half) with the resulting development of greater competency for that set of mental activities that are located in the parts. Just as the less developed non-dominant hand assists the stronger, more skillful dominant hand, the less developed brain structures collaborate with the more preferred (and therefore dominant) thought processes of the brain in order to fully apply manôs best mental ability to everyday tasks and events. Therefore, it is natural for the brain to form a coalition of the structures in order to deal with complex situations (Herrmann cited in Hermann, 1996; Hermann International, 2000).

Ned Herrmannôs Whole Brain Theory identifies the learning preferences, brain dominance and frustrations of learners. High ability children in Nigerian regular schools particularly the right brain dominant ones would be served, and their rare creative and cognitive/intellectual potentials optimized if whole brain learning strategies are incorporated into education service delivery. Thus, the use of mind mapping and synectics learning strategies would mitigate diversity of learning preferences and frustrations evident in schooling among

high ability children, giving way to a greatly enriched child centered whole brain learning environment.

Theory of Multiple Intelligences

In 1983 American psychologist Howard Gardner proposed a theory that sought to broaden the traditional definition of intelligence. Gardner felt that the concept of intelligence, as it had been defined by mental tests, did not capture all of the ways humans can excel. Gardner argued that man does not have an underlying general intelligence, but instead multiple intelligences, each part of an independent system in the brain.

In formulating his theory, Gardner placed less emphasis on explaining the results of mental tests than on accounting for the range of human abilities that exist across cultures. He drew on diverse sources of evidence to determine the number of intelligences in his theory. For example, he examined studies of brain-damaged people who had lost ability, such as spatial thinking, but retained another, such as language. The fact that two abilities could operate independently of one another suggested the existence of separate intelligences. Gardner also proposed that evidence for multiple intelligences came from prodigies and savants. Prodigies are individuals who show an exceptional talent in a specific area at a young age, but who are normal in other respects. Savants are people who score low on IQ tests and who may have only limited language or social skillsð but demonstrate some remarkable ability, such as extraordinary memory or drawing ability. To Gardner, the presence of certain high-level abilities in the absence of other abilities also suggested the existence of multiple intelligences.

Gardner initially identified seven types of intelligence and proposed a person who exemplified each one. The seven types of intelligences are:

- Verbal-linguistic
- Logical-mathematical
- Visual-spatial
- Body-kinesthetic
- Auditory-musical
- Inter-personal communication
- Intra-personal communication

Linguistic intelligence involves aptitude with speech and language and is exemplified by poet T. S. Eliot. Logical-mathematical intelligence involves the ability to reason abstractly and solve mathematical and logical problems. Physicist Albert Einstein is a good example of this intelligence. Spatial intelligence is used to perceive visual and spatial information and to

conceptualize the world in tasks like navigation and in art. Painter Pablo Picasso represents a person of high spatial intelligence. Musical intelligence, the ability to perform and appreciate music, is represented by composer Igor Stravinsky. Bodily-kinesthetic intelligence is the ability to use oneôs body or portions of it in various activities, such as dancing, athletics, acting, surgery, and magic. Martha Graham, the famous dancer and choreographer, is a good example of bodily-kinesthetic intelligence (Gardner in Lazear, 1999).

Furthermore, Interpersonal intelligence involves understanding others and acting on that understanding and is exemplified by psychiatrist Sigmund Freud. Intrapersonal intelligence is the ability to understand oneôs self and is typified by the leader Mohandas Gandhi. In the late 1990s, Gardner added an eighth intelligence to his theory: naturalist intelligence, the ability to recognize and classify plants, animals, and minerals. Naturalist Charles Darwin is an example of this intelligence. According to Gardner, each person has a unique profile of these intelligences, with strengths in some areas and weaknesses in others.

Gardnerôs theory found rapid acceptance among educators because it suggests a wider goal than traditional education has adopted. The theory implies that traditional school training may neglect a large portion of human abilities, and that students considered slow by conventional academic measures might excel in other respects. Gardner is a strong believer in the plurality of intelligences and does not consider these the definitive set.

The visual-spatial seems to have some aspect of right brain styles. The logical-mathematical intelligence seems a questionable grouping. Arithmetic is often associated with the left-brain sequential processing yet there is good evidence that mathematically gifted children tend to be left handed implying right-brain dominance. This could reflect a difference between early mathematics, which is often repetitive rote learning, and more advanced mathematics, which often requires high levels of visual-spatial reasoning and abstract thinking. The naturalistic grouping is also questionable, some very different skills such as classifying flora and fauna (very much an analytical/sequential skill in Herrmann's system) to immersing in a natural setting - accessing emotional and holistic preferences.

As it relates to this study, the theory of Multiple Intelligences supports whole brain learning and creative production of high ability children. This is because the brain endows each learner with potential abilities, which require interhemispheric processing of the brain in order to develop; unlike traditional belief in narrow concept of intelligence. Thus, application of mind mapping and synectics could engage verbal/linguistic, visual/spatial, logical and intrapersonal

(avid imagination) intelligences, and stimulate other potentials of learners in regular school system.

Enrichment Triad Model

The original Enrichment Triad model was developed in 1977 and implemented by school districts primarily in Connecticut (Renzulli & Reis, 1997). This model was designed to encourage the creative productivity of young people by exposing them to various topics, areas of interest, and fields of study; and to further train them to apply advanced content, process-training skills, and methodology training to self-selected areas of interest. Renzulliôs enrichment triads are both a programme delivery service and curriculum programme. It simply means providing richer, more varied educational experiences. In modifying a programme, it could entail working on the content or the teaching strategies to be employed.

The general goals of enrichment are to offer curriculum that is deeper in depth or breadth than the one generally provided. The enrichment triad is based on the precept that all learners are unique, so all learning experiences must take into account their abilities, interest and learning styles. Learning is more effective when students enjoy what they are doing. In addition, it is more meaningful and enjoyable, when content and processes are learned within the context of a real and presenting problem. Hence, the assumption that formal instruction may be used in enrichment learning and teaching as far as knowledge and thinking skills are enhanced, while students construct their own meaning (Onu, 2001).

Enrichment Triad Model as the name implies, has three interactive stages of activities. These stages are designated Type I, Type II, and Type III. The Type I enrichment is designed to expose students to a variety of disciplines, topics, occupations, hobbies, persons, places, and events that ordinarily would not be covered in the regular curriculum. In schools that use this model, an enrichment team consisting of parents, teachers, and students often organize and plan Type I experiences by contacting speakers, arranging mini-courses, demonstrations, or performances, or by ordering and distributing films, slides, videotapes, or other print or non print media (Renzulli & Reis, 1997). Through this, they are consolidating their abilities to pursue independent projects.

Type II enrichment consists of materials and methods designed to promote the development of thinking and feeling processes. Type II enrichment is general, consisting of training in areas such as creative thinking and problem solving, learning-how-to-learn skills such as classifying and analyzing data, and advanced reference and communication skills. The development of general and specific skills is in four categories:

1. Cognitive and affective thinking (covers creative thinking, problem-solving, decision-making, critical and logical thinking; affective processes such as appreciating and valuing).
2. Skills learning such as listening, observing, perceiving, reading, note-taking, outlining, interviewing and surveying, analyzing and organizing data.
3. Advanced research skills and reference materials that prepare students for Type III investigations, including use of library, information retrievals systems and community resources.
4. Written, oral and visual communication skills that will be directed toward maximizing the impact of studentsô products.

Type III enrichment occurs when students become interested in pursuing a self selected area and are willing to commit the time necessary for advanced content acquisition and process training in which they assume the role of a first hand inquirer. Type III enrichment deals with individuals or small groups research projects aimed at making creative children become actual researchers, artists, scientists etc.

As it relates to this study, Type II enrichment consists of training in areas such as creative thinking, problem solving, learning-how-to-learn skills, among other cognitive and affective process skills. Thus, the mind mapping and synectics training programmes provides a Type II Enrichment package for enhancing creative production and other cognitive potentials of high ability children; thereby meeting their developmental needs in a whole brain learning state. It equally provides high ability children with ample opportunity to explore activities of interest, acquire additional skills, complete challenging tasks beyond regular education provisions.

Synectics Theory

William J.J. Gordon & George Prince developed the synectics approach to problem solving in 1960 (Gordon, 1961). They observed that business meetings had inconsistent results. After hours of studying tapes from meetings, they determined the success factor to be free-form brainstorming. This brainstorming process in an open, non-judgmental climate paired with analogies and metaphors led to more creativity and innovation.

Synectics is a theory or system of problem-stating and problem-solving based on creative thinking that involves free use of metaphor and analogy in informal interchange within a carefully selected group of individuals of diverse personality and areas of specialization. Gordon later adapted synectics for classroom use. Teaching approaches using metaphors and analogy increase the understandings of students about a particular topic or issue. They can also help

develop studentôs ability to think creatively since they can deliberately force strange things together and form uncommon connections.

Gordon based synectics on the concept that traditional thought should be challenged. Synectics theory is based on four goals and assumptions that revolve around creativity: first, that creativity is important in the problem solving process, creativity is not mysterious, creative invention is similar in all fields, and individual & group invention are similar. The synectics approach is based on the psychology that creative capabilities can be developed. Creativity is an emotional process that aids intellectual processes, and understanding the irrational aids in problem solving success. Gordon (1961) noted that synectics theory plays with seemingly irrelevant words that prompt new viewpoints with respects to problems. Synectics incorporates metaphors and analogies to promote creativity. Direct analogies are based on the comparison of seemingly unrelated topics, ideas, objects among others. Personal analogies enhance understanding when the participant is asked to become the topic, idea, or object. Compress conflict is the comparison of opposing statements or terms. A full synectics approach would include a step-by-step process using each of these analogies in a particular pattern. Synectics participants attempt to adapt an apparently out-of-focus view of some aspect of the known world. Using analogies, they make new connections between the familiar and the strange. As participants transcend both the usual ways of perceiving and the usual expectations about how the world will respond, their production of ideas increases.

Through *synectics excursion,* a group problem solving activity in which participants are stimulated to think creatively under a loosely structured system, time analogies are transformed into workable solutions. The synector is responsible for directing the group through the step of a flow chart and for deciding which type of analogy to use. Gordon and his colleagues developed operational mechanisms for initiating and sustaining these states. The synectics theorists then fit the analogies into a flow chart by which the synectics session or excursion could be conducted.
Teacher/facilitators use synectics in the classroom by leading students through a process which results in a three dimensional view of a "problem" in order to create solutions. Although this process appears a bit cumbersome, the resultant scope and depth of options will justify the time spent. With synectics, the teacher becomes the facilitator. Competence in this process by the teacher is imperative. Students experience intrinsic rewards through satisfaction and pleasure in leading the activity and learning from the activity. Teachers and students must note that all ideas, regardless of how far-fetched or bizarre they may seem must be accepted.

Teachers must guide students away from making premature judgment for the problem being solved. Synectics can be used across the curriculum or as part of interdisciplinary learning. Applications of synectics are numerous and include creative writing, exploring social problems, problem solving, creating a design or product, and scientific investigations. Other academic benefits include broadening concept perspectives and understanding, correcting misconceptions, and generalizing learning. The synectics process is both instructional and nurturing to its participants. Instructional effects include promotion of cohesion and productivity in the classroom, development of tools for metaphoric thinking, and increased problem solving capabilities. Nurturing effects include development of positive self-esteem in students, increased risk-taking by participants, and higher achievement of curricula content.

Regardless of whether the full synectics model, stretching exercises, or a modified version of the model is used, there are general guidelines for the teacher to ensure success of the process. The classroom environment should promote feelings of cooperation, openness to express oneôs opinion and explore new ideas, be non-judgmental in nature, and foster class and group discussions. Graphic organizers may be used in conjunction with synectics to promote learning and understanding. Synectics can be assessed through discussion, graphic organizers, projects, writing, etc. To be most advantageous, the process should be implemented daily in some form. Diversity creates an optimal environment for synectics. Teachers need to ensure that student groups include learners with varying backgrounds/experiences, academic abilities, and different knowledge bases. The teacher/facilitator is to monitor the process not the content.

As it relates to this study, synectics model facilitates whole brain processing and creativity in generating novel and original products by connecting an already known concept, perspective or problem with seemingly unrelated ones using metaphor and analogies. Thus, a new perspective is created as the logical and rational left brain (the known) meet the creative and innovative right brain (unknown).

Cognitive Constructivism

Cognitive Constructivism evolved in the early part of the 20th century when behaviourism dominated educational theories and research. Cognitive constructivism is based on the work of Swiss Developmental Psychologist Jean Piaget. Piaget's theory has two major parts: an "ages and stages" component that predicts what children can and cannot understand at different ages, and a theory of development that describes how children develop cognitive abilities. Cognitive Constructivism is a model of learning in which a student does not learn by receiving a transmission, but by interpreting a message. It is concerned with the individualôs active

construction of meaning. The focus is on meaning-making and knowledge construction, not memory for information. This implies that students must engage with and take some responsibility for their learning. Cognitive Constructivism is an orientation that emphasizes the active role of the learner in building understanding and making sense of information.

Cognitive Psychology views learning as an idea of mental constructions or schemes. Such schemes are used by learners to interpret new physical phenomena and these schemes are actively constructed by the learners. Learners do not simply absorb what they are told or what they read. Learning involves the learner in bringing existing schemes to bear on physical concepts in an attempt to understand them. This implies that what is learnt depends not only on the features of the physical concepts presented but also on the schemes the learner has available. Therefore, learning process is an interaction between mental schemes of the learner and features in the learning environment. That is to mean students constructing their meaning from their experiences.

Constructivism indicates that each learner must put together ideas and structures that have personal meaning so to learn. In other words, an individual actively generates his own meanings. Learning is regarded as a social activity in which learners are engaged in constructing meaning through activities, discussions and negotiations among peers, students and teachers. Learnersô individual constructions of meaning occur when their ideas are compared, explored and reinforced in social settings with each student having the opportunity to recognize his or her ideas through talking and listening. Through social interaction, learner becomes aware of other ideas, and sees confirmation of their personal construction.

There are five guiding principles of constructivism. The first principle is posing problems of emerging relevance to students. The second principle, which is structuring curriculum around primary concepts, is a critical dimension of constructivist pedagogy. Much of traditional education breaks whole into parts and then focuses separately on each part. However, students are most engaged when problem and ideas are presented holistically rather than in separate, isolated parts. When designing curriculum, constructivist teachers organize information around conceptual clusters of problems, questions and discrepant situations. With curricula activities clustered around concepts, students can select their own unique problem solving approaches and use them as springboards for the construction of new understandings.

The third principles talks about seeking and valuing studentsô point of view. Seeking and valuing studentsô point of view is essential to constructivist education. Awareness of studentsô

point of views is windows into their reasoning, helps teachers challenge students, making school experiences both contextual and meaningful. It is entry point to personalized education.

The fourth principle discusses the issue of adapting curriculum to address studentsô suppositions. Learning is enhanced when the curriculumôs cognitive, social and emotional demands are accessible to the students. If suppositions are explicitly addressed, most students will find lessons bereft of meaning, regardless of teacher or material effectiveness. Most crucial in the constructivist instructional approaches is the fifth principle that discusses assessing studentsô learning in the context of teaching. Posing narrow questions for which one seeks a singular answer denies teachers the opportunity to peep into studentsô minds.

As it relates to this study, cognitive constructivism is centered on the needs of each learner rather than the teacher. Thus, high ability children are afforded the educational climate that fosters individualized learning and pacing, right brain holistic processing (whole to part), and creativity as each learner construct knowledge based on personal experience. While curriculum could be restructured around certain topics or adapted to serve the needs of high ability children by enriching with skill training, constructivism supports application of graphic organizer such as mind mapping in representing knowledge, and synectics through the use of analogies in creating new concepts out of familiar ones.

Strategies Integration Model

One of the most popular and well articulated strategies instructional approach according to Nichy News Digest (1997) is the Strategies Integration Model (SIM) which emerged from the research conducted at University of Kansas. In using this model, the teacher selects a strategy based on the studentsô need, which should be clearly linked to the task the students are to perform. This model follows some steps, which serve as useful guide on how actual instruction should proceed.

(a) ***Pretest and commitment*** - Pretest students and get them interested in learning the strategy. This is done to know how much the students already know about the strategy and therefore, secure their commitment to learning the strategy. Research has shown that when students are told that they will learn a strategy that can help them in reading or writing, they tend to perform better than those who were only told to do their best (Schunk and Rice, 1989). It is therefore important to teach students the strategy and ensure they understand how it can help them. The material used in the pretest will be similar to those used in the classes. There is the need to get the students committed to the strategy to make them aware that

their participation in learning and using the strategy is vital to their eventual success.

(b) ***Describe the strategies*** - Describe the strategy and in doing this, the teachers should present the strategy with suitable examples and then have the students discuss various ways the strategy can be used. A clear definition of the strategy should be given and the teacher should identify real assignments in which students can apply a strategy while students should be told the various stages involved in learning the strategy. During this stage, the class may identify how this new approach differs from ones currently in use.

(c) ***Model the strategies*** - Model the strategy. The teachers use this strategy to perform a relevant classroom task; talking aloud as they work so that the students can see what the person does while using the strategy. Lenz, Ellis and Scanlon (1996) advised that teachers should model the strategy in such a way that the students should make their own input.

(d) ***Controlled practice and feedback*** - Practice the strategy so that the students should be given opportunities to practice the strategy. The students should be required to ćthink aloudô as they practice the strategy. In doing this, they should start with materials that are slightly below their comfort level and gradually be introduced to content that is more difficult.

(e) ***Grade-appropriate practice and feedback*** - The next step is practice on grade appropriate materials with which the students is working in the special education class. This step usually takes 5 to 10 instructional periods, and chart of progress is kept during this phase. Provide feedback since these feedbacks are very critical in helping students use the strategy effectively.

(f) ***Generalization, Post-test, and communication*** - The last step is generalization. Promote the application of this strategy in novel situations. The student is trained to apply the strategy to materials from the regular classes. Wood, Rosenburg and Carran (1993) observed that merely exposing the students to strategy training is insufficient for proper strategy training and learning. In other words, the strategy should be generalized and applied to various settings and tasks. Instruction is provided on how to choose an appropriate task for the strategy that has just been mastered. Initially, during this phase, the special education teacher will check the

assignments in order to assess strategy usage. Finally, during this phase, maintenance is emphasized by occasional post checks of strategy application.

The Strategy Integration Model would provide a systematic procedure for applying and evaluating effects of the validated training programmes on high ability pupils in the school setting.

RELATED EMPIRICAL STUDIES

Studies on Whole Brain Learning

In keeping with on going researches in kinesiology, physiology of the brain and learning, studies on whole-brain learning have been conducted on human behavior, in order to determine its effects on learning and creativity. Nonetheless, the findings of these studies are mixed; some supported its effectiveness, while others found its effect not significant.

Campbell (2008) study is concerned with determining whether the application of Ned Herrmannôs ñwhole-brainò model would affect violin teaching in any way. The researcher set out to determine whether the use of whole-brain development would lead to any significant changes in the learning process. For a period of two school terms, case studies using action research were conducted on five of the learners that received instruction from the researcher. The research participants were so chosen as to make the experimental group as homogenous as possible. Data was collected qualitatively by means of diaries and was presented descriptively. Every week the learners received a printed copy of the homework exercises. They recorded their feedback weekly, in their diaries. The researcher, as the teacher of the learners, made weekly observations during lessons. During this research, the process of triangulation was used. This process added validity to the study as information about specific aspects was gained from three different perspectives, namely, that of the learners, the teacher and the learnersô accompanists. The accompanists gave their feedback before the start of the research and again at the end. After applying Herrmannôs model for two terms, the following became apparent: The learners practiced more, were more motivated and there was a general improvement in their attitude. The learners felt that having received a printed copy of the exercises, a whole brain exercise in itself, had helped them to know what and how to practice.

There was a significant change in the playing of the majority of learners (three of the five). The learners, where significant changes were not apparent in their playing, indicated that their understanding of their practicing methods and playing had increased. The learners felt that they had benefited from the experiment as they all indicated that they would like future lessons to be conducted in the same manner. In view of the positive outcome of the research, and given

that this was a pilot study, the researcher suggests that similar studies conducted using larger numbers of learners, involving a longer period and a control group would also render the findings more conclusive. The researcher also suggests that violin teachers become knowledgeable about learning styles and whole-brain learning if they wish to reach all learners and enable them to achieve their potential. As it relates to the present study, Campbell (2008) study is similar in that it was conducted on high ability pupils; however, it differed in research design, location and sample size. While Campbell (2008) was a case study conducted on five high ability violin students for two terms, the present study is a quasi-experimental study conducted on twenty-one high ability pupils and lasted for one term.

Dejager (2008) conducted an evaluation of brain gym as a technique to promote whole brain learning - a personal and professional perspective. The aim of this research study was to scrutinize brain gym as a technique that promotes whole brain learning and contributes to learner success and independence. This scrutiny was approached from a personal and professional leadership perspective, whose domain is (amongst others) the value of self-mastery through mental and emotional-state management resulting in self-actualization. A multi-layered action research strategy was followed with incorporating concept analysis, a descriptive and analytical literature study, qualitative and quantitative research methods and programme development. Only the following concepts were evaluated: logic and gestalt brain integration, crossing of the visual midline, eye-hand co-ordination, self-image, mathematical computation, and concentration. Developing and implementing a brain gym programme for a period of six weeks and evaluating the resultant changes examined causality.

Quantitative data was collected by means of the Aptitude test for School Beginners and qualitative data through focus group interviews and artifacts. The qualitative data was analyzed by means of descriptive and inferential statistics, and yielded no significant results, which indicate that the brain gym intervention did not have a measurable effect on their ASB test scores. Feedback from the principal educators, facilitators and the researcher indicated a noticeable improvement in all six concepts means of analysis. The findings indicated that the learners have improved on a physical, emotional and social level in terms of sensory integration, confidence, attitude, concentration and motivation. Due to the research period only being six weeks and thus inadequate for measurable cognitive development, it may account for the lack of improvement on a cognitive level. It can be concluded that a brain gym is a technique that can stimulate the whole brain state and as such address the vast array of learning difficulties effectively in the classroom conditional to regular implementation and for a period longer than 6

weeks. In relation to the present study, both studied whole brain learning as dependent measure. Both studies also differed on the treatment variables used, treatment duration, techniques for data collection. While Dejager (2008) study lasted for a period of six weeks; and test, interviews and evaluation of artifacts used as techniques of data collection, the present study lasted for eight weeks, test only was used for data collection.

Walker (1995) studied how after-school fine arts programme was developed at J. W. Sexton High School (Lansing, Michigan), based on the premise that participation in the fine arts, particularly by African Americans would lead to higher grade point averages and a greater commitment to school life. A review of relevant literature revealed a number of reasons for low academic achievement in African American children, including low self-confidence and non-supportive school environment. Research on brain hemisphericity and learning theory, integration of fine arts to enhance whole brain learning, and motivation and engagement of students in school life also supported the Sexton High School programme. The programme was designed to give participants confidence to join clubs, take academic risks, and become part of band, orchestra, drama, forensics, etc. during the next semester or year. Total number of programme participants was 68, of whom 54 were considered "at risk."

During the study, 45 percent of the participants increased their grade point average, 100 percent of participants joined a school club or sport, and school staff noted an improvement in the behavior of participants. Parents involved in the programme reported positive changes in their children's home and school behavior. The findings suggested that students are unsuccessful at school not because they lack the mental ability to perform the tasks, but because they lack responsible behavior. Fine arts require higher order thinking skills, individual and group efforts, and an atmosphere of controlled freedom. In this particular high school, the programme supported the theory that whole brain development is critical to learning theory and should assure the inclusion of fine arts in the school curriculum and extra-curricular activities. The programme also supported the premise that students involved in student life make a greater commitment to their academic achievement, and hence have greater success in high school. The present study differed from Walker (1995) as follows: while fine art integration programme, 54 at risk out of 68 participants from post-primary school population in African American people group formed the population for Walker (1995) study, mind map and synectics integration in English Composition was used as technique for enhancing creative production and whole brain learning, twenty-one high ability pupils selected from Nigerian primary school engaged in the present study.

Khalsa (1986) conducted a quantitative study using whole-brain learning activities with learning disabled students, ages seven to eleven years old. The six-week study measured the psychomotor skills of the children. Students were randomly assigned to three groups. One group did Dennison Laterality Repatterning prior to using whole-brain learning activities. Dennison Laterality Repatterning is a series of activities that reestablish efficient, integrated patterns among cross-lateral movements, vision and hearing. The second group used only whole-brain learning activities. The third group had no interventions. The two groups that used whole-brain learning activities showed improvement in psychomotor skills, while the control group showed no improvement. Result of the study suggests that whole brain learning activities may influence psychomotor skills. The method of data analysis was not reported in this study.

In a second study, Sifft and Khalsa (1991) researched on college students. They used the same three categories as the previous study, repatterning with whole-brain activities, whole-brain activities alone, and no intervention. The period for this study was 10 minutes. Results indicated that the groups using whole-brain learning increased in their psychomotor skills, while the control group did not. These results were similar to the previous study. However, Khalsa (1986) and Sifft & Khalsa (1991) studies are related to the present research in that they involved three experimental groups, out of which one provided training on whole brain learning activities, while the second on creativity. Though the third group had no intervention, in the present study they received conventional instruction. Khalsa (1986) and Sifft & Khalsa (1991) studies differed in that they were conducted in a foreign culture, and on learning disabled students; while the present study on high ability pupils.

While Khalsa (1986) and Sifft and Khalsa (1991) found positive results, Templeton and Jensen (1996) did not. Templeton and Jensen (1996) studied fourth graders, using the brain gym as a model for seven weeks. They used Fraserôs ôMy Class Inventoryô prior to the start of the programme and at the end. In addition, they interviewed the students. Templeton and Jensen concluded that the overall classroom environment (being a stick, traditional classroom environment) as perceived by the students, had not improved. They also noted that the majority of the studentsô grades did not change, positively or negatively. Templeton and Jenson, through the interviews, found that the students did feel better about themselves, having a way to improve their grades and behavior. They also suggested that the teacherôs negative attitude toward the programme affected the results. The results of this study do not support positive effects of using whole-brain learning activity (brain gym) on student achievement. Templeton and Jensen (1996) study experimented using brain gym (a whole-brain learning activity) as treatment for improving

studentôs achievement, unlike the present study that experimented on effects of mind maps and synectics on creative production and whole-brain learning.

Another study with negative result was conducted by Witcher (2001). Witcherôs study was a year-long study in rural Southeast Virginia with kindergarten children. She used eight kindergarten classes from two different schools to determine whether whole-brain learning activities influenced emergent literacy skills. She also compared the effects of whole-brain learning activities on low and high achievers, boys and girls, and social economic status, with a control group. The classes were randomly, but evenly assigned within each school to perform the activities or to be in the control group. The teachers gave the general explanation of the activities and led the activities for the classes that participated in the activities. Activities were done twice a day, first thing in the morning and in the afternoon. Six whole-brain learning activities were included in the study. Two activities from the three main types of whole-brain learning activities were used, midline movements, lengthening activities, and energy exercises and deepening attitudes.

Witcher used the Phonological Awareness Literacy Screening test to measure the studentsô reading abilities at the beginning and end of the school year. At the end of the year, the childrenôs reading scores were assessed. There was no significant difference in results for emergent literacy skills, regarding the different classifications of students, between the treated group and the control group. Witcher concludes that the findings of this study fail to support the overall effectiveness of brain gym exercises for enhancing the learning-to-read skills acquired by kindergarten students during one school year. The results of this study also do not support positive effects of using whole-brain learning activities on emergent literacy skills. As it relates to this study, Witcher (2001) was a year long longitudinal study conducted on eight intact kindergarten classes from two schools in rural community of Southeast Virginia State in US, while the present study is a quasi-experimental study conducted on twenty-one high ability pupils from three urban schools in Nigeria. Whereas, the former study focused on emergent literacy skills, the latter focused on creative production and whole-brain learning.

In sum, findings made on this empirical review are mixed. While some studies found significant effects of some strategies such as brain gym, Hermann Brain Dominance Instrument, Dennison laterality repatterning, Fraserôs my class inventory, phonological awareness in improving teaching process and learning outcome in subject areas, others did not find any significant effect. However, no study was found in literature conducted on effect of whole brain learning strategies on creativity in the Nigerian context. Also, these studies reviewed were

conducted only on diverse learners in other cultures, hence the need to examine effect of mind mapping and synectics in enhancing whole brain learning and creative production of high ability pupils in Nigeria.

Studies on Creative Production

Onu, Eze, & Onuigbo (2008) examined effect of training on ideational fluency in increasing creativity of students in Nigeria. Sixty junior secondary school students constituted the sample size. The study was a quasi-experimental design, with a researcher developed instrument for idea generation which required students to ask questions on what, where, when, why and how an ambiguous event occurred, suggest reasons for the event, predict what happened before, and possible consequences of actions. The findings of the study were analyzed using Analysis of Covariance (ANCOVA) show that students in the treatment groups obtained a greater mean score than those in the control condition, and a significant effect of ideational fluency in generating divergent ideas. Therefore, creative production seems to be enhanced in schooling adolescents when they are trained to apply creative technique in strand. Onu, Eze, & Onuigbo (2008) study differed in that it used intact class sample, a 60 high sample size of junior secondary school students, and ideational fluency technique in enhancing creativity; while the present study used a special group of 21 high ability pupils selected from three urban primary schools, mind mapping and synectics as treatment variables. However, both studies share similarities in terms of quasi-experimental research design, method of data analysis, and area of the study.

Zenasni, Besançon & Lubart (2004) examined the relationship between creativity and tolerance of ambiguity. Sixty-eight French volunteer participants consisting of 34 pairs of adolescents and their parents took part in this study. Adolescents ranged in age from 11 to 17. There were 14 girls and 20 boys. Parents ranged in age from 39 to 61. There were 28 mothers and 6 fathers. Three measures of creativity were used: a divergent thinking task, a story-writing task and a self-evaluation of creative attitudes and behavior. Participants completed two self-report measures of tolerance of ambiguity: the short version of the ñMeasurement of Ambiguity Toleranceò and the ñBehaviour Scale of Tolerance/Intolerance for Ambiguityò. Adolescents have to indicate which parent spent the most time and knew him or her best. Tolerance of ambiguity was significantly and positively related to creativity. Creativity of parents was related to their adolescentsô creativity. However, parentsô tolerance of ambiguity was not related to adolescentsô tolerance of ambiguity or creativity. Zenasni, Besançon & Lubart (2004) study could be related to the present study in terms of similarity of dependent measure (creativity), measures of

creativity using divergent thinking task, a story-writing task, and a self-evaluation of creative attitudes and behavior. However, it differed across the sample type, sample size and area of the study.

Eisenstadt (1966) studied problem-solving ability of creative and non-creative college students. College students were given Guilford Alternate Uses, Guilford Consequences and an Anagram test which determined a creative and noncreative group. Rebus puzzles comprised of a neutral and threat categories were administered to 4 subgroups formed to control set and practice effects. The heightened ability of creative students to observe accurately was supported by significant findings: faster solution times, and increased number of solutions under an incomplete information condition. Results failed to confirm the hypothesis that creative individuals respond differentially in a threat situation. The third significant finding obtained was that creative students gave up on puzzles they could not solve faster than noncreative students. Eisenstadt (1966) study differed in that it examined only creative problem solving ability of mixed students in tertiary education using Guilford Alternate Uses, Guilford Consequences and an Anagram test as methods of data collection; while the present study is focused on creativity of high ability pupils only, investigating how mind map and synectics affect it and their whole brain state. However, both studies were similar in terms of their interest in creative productivity.

Kim and Michael (1995) studied the relationship of creativity measures to school achievement and to preferred learning and thinking style in a sample of Korean high school students. The two major purposes of this study were to ascertain from a sample of 193 11th grade Korean high school students (92 males and 101 females) the extent to which performance in selected measures of creativity involving both verbal and visual tasks was related to school achievement as revealed by a quantitative indicator and the expressed preference for a given learning and standardized measures (style of learning and thinking by Torrance) intended to portray left-brain, right-brain, or an integrated left-brain right brain function. A secondary purpose was to identify possible gender differences of Korean students in the variables under study. The following conclusion became evident. First, measures of creativity translated from the Torrance Tests of Creative Thinking show little, if any relationship to school performance. Kim and Michael (1995) study is similar to the present study in terms of measures of creativity (Torrance Tests of Creative Thinking) on whole brain learning. However, both studies differed in terms of examination of student achievement, area of the study, sample type and size.

Iordaah (2009) conducted a study to find the effects of a cognitive research trust training programme on creative thinking among secondary school students in senatorial zone B in Benue

state. The study used a quasi-experimental design. One hundred and forty-two senior secondary school II students were used as sample for the study. Random sampling procedure was used for identifying the schools and classes for the study. The instrument used for data collection was creative thinking test. Data were analyzed using mean, standard deviation and Analysis of Covariance. Results have shown that students who received training had significantly greater improvement in creative thinking performance. The findings revealed that no significant difference was found on the mean performance of urban and rural school students in creative thinking test. The finding of the study also showed that there was no significant difference in the mean performance of younger and older students in creative thinking test. Iordaah (2009) study relates to the present study in terms of quasi-experimental research design, and focuses on creative thinking; but differed in terms of diverse sample type, 142 sample size, Benue geo-cultural area, and participants from senior secondary school II class.

Most of these reviewed studies were conducted on diverse learners; few others were conducted on creative and non-creative students, but none was found in reviewed literature on how training in mind mapping or synectics could boost whole brain learning and creativity of high ability pupils, particularly in Nigeria. Thus, there is the need to examine effects of mind mapping and synectics in enhancing creative production among high ability pupils in Nigerian regular school.

Studies on Mind Mapping

Nsikak-Abasi (1995) observed that students notes in Physics were badly formed resulting in poor responses to questions and achievement. In his study, Nsikak-Abasi examined the differential effectiveness of two methods of note taking; (mind map and conventional note) on Physics achievement. Non equivalent pretest - posttest control group design was used in the study. Senior Secondary Two Physics students were the subjects. One of the two classes involved was taught note taking by mind map. Both received a three weeks lecture on lens. One test battery was repeatedly administered on them before, immediately and eight weeks after receiving the instructions. The mean gain scores and graph were used in answering the research questions. Analysis of covariance was used in testing the hypotheses at 0.05 level of significance.

The result of the analyses revealed that mind map students performed significantly better them the conventional notes students in both Physics Achievement Test and Physics Retention Test (PRT). Mind map group performed significantly better than the conventional note group within the gender and higher achievers, but not among the lower achievers. The higher achievers

performed better than lower achievers, but there was no significant difference among male and female student. The superiority of mind map over conventional note was traced to its ability to supply recognition cues during informational storage, which facilitates understanding, recall and greater achievement. Nsikak-Abasi (1995) study relates to the present study in that both were conducted within a similar geographical context, in terms of quasi-experimental research design, ANCOVA method of data analysis and in the use of mind map as treatment variable. However, they differed in terms of Physics achievement measured, in application of mind map to note taking only, Senior Secondary Class II Physics students that constituted the sample, in two experimental group conditions, in terms of three weeks treatment duration, and in the use of only one type of test for data collection.

Abi-El-Mona and Adb-El-Khalick (2008) conducted a study to assess the effects of using mind maps as a learning tool on eighth graders' science achievement, whether such influence was mediated by students 'prior scholastic achievement, and the relationship between students 'mind maps and their conceptual understandings. Sixty-two students enrolled in four intact sections of a grade 8 science classroom were randomly assigned to experimental and comparison conditions. Participants in the experimental group received training in, and constructed mind maps throughout a science unit. Engagement with mind mapping was counterbalanced with involving the comparison group participants with note summarization to control for time on task as a confounding variable. Otherwise, the intervention was similar for both groups in all respects. A multiple-choice test was used to measure student gains across two categories and three levels of achievement. Analysis of covariance statistic was used for data analyses.

The results of the study indicated that the experimental group participants achieved statistically significant and substantially higher gains than students in the comparison group. The gains were not mediated by participants' prior scholastic achievement. Analyses also indicated that iconography was not as central to participants' mind maps as often theorized. Depicting accurate links between central themes, major and minor concepts, and using colors to represent concepts were the major aspects that differentiated the mind maps built by students who achieved higher levels of conceptual understanding. Abi-El-Mona and Adb-El-Khalick (2008) study differed from the present study in terms of intact sample type of diverse learners, sixty-two 8^{th} grade (JSS II) students sample size; in terms of science achievement dependent measure, in terms of random sampling technique used in assigning science classes to treatment conditions, in two group conditions and in the used of multiple-choice test for data collection.

Imoke (2005) studied the efficacy of concept mapping in enhancing the achievement and interest in trigonometry. Data were collected from 297 Senior Secondary II students using two instruments, the Trigonometry Achievement Test and the Trigonometry Interest Inventory. Concept maps and lesson plans on sine and cosine rules were used for the treatment. The research questions were answered using the mean and standard deviation scores, while the hypotheses were tested at 0.05 level of significance using a 3 way Analysis of covariance (ANCOVA). Results from the study revealed that students exposed to the concept mapping strategy achieved higher and showed greater interest in the trigonometry concept than those who were not. Also, the urban students were significantly higher in both achievement and interest than the rural students. However, the study revealed no significant difference in the means achievement and interest scores of male and female students. The study recommended the adequate training of Mathematics teachers on the use of concept mapping for classroom instruction in Mathematics. Imoke (2005) study differed in term of the graphic tools ï concept mapping used as against mind mapping - used in the present study. Also, both studies differed in terms of the dependent variable measure achievement and interest in trigonometry, the large intact sample size, and the participantsô level of education (SSII).

Ezeugo and Agwagah (2000) carried out a study whose purpose was to determine the effect of concept mapping on studentsô achievement in algebra. They used a sample of 387 SSIII students. Data was collected using the Algebra Achievement Test (AAT). A 2 ï way Analysis of Covariance (ANCOVA) was used to test the hypothesis. The results revealed that students exposed to concept mapping strategy performed better than students who were not. The researchers found that concept mapping was an effective technique for enhancing studentsô achievement and interest in trigonometry, that concept maps facilitated the achievement and interest of students in urban and rural schools. Ezeugo and Agwagah (2000) study differed from the present study in terms of the type of graphic tool used (concept map), dependent measure (achievement in algebra), large sample size, and the participantsô level of education (SSIII).

Ezeudu (1995) study sought to find the effects of concept maps on studentsô achievement, interest and retention in selected units of Organic Chemistry. The effects of gender on achievement, interest and retention were also ascertained. The study was a non equivalent control group design. Two validated research instrument were used. Stratified random sampling techniques were used in drawing subjects of 411 Senior Secondary three students in Nsukka Educational Zone. The research instruments were administered to the subject by the regular chemistry teachers during the normal period for the subjects in the school time table. In

analyzing the data collected, a 2 x 2 Analysis of Covariance was used. The findings of the study showed that concept mapping had a significant effect on students overall achievement, interest and retention in selected Organic Chemistry concepts; that concept mapping was superior to conventional method in enhancing interest in Organic Chemistry, and that both males and females performed, retained and showed interest in Organic Chemistry concepts. Ezeudu (1995) study relates to the present study in terms of the use of graphic tool, and area of the study. But, differed in terms of the type of graphic tool (concept map) used, the dependent measures achievement, interest and retention in selected units of Organic Chemistry, large sample size, stratified random sampling techniques used in drawing participants for the study, and the participantsô level of education (SS III).

Mba, Kumari and Aliyu (1985) investigated the relative effectiveness of the use of Ausubelôs subsumption model and Gagneôs learning hierarchy as pre-instruction strategies in high school Biology instruction. They sampled two arms of form four students in an all boys secondary school. Each arm was made up of 30 students. Appropriate instructional materials were prepared for each according to Ausubelôs subsumption theory and Gagneôs description of learning hierarchies. The study showed that both strategies led to substantial gains in the achievement of the students. There was no significant difference between the class which used advanced organizers and the class which raised learning hierarchies. Their sample of 60 students is very small and there was no indication of the method of sampling used. The instrument which was a set of 30 multiple choice objective Biology test items were not valid or reliable. The controls of extraneous variables were not specified. All these lapses limited the generalizability of the research findings. However, Mba, Kumari and Aliyu (1985) study relates to the present study in terms of graphic tool used, but differed in terms of dependent measure - achievement in Biology, sample size, method of data collection, and educational characteristics of participants used (SSI).

Ezeh (1992) studied the effect of study questions as advance organizer of studentsô achievement, retention and interest in Integrated Science. The researcher used intact classes, 356 Junior Secondary School class one and two randomly drawn from five schools in Isi-Uzo LGA of Enugu State served as the subjects for the study. Man-In-Space Achievement Test (MISAT) and Man-In-Space Interest Scale (MISIS) were developed and validated for data collection. A 2 x 2 ANCOVA (Analysis of Covariance) was used for data analysis. The results show that advance organizer had significant effect on the pupilsô achievement and interest. The difference between the pupilsô mean post treatment achievement and retention test scores was not

significant. Advance organizer and ability level interaction effect was significant only with respect to achievement, but non-significant for retention and interest. Ezeh (1992) study differed form the present study in terms of the type of graphic organizer used (study questions), dependent variables - studentsô achievement, retention and interest in Integrated Science measured, large sample size of diverse students intact classes that participated in his study and area of the study.

Scholarly research by Farrand, Hussain and Hennessy (2002) found that the mind map technique had a limited but significant impact on memory recall in undergraduate students (a 10% increase over baseline for a 600-word text only) as compared to preferred study methods (a ī 6% increase over baseline). This improvement was only robust after a week for those in the mind map group and there was a significant decrease in motivation compared to the subjects' preferred methods of note taking. Farrand et al. inferred that learners preferred to use other methods because using a mind map was an unfamiliar technique, and its status as a "memory enhancing" technique engendered reluctance to apply it. Nevertheless, the conclusion of the study was that "Mind maps provide an effective study technique when applied to written material. However it was recommended that before mind maps are generally adopted as a study technique, consideration has to be given to ways of improving motivation amongst users. Farrand, Hussain and Hennessy (2002) differed from the present study in terms of memory recall dependent measure studied and the undergraduate student sample type.

Chen (2007) examined the role of experience on 2.5 to 5 year old children's discovery of spatial mapping strategies. With experience, 3 to 4 year olds discovered a strategy for mapping corresponding locations that shared both featural and spatial similarities. When featural and spatial correspondences were placed in conflict, requiring children to negotiate both object-centered and location-centered mapping possibilities, 4 to 5 year olds proved capable of discovering a novel mapping strategy, abandoning an ineffective strategy, and generalizing the acquired strategy across analogous tasks. Chen (2007) study differed from the present study in terms of age characteristics of the participants, discovery of spatial mapping strategies in Chenôs study was the dependent measure rather than the independent variable and the exact mapping strategies were not explicitly mentioned.

According to Atance and Meltzoff (2005), two experiments examine preschool-aged children's ability to anticipate physiological states of the self. One hundred and eight 3, 4, and 5 years old children were presented with stories and pictorial scenes designed to evoke thought about future states such as thirst, cold, and hunger. They were asked to imagine themselves in

these scenarios and to choose one item from a set of three that they would need. Only one of the items could be used to address the future state. In the experiments, developmental differences were obtained for correct item choices and types of verbal explanations. In experiment 2, the performance of the 3 and 4 years old children was negatively affected by introducing items that were semantically associated with the scenarios but did not address the future state, whereas the 5 years old ones performance was not. Atance and Meltzoff (2005) experiments differed from the present study in terms of the large sample size, preschool aged participants used for the study, and the number of experiments conducted. It also differed in that pictorial stimulus was used as one of the tests rather than as an intervention set. Also, the dependent variable differed.

In sum, mind mapping is graphic tool, efficacious in integrating the whole brain, improving achievement, and fostering creative production; since it involves learnersô construction of knowledge by engaging actively the verbal, visual, spatial, aesthetic and imaginative processing skills of the brain. Yet, there is no study reviewed on mind mapping using high ability pupils as sample type, none on its effect on whole brain learning and creative production. However, limited studies conducted in the Nigerian context used secondary aged participants as sample, measured mostly achievement and interest in subject areas, and no such study in Nsukka educational zone. Thus, there is need to examine effects of mind mapping in enhancing whole brain learning and creative production of high ability pupils.

Studies on Synectics

Gendrop (1996) conducted a descriptive, quasi-experimental study, which identified reflective reasoning aptitudes of ninety-seven nurses and investigated the effect of synectics on their creative thinking. Aptitude for reflective reasoning was pretested by the Torrance Verbal Test of Creative Thinking (TTCT), the Gordon Creative Problem Solving Test (GCPST), and the Watson-Glaser Appraisal of Critical Thinking (WGACT). Participants were post tested only in creative thinking, using the TTCT and the GCPST. The experimental intervention was adapted from synectics under the tutelage of its inventor, W. J. J. Gordon. The participants were randomly selected for either the experimental group (trained in synectics) or the control group (not trained in synectics); their pretest mean scores on the TTCT and WGACT were compared with normative data from graduate students.

The differences in critical thinking, fluency, and flexibility were not significant. Significant differences were found in originality. Posttest TTCT and GCPST mean scores revealed significant gains for the experimental group over the control group on all pretested creative abilities. Findings reveal several potential strengths and one weakness in the reflective

reasoning of nurses. Thus, the educational intervention (synectics) enhanced the creative abilities of nurses. Gendrop (1996) study is related to the present study in terms of similar data collection technique used (Torrance Verbal Test of Creative Thinking), the dependent variable (creative thinking) measured, and the quasi-experimental research design used. Both studies differed in terms of types of subject that participated in the study, sampling techniques used in selecting the participants, sample size and areas of the study.

Shreyashi (2008) also studied the impact of synectics model of teaching in life science to develop creativity among students. One hundred and twenty (120) students of class nine of two schools of which 64 were girls and 54 were boys constituted the sample of the study. One school (School-I) had facility for coeducation and the other (School-II) was a girls high school. The students were divided into two groups in each school. The experimental group and the control group had equal number of students. The groups were constituted by considering the previous science achievement scores and their intelligence. The investigator administered Jalotaôs General Mental Ability test to obtain intelligence score of students. She had also used science achievement score of students in half-yearly examination for the purpose. Then she taught life science through synectics model for 20 weeks to the experimental group of both the schools, while concerned science teacher taught same topics by traditional method. At the end of experiment, Life Science Achievement Test and Baquer Mehdiôs Verbal Test of Creative Thinking was administered as posttest to both the groups to obtain creativity scores. Total marks secured by students in science and other subjects in the subsequent annual examination were considered for testing significance in science achievement and scholastic achievement.

Shreyashi found on the effect of training on creativity to develop creative thinking ability of students that the t values between posttest and pretest scores of fluency, flexibility, originality and creativity were not significant in control group. The results indicated that posttest scores of fluency, flexibility; originality and creativity were significantly different from pretest scores in experimental group. Therefore, it was concluded that there is significant difference between effects of synectics model and traditional method of teaching life science in development of creative thinking ability of students. Gain in fluency, flexibility, originality and creativity scores were compared between experimental group and the control group. It was concluded that the gain score in creativity of the experimental group taught Life Science by Synectics model was significantly higher than the control group taught by traditional method (Shreyashi, 2008).

Impact of training on science achievement result also conducted by Shreyashi (2008) show that training in creativity by teaching through synectics model produce significantly higher

achievement in science. Also, result on impact of training on scholastic achievement show that the t value of scholastic achievement scores of experimental and control groups are significant. Therefore, it can be concluded that the experimental group taught through synectics model obtains significantly higher posttest scholastic achievement score than the control group. Shreyashi (2008) study differed from the present study in terms of programme integration instruction in life science used, intact sample from class nine (JSS III) students of two schools, identification method, t-statistic used for data analysis, large sample size, two experimental conditions, and methods of data collection.

Ali and Roghieh (2009) conducted a study on comparison of the effect of three methods of creativity development in second grade guidance school students. The research was designed with the objectives of examining the effect of three methods of creativity development (brainstorming, forced association and synectics) on creativity development in second grade guidance school students in Shahrekord. The study was a pretest-posttest experimental design with control group. To measure the dependent variable creativity, Torrance Tests of Creative Thinking (Form B) were used. In this study, 80-second grade guidance school students (40 boys and 40 girls) were randomly selected and divided into four groups (brainstorming, forced association, synectics and control group).

The results revealed significant differences between pretest and posttest scores of all groups except the control group. In addition, the difference between the methods of creativity development was not significant; in other words, none of the creativity methods was superior to the others. However, there was a significant difference between the control group and the three training groups. Nevertheless, creativity training can lead to an increase in studentsô creativity. Ali and Roghieh (2009) study differed from the present study in terms of areas of the studies, experimental research design, intact sample type, larger sample size, and in the measures of creativity compared of which synectics is only an aspect.

Raul (1984) studied the effects of a training intervention on dogmatism, flexibility, and attitudes of preservice students. The quasi-experimental research design was used for the study. The subjects were members of two intact groups. The content of the programme was based on the following two models of teaching: the Concept Attainment model and the Synectics model. All subjects were administered the Rokeach Dogmatism Scale, Form E, as a pretest and the Minnesota Teacher Attitude Inventory as a posttest. Flexibility was measured using the modified Flanders' Interaction Analysis System. The findings of the study showed no significant relationships between dogmatism and flexibility, dogmatism and attitudes, and flexibility and

attitudes of preservice students. A significant relationship, however, was detected between the levels of flexibility for preservice students.

Also, no significant difference was found between the pretreatment and post-treatment teaching flexibility of senior preservice students. No significant difference was detected between the teaching flexibility of junior and senior preservice students. Elementary preservice students were significantly more flexible than secondary preservice students. No significant difference was found in the teaching flexibility and attitudes between low dogmatic and high dogmatic preservice students. Preservice students were significantly more flexible during the second teaching episode than during the first teaching episode. The significant findings for this study indicate that the training intervention had an effect on the flexibility of preservice students; thus, suggesting that the teaching flexibility of preservice students can be influenced through training. This, however, is inconclusive as pre-treatment flexibility scores were not available and comparison between the pre- and post-treatment teaching flexibility of preservice students was not possible. Raul (1984) study differed from the present study in following areas: in terms of two intact sample groups used, data collection techniques, and on dependent variables (dogmatism, flexibility, and attitudes of preservice students) measured.

Sesadeba (2008) studied the effectiveness of synectics model of teaching in enhancing creativity, academic achievement and achievement motivation of learners. The investigator adopted the non-equivalent control group design of quasi-experimental type. Two primary schools of Bhubaneswar city having almost similar facility were randomly selected out of four apparently similar type of schools with regard to their management, infrastructural facility; teacher and student strength. All the 35 participants of the experimental group and 36 participants of the control group were subjected to the teaching of 18 lessons on General science. The experimental group was taught by the investigator himself using the MFS (Making the Familiar Strange) approach of Synectics model of teaching, whereas their regular class teacher taught the control group by following the traditional method of teaching. Furthermore, for the purpose of the assessing creative ability, academic achievement and achievement motivation; the investigator had used the verbal and non-verbal test of creativity as developed and standardized by Baquer Mehdi (1985); comprehensive achievement test on General science and achievement motivation inventory as developed and standardized by the investigator himself.

The pretest scores of both the control and experimental groups were found almost equivalent when tested using the t statistic for their normality of distribution. Making Familiar Strange (MFS) approach of synectics model of teaching was found to be effective in enhancing

the creative thinking ability of the learners. However, it did not prove to be effective in enhancing the achievement motivation of the learners, and did not put any significant impact upon the achievement of the learners in the subject General science. Sesadeba (2008) study differed from the present study in terms of area of the study (Bhubaneswar city), large sample size (71), random selection of sample for the study, t-statistic method of data analysis, two experimental group conditions, and achievement based assessment of creativity.

Madahi (2010) conducted a study on comparison of effectiveness of the three methods of brainstorming, synectics and deductive reasoning on increasing creative thought of female sixth grader middle school students in Rasht, Iran. The sample of this research was all the female six-grader students of non-profit-making middle schools in Rasht during the 2008-2009 school years. The total number of these students was 822 persons. Therefore, 106 students from districts 1 and 2 of the city were randomly selected as a statistical sample. In order to study research hypotheses with consideration of the nature of variables in mind, One-Way Analysis of Variance (ANOVA) and Covariance tests were used; and the Scheffe Incidental Test was used to measure the means.

Obtained results confirmed that there is a difference between the effects of brainstorming, synectics and deductive methods on the creativity level of students, and that compared with the synectics method, brainstorming has a greater effect on student creativity, and that the synectics in its turn, improves this variable much more than the deductive method. Madahi did not indicate if the observed differences were significant. Madahi (2010) study differed from the present study in terms of area of the study (Rasht, Iran), female specific sample type, large sample size, and random selection of sample for the study.

From the foregoing, findings from empirical literature reviewed are mixed. However, most of the studies found synectics an effective technique for enhancing creativity, deductive reasoning, achievement motivation and academic achievement. There seems to be no available study in literature reviewed using high ability sample type or application of synectics on whole brain learning, particularly in the Nigerian context. Thus, it is needful to examine in this study effect of synectics on whole brain learning and creative production of high ability pupils in Nigeria.

Studies on High Ability

Onu (2001) examined the effect of bloomôs taxonomy based teaching strategy on the cognitive skills of high ability learners in primary schools. It also sought to find out if gender would have significant influence with performance. A non equivalent control group design

involving three classes of students served as subjects for the study. Efforts were made to control extraneous variables. Differentiated Product Test developed and validated was used for data collection. Split-half and test-retest reliability were used to ensure the internal consistency of the test items. The posttest was administered four weeks after the pretest. Data was collated and analyzed using mean for research questions; Analysis of Covariance and t-test were used to test the hypotheses.

The results of the study revealed that students taught with BTTS performed better than those taught with conventional method. Students taught with conventional method performed better than those who had no training. Gender was found to have significant effect on the cognitive skills. Onu (2001) study differed from the present study on the following counts: in terms of bloomôs taxonomy based teaching strategy used as treatment variable, cognitive skills (based in the left brain hemisphere) dependent variables measured, in terms of method of data collection, and educational characteristics of the participants (primary four).

Irele (2009) evaluated the administrative and instructional procedures in gifted education programmes at Federal Government Academy Suleja Nigeria from 1992 to 2006. The study used a descriptive research design of the ex-post-facto type. It also employed the Context, Input, Process, Product (CIPP) model of evaluation. The participants included the entire 153 student in Junior Secondary 3, 36 teachers and two principals using total enumeration sampling. Thirteen instruments were used to collect data out of which nine were West Africa Examination standardized achievement tests. The remaining four were: Programme Influencing Factor Scale, Teachers Questionnaire on Teaching Strategies, Programme Objectives knowledge Scale and Student Attitude Scales. Data collected were analyzed using frequency counts, mean, standard deviation, mean, and percentage for answering the research questions; t-test and multiple regressions for testing the hypotheses.

Results of the study show that the teachersô knowledge about the programme objectives was very high and studentsô attitudes towards the programme were positive. Also, only 21 out of the 38 teachers (55.3%) had training in gifted education. The teachers used different methods of teaching, while non-availability, inadequacy and non-utilization of some equipment constituted constraints. Studentsô performance in English Language senior secondary was generally high with males performing significantly better than females. In Mathematics, males, performance was better than that of females to a significant extent but the difference is not significant. The Independent variables (studentsô gender, studentsô age, teachersô gender, Teachersô knowledge of the objectives of the programme, availability, adequacy and utilization the equipment, funding,

teachersô qualification, teachersô experience, curriculum and content coverage) in the study correlated strongly and positively with the studentsô performance. Studentsô academic performance was adequate but the teaching strategies and materials in the school were inadequate for effective implementation of the school administrative and instructional programmes.

Irele recommended that the planners of the programme should, therefore, make available appropriate teaching materials, and teachers should, be given opportunity to attend seminars and workshops to improve their efficiency. In respect of the present study, Irele (2009) differed in the following ways: in terms of the independent and dependent variables measured, descriptive research design of the ex-post-facto type, area of the study, large sample size, participants for the study (students and teachers), 13 instruments for data collection, t-test and multiple regressions method of data analyses used in testing the hypotheses, and CIPP model of evaluation.

Okediadi (1990) studied some factors association with the expression of giftedness among primary school pupils in Onitsha urban. The objective of the research was to find out the extent to which parents and teachers are aware of the expression of giftedness in children. The research questions were analyzed with the use of percentages and bar chart. Analysis of variance was used to test for statistical difference. Randomized Complete Block Design was specifically used for the survey research study. The instrument for the study was a questionnaire, and 20 teachers were randomly sampled for each of the schools. Parents of the children from the top 10% of the schools were randomly sampled. Field trial of the questionnaire was carried out in Aba in Imo State, while the actual research was conducted in Onitsha in Anambra. Fifteen primary schools were randomly sampled.

The findings of the study reveal that teachers are not really aware of the expression of giftedness in children that parents would rather enhance than stifle giftedness in their children. Parents are not aware of the manifestation of giftedness in children. There is no significant difference between teachersô awareness of intellectual and affective characteristics of giftedness and parental awareness of such in their children. In respect of the present study, Okediadi (1990) study differed in the following ways: in terms of area of the study (Onitisha urban), survey research design, participants in the study (parents and teachers), the use of questionnaire for data collection, random sampling of 15 schools from where the sample for the study was composed and dependent/independent variables studied.

Runco and Albert (2005) examined how family-related variables may influence giftedness of children. Using the Californian Personality Inventory, divergent thinking tests and

the Biograpical Inventory of Creativity, Runco and Albert explored personality profiles of exceptionally gifted students and their parents. Exploring two groups of gifted boys (one group with exceptionally high IQ and one group with exceptional math-sciences abilities), their results indicate some significant relationships between parentsô and childrenôs personality. For the math science sample they observed that both Masculinityï Feminity and Type A behavior scales show father-sons correlations. For the high IQ sample, they observed moderate to strong correlations between social poise, leadership and Type A scores of parents and those of their children (regardless of the sex of the parent). In view of the present study, Runco and Albert (2005) differed in terms of (personality) variables examined, three instruments of data collection, two sets of participants in the study (parents and children), and two aspects of giftedness (exceptionally high IQ and exceptional math-sciences abilities) explored.

Simonton (2000) in order to test creative-expertise hypothesis, the careers of 59 classical composers were examined according to the differential aesthetic success of their 911 operas. The potential predictors were seven measures of domain-relevant experience: cumulative years (since first operas, first compositions, and first lessons) and cumulative products (genre-specific operas, all operas, all vocal compositions, and all compositions). The non-monotonic longitudinal trends and the relative explanatory power of the expertise-acquisition measures indicate that complex specialization (overtraining) and versatility (cross-training) effects may determine creative development across the life span. Simonton (2000) differed from the present study in terms of its survey research design, area of the study, variables studied, and the characteristic nature of the participants in the study.

Walberg and Stariha (1992) conducted a longitudinal study for more than two decades on early lives of people who achieved eminence in such fields as the visual art, music, politics, and science. As children, the eminent men showed intellectual competence and motivation, social and communication skills, general psychological wholesomeness, and both versatility and persevering concentration during childhood. A large percentage of the sample was exposed to stimulating family, educational, and cultural conditions during childhood. Only slightly more than half were encouraged by parents, but majority was encouraged by teachers and other adults and were exposed to many adults at an early age. Significantly more than half (60 percent) were exposed to eminent persons during childhood. About 80 percent were successful in school, the majority liked it, and a quarter had school problems. Seventy percent had clear parental expectations for their conduct; but nearly nine out of ten were allowed to explore their environments on their own, obviously a delicate, important balance in child rearing and teaching.

In view of the present research, Walberg and Stariha (1992) study differed in terms of its longitudinal survey research design, method of data collection, use of percentage statistic in data analysis, the sample types, and multiple areas of giftedness measured.

Pazzaglia and De Beni (2006) investigated whether the alignment effect is influenced by mental rotation abilities. In two experiments, groups of undergraduate students with high and low performance in mental rotation tasks were required to study either schematic (experiment 1) or more complex (experiment 2) maps, and to perform a number of pointing tasks adopting a perspective which could be aligned, misaligned (45 degrees, 135 degrees), or counter aligned (180 degrees) with the perspective assumed during learning. Cognitive styles in spatial representation have also been considered. Results of experiment 1 show that people with low performance in mental rotation tasks prefer to adopt a representation of space focused more on landmarks. Their performance in the pointing tasks depends on the alignment conditions, with more errors in the counter aligned condition followed by the two misaligned and aligned ones.

In contrast to this, high-ability mental rotators prefer survey and route spatial representations and are affected only by the aligned and non-aligned conditions. In the second experiment, practice was studied as a function of mental rotation and alignment. The group high in mental rotation ability was found to be free from the alignment effect in the pointing tasks performed after the final of four learning phases. Pazzaglia and De Beni (2006) study relates to the present study in terms of interests in learning styles, mental rotation abilities measured, and spatial representation (complex maps) studied. However, both differed in terms of undergraduate sample type and ability groups (high and low abilities) studied.

Gleaning from the reviewed literature, many empirical studies have investigated the cognitive abilities of high ability persons, while others explored several aspects of giftedness. However in Nigeria, no study was found in reviewed literature that examined the effects of training on mind mapping or synectics strategies in enhancing creative production and in optimizing whole brain potentials of high ability children. Thus, there is need to examine the effects of mind mapping and synectics on whole brain learning and creative production of high ability pupils.

Gender Influence on Creativity

Findings from empirical researches on gender and creativity are mixed, and point to various and often contradictory directions. The evidences do not clearly support gender differences in creativity based on test results; but to the extent that a case for such gender differences can be made.

In a quasi-experimental study conducted by Onu, Eze and Onuigbo (2008) on effect of instruction on ideational fluency on creativity of schooling adolescents in Nsukka, sixty junior secondary class two students constituted the sample - thirty-one males and thirty-seven females. Data was collected using test instrument on ideational fluency, an ambiguous stimulus; while data collected was analyzed using analysis of variance (in testing the hypotheses). The results of the study show that males in the treatment group had higher mean achievement score as against the mean achievement score for the males in the control group; while female students in the treatment group had higher mean achievement score as against the mean achievement score for the females in the control group. However, hypothesis testing shows no significant influence of gender on ideational fluency. This means that male students did not perform significantly better than females. Onu, Eze and Onuigbo (2008) study differed from the present study in that the participants in the study were secondary school students, instrument for data collection was a descriptive /projective test, as such did not concern with production of novel problem solving ideas, diverse intact sample type, and a large sample size was used for the study

Kim and Michael (1995) studied the relationship of creativity measures to school achievement and to preferred learning and thinking style in a sample of Korean high school students. The two major purposes of this study were to ascertain from a sample of 193 11th grade Korean high school students (92 males and 101 females) the extent to which performance in selected measures of creativity involving both verbal and visual tasks was related to school achievement as revealed by a quantitative indicator and the expressed preference for a given learning and standardized measures (style of learning and thinking by Torrance) intended to portray left-brain, right-brain, or an integrated left-brain right brain function. A secondary purpose was to identify possible gender differences of Korean students in the variables under study.

It was concluded that Korean high school females may be expected to exhibit higher average levels of performance on creativity tests than will their male counterparts. Third, irrespective of gender, but especially in the instance of females, those students classified as showing a learning and thinking style preference hypothesized to be associated with right brain dominance are likely to earn higher scores on creativity measures than will those students classified as displaying a learning and thinking style preference hypothesized to correspond to either a left brain dominance or an integrated brain dominance. Kim and Michael (1995) study differed from the present study in terms of the area of the study (Korea), diverse sample type, participants in the study were 11^{th} grade (perhaps SSI) high school students, and large sample

size; but relates to the present study in terms of aspects of creativity studied, the use of Torrance Test for data collection, and measurement of brain hemispheric preferences.

Moreover, some other studies (Ai, 1999; Habibollah, Rohani, Tengku Aizan, & Jamaluddin, 2009; Palaniappan, 2000; Habibollah, Rohani, Tengku Aizan, Jamaluddin and Vijay, 2010) show that males surpass females on some components of creativity, but females are generally better than males on others. Habibollah, Rohani, Tengku Aizan, Jamaluddin and Vijay (2010) studied the relationship between creativity and academic achievement; and if the relationship differs between males and females. One hundred and fifty-three (153) Iranian undergraduate students in Malaysian universities (31.4% -105 females and 68.6% - 48 males) selected as respondents in this study, completed creativity tests such as Khatena-Torrance Creative Perception Inventory. Their ages ranged from 18-27 years for females and 19-27 years for males.

Pearson Correlation analysis indicated that aspects of creativity are related to academic achievement for both males and females. The results of this research indicated that there existed gender differences regarding specific aspects of creativity, in relation to academic achievement. Dissimilar aspects of creativity and achievement were found to be significant for males and females. One interpretation that might explain this gender difference is that males and females do extremely well in different aspects of creativity. The relationship could be altered when different gender is examined and when different creativity is measured. This dissimilarity may be possibly due to gender identity. Habibollah, Rohani, Tengku Aizan, Jamaluddin and Vijay (2010) study differed from the present study in terms of correlation research design of the study, cross cultural dimension of the area of the study (Iranians in Malaysia), undergraduate sample type, large sample size, and use of Pearson Correlation for data analysis.

Ai (1999) studied Spanish studentsô relation between creativity and academic achievement. In the study, the students were randomly selected from 68 schools (2,264 students, 38% were boys and 62% were girls). Three creativity batteries, the Torrance Test of Creative Thinking (TTCT), the Abedi-Schumacher Creativity Test (CT), and the Villa and Auzmendi Creativity Test (VAT) were administered to the students. The academic achievement of the studentsô was assessed using a self-reported achievement in six subject areas: Spanish, Basque, English, Natural Sciences, Mathematics and Social Sciences.

The results indicate that some differences exist between males and females on aspects of creativity related to academic achievement, although creativity is shown to be related to academic achievement for gender. Canonical correlation analysis found that when

operationalized by their grades, creativity was related to academic achievement for both boys and girls. For girls, elaboration related to four of the academic subject areas (Basque, Spanish, Social Science and English), and fluency related to Natural Science and Mathematics. For boys, flexibility was the predominant factor that related to all six academic subject areas. These differences may be explained by the different gender roles for males and females in most countries. Hence, it is conceivable that the gender differences in creative ability are determined by the different characteristics that identify the gender. Ai (1999) study differed from the present study in terms of area of the study (Spain), correlation research design of the study; random sampling used in identifying participants for the study, use of Canonical correlation analysis, data collection using three creativity batteries and self-reported achievement in six subject areas.

In another research investigation, Nori (2002) studied the sex differences and the type of relationship between creativity and academic achievement among high school students in Shiraz city. There were 306 high school students (150 boys and 156 girls) in the research. To measure the rate of creativity, Nori used an Abedi questionnaire and cumulative grade point average (CGPA) for academic achievement. Data were analyzed by CGPA for academic achievement. The analysis revealed that there was no significant relationship between creativity and academic achievement, but the result was different for the both sexes. Nori (2002) study differed from the present study in terms of area of the study (Shiraz city), large number of high school students used, and in method of data analysis used. However, creativity cannot be assessed based on data generated from cumulative grade point.

Habibollah, Rohani, Tengku Aizan, & Jamaluddin (2009) found no gender differences on the overall factor scores for both ówhat kind of person are you?ô and óSomething about myselfô, except for environmental sensitivity and initiative among Iranian students. Environment sensitivity relates to being open to ideas of others, relating ideas to what can be seen, touched, or heard, interest in beautiful and humourous aspects of experiences, and sensitivity to meaningful relations. While, initiative relates to directing, producing, and playing leads in dramatic and musical productions; new formulas or new products; and bringing about changes in procedures or organization. Females scored significantly higher on environmental sensitivity than males, and males scored significantly higher on initiative. This is consistent with the findings in Palaniappan (2000) study, which supported the view that there are no gender differences for environmental sensitivity and initiative among Malaysian students. Palaniappan stated there was no significant difference on the factor environmental sensitivity between males and females, while males obtained higher scores on initiatives than females. Habibollah, Rohani, Tengku Aizan, &

Jamaluddin (2009) study differed from the present study in terms of area of the study (Malaysia), Iranian participants, and variables studied (environmental sensitivity and initiative).

Goldsmith and Matherly (1988) gave 118 college students three self-report measures of creativity and found no gender differences. The subjects also completed three self-report measures of self-esteem. There was a positive correlation between the self-report measures of creativity and the self-report measures of self-esteem, but the relationship was both stronger and more consistent for women than for men. This gender difference in the relationship between self-esteem and creativity confirmed a prediction based on a study by Forisha in 1978, which found that creative production in women was associated with sex role masculinity (a construct that includes the personality traits of competence and self-reliance). Goldsmith and Matherly (1988) study differed from the present study in terms of three self report instruments used for data collection, 118 sample size, diverse sample of college students, aspects of creativity and self esteem measured, and use of correlation statistic.

Runco (1986a) had 150 5th through 8th grade students with mean Intelligent Quotient of 133 report on their creative activities in seven domains: writing, music, crafts, art, science, performing arts, and public presentation, as part of a study designed to assess the predictive validity of divergent thinking test scores. From these self-reports, scores for both quality and quantity of creative performance in each of the seven areas were computed. Significant gender differences were found only for a self-report of quantity of performance (e.g., ñnever,ò ñonce or twice,ò ñthree to five times,ò ñsix or more timesò) in music performance. Runco (1986a) study differed from the present study in terms of IQ identification modality, the sample size for the study, the use of primary school and secondary school aged children, and the study of creative activities in seven domains or subject areas.

Henderson (2003) found no gender differences in self reported creative achievement of 247 inventors working in multinational firms who responded to a 90-question on-line survey. Women in this study did report more publications and conference presentations than men. Early environments were important; subjects cited many instances of early family, school, community, and higher education experiences that had influenced their ability to invent. This study differed from the present study in terms of the sample type, survey research design, variables studied, and number of sample size.

Gough (1992) looked for correlations between professorsô assessments of psychology graduate studentsô creativity, defined as ñThe creative quality of the studentôs thinking and research in psychologyò, and various personality and cognitive test scores. This continuing

assessment procedure began with graduate students in psychology at the University of California at Berkeley in 1950 and included 1,028 graduate students (623 men, 405 women) between then and 1981, the period covered by Goughôs report. Gough (1992) found that the Creative Personality scale was the only one of 37 Adjective Check List scales that was significantly correlated with creativity for both women (.26) and men (.17). There were several Adjective Check List scales correlated with assessments of only womenôs or only menôs creativity. Gough also compared correlations of women and menôs creativity ratings with their scores on California Personality Inventory scales. Overall the patterns showed only minor differences. A new scale, Creative Temperament (CT), was developed using this sample of graduate students and their professorsô ratings of their creativity. Not surprisingly, this CT scale was correlated with the creativity ratings of both women (.33) and men (.25) in this sample. Gough (1992) study differed from the present study in terms of longitudinal research design, duration covered by the study, Psychology graduate sample type, areas of the study, large sample size studied, and the number of instruments used for data collection.

Kaufman, Baer, and Gentile (2004) studied 102 poems, 103 fictional stories, and 103 personal narratives taken from the 1998 NAEP Classroom Writing Study (in the NAEP study, eighth graders from 32 states were asked to choose their two best pieces of writing that they had completed for their regular classroom assignments). Three groups of experts read all 308 pieces of writing. The experts included teachers of 8th grade creative writing, psychologists who studied creativity, and published creative writers who had extensive experience working with middle school students. Across all groups of experts, no gender differences were found for the poems, stories, or narratives. Kaufman, Baer, and Gentile (2004) study differed from the present study in terms of its survey ex post facto research design, large amount of creative products studied, and the method of analysis and analysts used.

Conclusively, empirical evidences on gender differences in creativity and academic achievements are inconclusive. Many studies looked for gender differences in scores on tests designed to measure and predict creativity; few have found such differences, and no consistent pattern has also emerged. Such differences could be interpreted as due to societal masculinity sex role stereotype, expectancies and brain hemispheric preferences. Considering these inconclusive and unpredictable research findings, the researcher deems it pertinent to investigate further gender influence in relation to whole brain learning and creative production among high ability children in Nigeria.

Summary of Literature Review

Conceptual review of literature was conducted on ability, high ability children, creativity, creative production, whole brain learning, mind mapping, and synectics. The researcher grasped that high ability refers to talent or superior aptitude in particular content areas such as the four major content areas of English Language, Social Studies, Mathematics, Science; and other less traditional areas; while high ability pupils are learners with potential or demonstrated outstanding academic abilities/performances that could sublimate to creative activities or productivity if properly harnessed. Though high ability is a predisposing factor in academic and creative productivity, it has been conceptualized variantly. Out of all characteristics of high ability pupils identified, creativity seems to be greatly inhibited by the orientation of the Nigerian educational system, which is tilted toward the left brained learners.

Creativity is generally concerned with innovation of original solutions, creation of novel products or alternative ways of solving problem; while creative production is the process of generating unusual or infrequently seen product in a universe of products, made by pupils with similar experience and training. Hence the brain is identified as the source of creativity and high intellectual functioning, the best way to creativity and cognition is to boost inter-hemispheric communication between the left and right brain. Thus, whole brain learning has to do with integrating the processing skills of the right and left brain hemisphere into the learning process. Mind mapping was defined as a presentation form of radiant thinking, utilizing lines, colors, characters, numbers, symbols, images, pictures or keywords to associate, integrate and visualize the learned concept, and maximize brain potentials; while, synectics, a metaphor/analogy-based technique, involves connecting seemingly unrelated elements together in a search for new ideas or solutions.

The theoretical framework show many theories relevant to this study. Both the Brain Hemispheric Theory and the Ned Hermannôs Whole Brain Model agree that hence the brain has many parts, integration and experiential stimulation of these parts would result in whole brain learning and greater creativity. Other theories such as Multiple Intelligences, Enrichment Triad Model, Constructivist Theory, and Synectics Theory also emphasize the need to provide enriched and challenging programme beyond general educational provision, encourage personalized learning, learner construction of knowledge, creative production and higher integrative intellectual functioning.

Results of much empirical literature reviewed on whole brain learning, creative production, mind mapping, synectics, high ability and gender influence on creativity are mixed.

Some findings did not support application of brain gym; while others show the efficacy of whole brain activities on teaching and learning of subject matters. It is also evident in empirical literature reviewed that effects of mind mapping and synectics in enhancing creativity, conceptual understanding, academic achievement and whole brain learning are also mixed. While some studies found mind maps and synectics significantly effective, others did not; notwithstanding improvements observed on dependent variables measured. Likewise, empirical research findings on gender influence on creativity and whole brain learning are mixed, unpredictable, contradictory and inconclusive; hence the need to further investigate the influence of gender on creative production and whole brain learning among the high ability children.

Nonetheless, there are some problems posed by these findings. Most of the reviewed empirical studies on mind mapping, synectics, and whole brain learning activities were conducted in different cultural and educational contexts using mainly diverse sample type; it would be appropriate to observe if they will have the same effects on whole brain learning and creative production of children in Nigeria. Another major problem is that while mind map and other graphic tools (like concept map) have been applied in the Nigerian educational context as means of improving academic achievement among secondary school students, there is a dearth of studies on its total utility as a tool for boosting creativity and enhancing whole brain learning among the high ability pupils in the Nigerian regular schools. Interaction effects of gender, mind mapping and synectics techniques on the dependent measures are also inconclusive. There is need to further study the interaction effects of mind mapping, synectics and gender in enhancing high ability pupilsô whole brain learning and fostering creative production in Nigerian regular school. The bid to fill these gaps motivates this empirical study.

CHAPTER THREE
RESEARCH METHOD

This chapter presents specifically the following subheadings: design of the study, area of the study, population of the study, sample and sampling technique, instruments for the study, development and validation of the instruments, trial testing and reliability of the instruments, development and validation of the training programmes, experimental procedure, control of extraneous variables, procedure for data collection and scoring, and method of data analysis.

Design of the Study

This is a quasi-experimental study of the effects of training in mind mapping strategy and synectics technique on the whole brain learning and creative production of high ability pupils. Specifically, the study adopted a non-equivalent pre-test posttest control group research design involving two experimental groups and one control group. Each of the two experimental groups received treatment conditioning through training in mind mapping or synectics, while the control group received Conventional Instructional Programme. The design is recommended where randomization of sample to group conditions is not possible (Ezeh, 2005). Though the study was conducted in three intact classes, data was collected on high ability pupils identified in three regular schools that participated in the study. Thus, normal school activities were not disrupted.

E_1	**O**	**X_1**	**O**
E_2	**O**	**X_2**	**O**
C	**O**	**X_3**	**O**

Figure 2: Quasi-Experimental Design

The symbols are defined as follows:

E_1 - Experimental Condition 1

E_2 - Experimental Condition 2

C - Control Condition

O - Pretest

O - Posttest

X_1 - Training on Mind Mapping Strategy

X_2 - Training on Synectics Technique

X_3 - Conventional Instruction

Area of the Study

The study was conducted in Nsukka urban town of Nsukka Local Government Area. Nsukka is one of the 17 local government areas in Enugu State, made up of fifteen communities (Nsukka, Obukpa, Edem, Obimo, Eha-Alumona, Lejja, Okpuje, Okutu, Anuka, Eziani, Ibagwa-Ani, Okpaligbo-ogu, Alor-Uno, Opi, and Ede-Oballa). Nsukka town has four autonomous communities, and situated in Nsukka Educational Zone, which comprises other local government areas and development centers. The choice of Nsukka town was based on its contiguity to the researcher. Contiguity ensures effective supervision and coordination of programme implementation and data collection which consequently guarantees internal validity of a study. Also, the choice of Nsukka urban was informed by high concentration of high ability pupils in the primary schools surveyed.

Population of the Study

The population of this study consists of 169 high ability pupils identified from 1,102 primary six pupils surveyed during the pilot study conducted by the researcher in thirty-four government approved primary schools in Nsukka urban area. For details see Appendix L, page 168 and Appendix M, page 169.

Sample and Sampling Techniques

The sample for the study consists of 21 high ability pupils identified in three primary (public and private) schools in Nsukka urban area using test score record and adapted teacher nomination form. Thus, using the 2012/2013 first term achievement test score records, 17 high ability pupils that scored 80 percents and above were selected. In view of this identification system, Renzulli and Reis (1997) recommended that in order to compose approximately 15 percent of the population, the talent pool be divided into half between all pupils who scored at or above 92 percent using achievement test aggregate, and those pupils whose potentials may not be reflected in standardized tests (such as, intelligence, achievement or aptitude tests). Renzulli and Reis argues that this approach guarantees the automatic selection of all traditionally bright pupils that account for approximately 50 percent of the talent pool.

Using the teacher nomination alternative pathway, four high ability pupils were selected. These pupils had average scores in subject areas like English Language, Verbal Reasoning, Mathematics, Quantitative Reasoning, Social Studies and Primary Science for the current school year; a demonstrated high interest in Fine Art, Music, Sciences, Drama, Creative Writing, Mathematics, Quantitative Aptitude, Social Studies, Language studies, Verbal Aptitude, Manual

Skills, and other special abilities (see Appendix G, page 157 for details). Using test score nomination and teacher nomination, approximately 15 percent (21 pupils) of the population for the study (169 pupils) was selected. Out of 21 pupils, eight pupils were in each of the two treatment conditions, while five pupils were in the control group. All together, there were ten males and eleven females in the study.

Purposive and simple random sampling techniques were employed in drawing and assigning three sample schools to group conditions. Nworgu (1991; 2005) states that in purposive sampling, specific elements which satisfy certain predetermined criteria are selected. However, the criteria to be used are usually a matter of the researcherôs judgment exercised in relation to what will constitute a representative sample and the research purpose. Thus, through purposive sampling technique, three schools were drawn for the study. To facilitate assignment of schools to group conditions, each sample school was randomly assigned using random sampling technique of simple toss of the coin. Thus, the sample schools labeled óAô (experimental group 1) and óBô (experimental group 2) received training in mind mapping strategy and synectics technique respectively, while the third sample school labeled óCô (control group) were taught using conventional instructional method.

Instrument for the Study

Four data collection instruments were adapted for the study. They are:

- **Participant Identification Instruments:** *Test Score Nomination and Teacher Nomination*
- **Test Instruments:** *Creative Productivity Test Battery (CPTB) and Whole Brain Self-Report Questionnaire*

Test Score Nomination procedure is a participant identification instrument adapted from the nomination form for school-wide enrichment programme developed by Renzulli and Reis (1997). Test score nomination procedure stipulates that any regularly administered standardized test can be used for identification and admission of high ability pupils based on a single test or subtest score. Thus, pupils with above average general abilities (80% aggregate score and above) during the first term continuous assessment period were selected for the study.

Teacher Nomination Instrument is also a participant identification instrument adapted from Renzulli and Reis (1997) nomination form for school-wide enrichment programme. It elicits information such as: names of school, teacher, and pupil being assessed; class, age, sex, and date of assessment. Also included are average scores in subject areas (like English Language, Verbal Reasoning, Mathematics, Quantitative Reasoning, Social Studies and Primary

Science) for current school year, projects, areas of interest, curricular strength areas (English Language, Mathematics, Social Studies and Primary Science), other special abilities, and teacherôs reasons (to include examples of ideas, projects, creative performances) for enlisting each pupil among high ability learners.

Creative Productivity Test Battery (CPTB) is a test instrument adapted from the work of Finke & Slayton (1988) on creative visual synthesis in mental imagery and a demonstrator form of the Torrance Creative Thinking Test (TCTT). The subtests of Creative Productivity Test battery were compiled by the researcher. CPTB consists of subtests such as creative visual synthesis, unusual uses task, product improvement task, imaginative stories test, and poem composition test. The test of creative visual synthesis involves a set of simple shapes given to participants to combine mentally in order to create a recognizable form or object. The first stage involves mental play with images of the forms by rotation, size adjustment, and repositioning; the second stage involves recognizing what combination of the forms could represent. Participants were more creative if they combined shapes without particular goal in mind at the outset, attempting an interpretation only after producing novel combinations. The unusual uses task calls for interesting and unusual uses of common objects. The product improvement task calls for the production of clever, interesting and unusual ways of modifying a common product or activity, so that it will become more interesting and enjoyable. Imaginative stories task involves creative writing about animals, concepts or people with divergent characteristics. Poem composition test concerns the ability to write simple poems that fit different purposes.

Whole Brain Self-Report Questionnaire (WBSQ) is an adaptation of the right brain versus left brain creativity online test. WBSQ is based on the various characteristics associated specifically with each hemisphere of the brain. This test produces results unique to each individualôs own left and right hemispheres. WBSQ contains 54 test items designed to assess various characteristics associated with learning preferences and processing skills of the brain left and right hemispheres. It is a four point Likert rating scale, ranging from Always-4, Sometimes-3, Occasionally-2, to Rarely-1. The left-brain section of the instrument examined the processing skills of linear, sequential, symbolic, logical, verbal, and reality-based; while the right-brain section examined the processing skills of holistic, random, concrete, intuitive, nonverbal, and fantasy-oriented, which are associated with the right hemisphere. At the completion of WBSQ, the responses were computed, after which a small detailed paragraph output explaining the characteristics associated with the brain hemisphericity of each respondent were produced.

Whereas the hemisphere with highest percentage score in each comparison determine brain dominance either to the right or left, the researcher deduced that humans should strive to utilize both halves of the brain when processing information. See Appendix K, page 165 for details.

The left brain/right brain percentages are calculated by combining the scores of each halfôs sub-categories or processing skills. Low percentages are common in the brain type test and are not indicative of good utility value. Instead, medium to high score (30 ï 50%) are desirable, as they show an ability to utilize a processing method without an abnormal reliance on it. Special focus is paid to highly dominant (50% or above) or highly recessive (0 ï 30%) methods, as they tend to limit approach when learning, memorizing, or solving problems. With highly dominant characteristics, normal thinking patterns will naturally utilize these methods. Conscious effort is required to recognize the benefits of other techniques. Using multiple forms of information processing is the best way to fully understand complex issues and become a balanced thinker. With highly recessive characteristics, normal thinking patterns naturally ignore these methods. One may only consider these under-utilized techniques when ñall else failsò, or possibly not at all. It is important to recognize the benefits of all the brainôs capacities in being a balanced thinker. See Appendix I, page 161 and Appendix J, page 163 for details.

The data collection instruments were used for pretest and posttest purposes. While the pretest items of Creative Productivity Test Battery were reshuffled, reordered, and spatially rotated; the pretest items of Whole Brain Self-Report Questionnaire were rearranged from descending to ascending order, and altogether administered as the posttest.

Development of the Instruments

Creative Productivity Test Battery *(CPTB)* was composed with creative visual synthesis in mental imagery developed by Finke & Slayton (1988), and other test tasks such as: unusual uses, product improvement, imaginative stories test and poem composition test adapted from the demonstrator form of the Torrance Creative Thinking Test (TCTT) developed by E. P Torrance to communicate the nature of the published tests without compromising or invalidating them. In order to further ensure the content validity of the test instruments, imaginative stories and poem composition subtests were based on learning outcome benchmarks for primary education provided by the Government of Enugu State Ministry of Education (in support of Education Sector Support Programme in Nigeria). They were also in line with the guide to essay writing in the Federal Ministry of Education 9-years basic education curriculum on English Studies for Primary 6 (FME, 2009). The guides stipulate that by the end of primary 6, pupils should be able

to write simple compositions that fit different purposes. Example, letters, accounts, descriptions, stories, poems indicating clearly the introduction, the body, and conclusion.

Whole Brain Self-Report Questionnaire (WBSQ) is an adapted version of right brain versus Left Brain Creativity Test, originally developed by the International Culinary Schools at the Art Institute of Vancouver. The content validity of WBSQ instrument was ensured by the use of test blue prints, which guided the generation of test items across the twelve brain processing characteristics of linear, sequential, symbolic, logical, verbal, and reality-based skills associated with the left hemisphere; and holistic, random, concrete, intuitive, nonverbal, and fantasy-oriented skills associated with the right hemisphere. Many of the brain processing skills were also based on Roger Sperryôs research on brain lateralization. See Appendix O, page 171 for details.

Validation of the Instrument

The face validity of` the teacher nomination form (identification instrument), and the test instruments (Creative Productivity Test Battery and Whole Brain Self-Report Questionnaire) were established. The researcher began by rephrasing some of the test items that were culture biased, and in simplifying others whose language difficulty levels were high; modifying the themes, description, nomenclature of subject areas, and activities in order to make the instruments adaptable for use. Afterward, copies of the tests (the original and the adapted versions), the research questions, the hypotheses, the tests blue prints, and copies of the scoring guides were given to two experts in Educational Psychology unit of Educational Foundations Department, University of Nigeria Nsukka to examine the adequacy of the tests in terms of number, clarity, appropriateness of language, accuracy of expressions, instructions, and response patterns. Their comments and suggestions helped in improving the final version of the instruments. See Appendix A, page 149.

The content validity of Creative Productivity Test Battery and Whole Brain Self-Report Questionnaire were ensured by the use of test blue prints, as the test items reflected the content areas on the table of specifications. The experts were requested to examine the instruments with respect to coverage of the relevant processing skills, and their objectives. Copies of the test blue print containing the table of specifications, the research questions, and purpose of the study were given to two experts in Educational Psychology unit of Educational Foundations Department, University of Nigeria Nsukka to enable them make suggestions. Based on the advice and creative input of the experts, some test items were deleted, modified or replaced. Thus, the overall adequacy of the instruments; its item number, language clarity and conciseness, skill coverage,

appropriateness of language, expressions, and instructions to the participants were greatly improved. See Appendix M, page 169 and Appendix O, page 171 for details.

Trial Testing of the Instruments

Trial testing was conducted on twelve (12) high ability pupils identified in three streams of primary six classes of a primary school in Nsukka town. The identification procedure involved nomination of five best pupils in the three streams of the primary six class (15 in all) based on mock examination record of a teacher-made achievement test, composed from the National Common Entrance Examinations past questions in English Language, Verbal Reasoning, Mathematics, Quantitative Reasoning, and General paper. Thus, six pupils that obtained not less than 80 percent test score (occupying first to sixth position) were selected based on the test result, while other six pupils with average scores and special abilities were selected using the teacher nomination form.

The identified high ability pupils were administered the Creative Productivity Test Battery (CPTB) and Whole Brain Self-Report Questionnaire (WBSQ) instruments. The appropriate length of time taken to complete the test by the first, middle, and last test-taker was recorded for the instruments. The average time of 67 and 30 minutes were obtained and used as the response time for each of the test instruments respectively. The answer scripts and questionnaires were collected, marked using the validated scoring guide, and collated for further statistical analysis. The trial testing also provided parameters for determining commonplace and original ideas on visual synthesis; unusual uses task, product improvement task, imaginative story, and poem composition subtests of the CPTB.

Reliability Analysis

In order to estimate the internal consistency of the data collection instruments (Creative Productivity Test Battery and Whole Brain Self-Report Questionnaire), data obtained from the trial test were subjected to Cronbach procedure for reliability analysis, which is apt for Likert scales and essay type questions that are not dichotomously scored (Ezeh, 2005). The coefficient alpha of .66 obtained on Creative Productivity Test Battery indicates a high internal consistency. The coefficient alpha of .60 obtained on the Right Brain section, and .76 estimate obtained on the Left Brain section of WBSQ indicate also a high reliability index. The internal consistency estimate gives a measure of the homogeneity of the items in the instrument. This kind of reliability is necessary for the test, as the scores obtained from the procedure represent the entire attributes of the participants.

To determine the stability of Creative Productivity Test Battery (CPTB) overtime a second trial testing was conducted after two weeks, and data obtained were correlated with the earlier one using Pearson Moment Correlation method. Thus, the test retest reliability indices obtained on the subtests are as follow: r = .69 for test of visual synthesis, r = .51 for product improvement task, r = .78 for unusual uses task, and r = .80 for imaginative story. Ezeh (2005) states that application of test retest measure is apt for a study that involves repeated measurements with the same instrument (pretest posttest experimental design).

Development of the Training Programmes

Three training programmes were used for this study. They are:

1. *Mind Mapping Strategy Training Programme*
2. *Synectics Technique Training Programme*
3. *Conventional Instructional Programme*

Mind Mapping Strategy and Synectics Technique Training Programmes were developed by the researcher with the help of two experts in Educational Psychology unit of Educational Foundations Department, University of Nigeria Nsukka. The programmes were meant to train high ability pupils on effective use of strategies that foster production of creative products. It contains systematic instructions necessary for effective use of mind mapping strategy and synectics technique in enhancing whole brain learning and creative production of high ability children. Strategy Instruction Model guided the development of the programmes, the researcher divided the training into three sections; namely the introduction phase, the modeling and guided practice, and grade appropriate practice. The specific objectives, the instructorôs activities, pupilsô activities, instructional strategies, and evaluation were also streamlined. Ten training sessions held in a period of eight academic weeks.

Conventional Instructional Programme (CIP) was designed to provide a control group conditioning that is consistent with the regular English Composition teaching approach in public primary schools. The researcher observed that this pedagogical approach aforementioned rarely implements the Enugu State Ministry of Education learning outcome benchmark for primary six in writing descriptive prose or poem nor the guide to essay writing provided in the Federal ministry of Education 9-year basic education curriculum on English Studies for Primary 6 (FME, 2009). The Conventional Instructional Programme was basically based on the use of adverbial question forms (what, who, where, when, why, and how) in introducing, developing the body, the ending part of an English Composition. it merely requires the pupils to provide general information, and make an own judgment or summarize the points already made seldomly. The

Conventional Instructional Programme lasted for ten training sessions across eight study weeks. Altogether, the programmes were designed to run concurrently for eight weeks across the group conditions, with each session lasting for 35 minutes. See the training programmes on Appendix Q, R and S, pages 173, 200 and 219 for details.

Validation of the Training Programmes

The initial drafts of the training programmes (Mind Mapping Strategy Training Programme, Synectics Training Programme, and Conventional Instructional Programme) were face validated by two experts in Educational Psychology. Copies of the programmes were given to them with letter requesting their critical evaluation in terms of clarity, and appropriateness of language and expressions. Template provided to guide them included comments on specific objectives, instructional activities, evaluation techniques, time limit, and number of the sessions. Thus, comments and suggestions of the experts were used in improving the training programmes.

Trial Testing of the Training Programmes

The trial testing of the face validated training and conventional instructional programmes were also conducted on twelve participants drawn from primary six classes of a school in Nsukka urban area. The researcher administered the trail testing in the assistance of the grade teachers. The rationale for this trail run is to identify possible lapses that could occur during the target training sessions (experiments). Thus, the systematic and comprehensiveness of the programmes were ensured; their adequacy in achieving the objectives of the study, and eliminating all possible ambiguities existing in the programmes implementation processes.

Experimental Procedure

The researcher surveyed techniques used in Nsukka urban schools in creative writing, and identified the need to infuse creativity into English composition teaching and learning. He observed that few schools and teachers employ the learning outcome benchmark for literacy in primary six and the guide to essay writing in the Federal Ministry of Education 9-year basic education curriculum on English Studies for Primary 6 (FME, 2009). The pupils were not aware of any learning strategy to use deliberately in creative writing, and often were simply asked to write stories on given topics. These observations acquainted the researcher informatively and equipped his readiness for the training.

Nevertheless, before the training sessions, the researcher visited the sample schools and intimated the school authorities of the purpose and significance of the study. Thus, convenient

time were negotiated and scheduled for the trainings. The pretest versions of the instruments - Creative Productivity Test Battery (CPTB) and Whole Brain Self-Report Questionnaire (WBSQ) - were administered to all participants in intact class group conditions in two sittings, before the training commenced. The training programmes were equally administered in intact classes during the lesson period for English Composition. Each experimental group met twice a week, over a period of eight weeks. The experimental group 1 and 2 were trained on the use of mind mapping strategy and synectics technique respectively; while the control group received conventional instruction in English composition. The essence of the training was to develop the capacity of the high ability pupils for creative production using the designated strategies.

The researcher was indirectly involved in the training. Six research assistants (3 regular teachers and 3 class assistants) trained by the researcher executed the training programmes. This decision was informed by the need to control reactance and adjustment to a new teacher, which may confound the experimental observation. This option maximized the teacherôs prior knowledge of the pupils as a means of facilitating the training. A three-hour train-the-trainer sessions was organized for the research assistants once a week for two weeks, while the researcher supervised the programmes delivery and performance evaluation so to ensure mastery of the validated training programmes (see Appendix P, page 172 for details). However, the training period lasted for eight weeks.

After the training sessions, the posttest versions of the data collection instruments mentioned above (CPTB & WBSQ) were administered to the participants in experimental and control groups. The researcher in conjunction with the research assistants administered the pretest and posttest instruments. The researcher ensured that the testing conditions and environments were homogeneous before administering and collecting the instruments. Though the trainings were conducted in intact classes, attention was focused on high ability children, whose pretest and posttest scripts were scored using the validated scoring guides. The scores were collected and collated for further statistical analyses.

Control of Extraneous Variables

In other to control the effects of extraneous variables that could intervene in the study and confound the experimental observations, the following measures were taken:

1. Teacher variability ï the regular teachers used as the research assistants received intensive training on how to use the training programmes. The research assistants were given opportunity for teaching practice, after which the researcher discussed the corrections, modifications and other areas that required improvement.

2. Initial non-equivalence of groups ï the pretest posttest control group design adopted in this study allowed statistical control of the initial non-equivalence of the three experimental groups.
3. Class attendance variance - there was roll call at the beginning and end of each session. This measure ensured that only pupils that participated fully in the training sessions were tested.
4. Effect of covarianceï after the pretest and eight weeks of training, disguised and reshuffled posttest instruments were administered with inverted instruction and presented in a rearranged form to the participants. Thus, the effect of pretest on the posttest performances was controlled.
5. Homogeneity of experimental procedure ï both training and testing times was same for the three experimental conditions in order to obtain a controlled result.
6. Hawthorne effect ï is the tendency that noticeable difference may occur if the participants are aware they are engaging in an experiment. In order to control the influence of the researcherôs presence on the participants, the training of regular teachers as research assistants was necessitated. However, the researcher supervised the programmes implementation processes and evaluation.
7. Conventional Instructional Programme ï this is the training programme for the control group under uniform conditions with the experimental groups.
8. Interaction effect ï the researcher eliminated within class and within school variance from the experimental observations by assigning each group condition to separate school. Thus, possible between group interaction were controlled.
9. Enabling environment ï the researcher ensured a child friendly environment in order to motivate greater participation, expression and learning in class. Such intervening variables as fear of the teacher, intimidating behaviour of other pupils and repressed emotions were controlled thereby.
10. Examination fatigue ï in order to eliminate error variance due to tiredness or stress, each of the tests were administered in two separate sittings.

Development and Validation of the Scoring Guides

The scoring guides for the data collection instruments were developed by the researcher and face validated by two experts in Educational Psychology unit of Educational Foundations Department, University of Nigeria Nsukka, whose comments and suggestions aided the latter

version of the tests. Thus, the scoring guide for the Creative Productivity Test Battery items was determined by computing the mode of response to test tasks. Thus, all responses occurring once, twice, thrice or more across the test takers were awarded five, four, three and one marks respectively. The ones with single occurrence across the test takers are considered as original ideas or products, and scored five points (see Appendix F, page 155 and Appendix H, page 158 for details). On the other hand, responses to subtest four of the Creative Productivity Test Battery were scored using the Student Product Evaluation Form developed by Renzulli and Reis (1997) for creative product assessment (see Appendix G, page 157 for details). Whole Brain Self-Report Questionnaire was scored using Likert rating scale of always-4, sometimes-3, occasionally-2, and rarely-1.

Administration and Scoring of the Instrument

Prior to the training session, Creative Productivity Test Battery (CPTB) and Whole Brain Self-Report Questionnaire (WBSQ) were administered to the participants in the experimental and control groups. The pretest scores served as a covariate to the pupilsô posttest scores. The Creative Productivity Test Battery (CPTB) was scored using the face validated scoring guide and Student Product Assessment Form adapted from the work of Renzulli and Reis (1997).

After the eight weeks of training, the disguised and reshuffled Creative Productivity Test Battery (CPTB) and Whole Brain Self-Report Questionnaire (WBSQ) were administered to the experimental and control groups. Afterward, the scripts were collected and marked using the validated scoring guides. The CPTB and WBSQ instruments, though administered by the research assistants, were supervised by the researcher.

Method of Data Analysis

The data collected were presented using percentage (computed through an online facility developed by the International Culinary Schools at the Art Institute of Vancouver), mean and standard deviations to answer research questions, while the hypotheses were tested using Analysis of Covariance (ANCOVA) statistic at 0.05 level of significance. The pre-test scores were used as covariate to the posttest scores. In order to determine the difference in whole brain learning before and after training among the group conditions, the overall mean ratings of 2.73 for the pretest, and 2.69 for the posttest obtained from the total means of groupsô responses to WBSQ determined the decision rules. Thus, each groupôs mean above or below the decision rule was either interpreted as more or less respectively. This latter procedure enabled the researcher to determine the difference existing in the mean scores obtained on group performances.

CHAPTER FOUR

RESULTS

This chapter concerns the analyses and presentation of the results obtained from variables investigated in this study. The results of the study are presented in tables in line with the research questions and hypotheses that guided the study.

Research Question 1

What is the difference in the whole brain learning mean scores of high ability pupils exposed to training in mind mapping and those not exposed?

Table 1: Mean and Standard Deviation of Pretest-Posttest Scores on Whole Brain Self Report Questionnaire

Groups	Pretest			Posttest			Mean Gain
	X	**N**	**SD**	**X**	**N**	**SD**	
Mind Mapping	2.73	8	0.29	2.74	8	0.34	0.01
Synectics	2.84	8	0.17	2.72	8	0.46	- 0.12
Conventional Teaching	2.55	5	0.16	2.56	5	0.16	0.01
Total	**2.73**	**21**	**0.24**	**2.69**	**21**	**0.35**	0.04

X - Mean, N - Number of Participants, SD - Standard Deviation

Results on Tables 1 show that the high ability pupils in treatment group 1, trained in mind mapping strategy obtained a pretest mean score of 2.73 with SD score of 0.29 and a posttest mean score of 2.74 with SD score of 0.34. Whereas the participants in the control group taught using conventional instructional method obtained a lesser pretest mean score of 2.55 with SD score of 0.16 and a lesser posttest mean score of 2.56 with SD score of 0.16. The low SD scores indicate a cluster of scores around the means, which implies lesser difference in scores of participants in the group conditions. Also, treatment group 1(mind mapping) and the control group (conventional instruction) obtained minimal mean gains of 0.01 a piece. However, the total pretest mean score of 2.73 with SD score of 0.24 and the total posttest mean score of 2.69 with SD score of 0.35 indicate that participants trained in mind mapping performed better than those in the control condition; hence those trained in mind mapping obtained mean scores that are above the total pretest and posttest mean scores. Therefore, these results seem to suggest that the high ability pupils trained in mind mapping strategy had more whole brain learning than those taught using conventional instructional method.

Research Question 2

What is the difference in the whole brain learning mean scores of high ability pupils exposed to training in synectics and those not exposed?

Results on Table 1 also show that the high ability pupils in treatment group 2, trained in the application of synectics technique obtained a pretest mean score of 2.84 with SD score of 0.17 and a posttest mean score of 2.72 with SD 0.46. Whereas, the participants in the control group taught using conventional instructional method obtained a lesser pretest mean score of 2.55 with SD score of 0.16 and a lesser posttest mean score of 2.56 with SD score of 0.16. The low SD scores indicate cluster of scores around the means, which further implies lesser difference in pretest and posttest mean scores of participants in the treatment group 2. Also, treatment group 2 (synectics) obtained a mean loss score of -0.12, while the control group had a mean gain score of 0.01. However, the total pretest mean score of 2.73 with SD score of 0.24 and the total posttest mean score of 2.69 with SD score of 0.35 indicate that participants trained in synectics performed better than those in the control condition; hence they obtained mean scores that are above the total pretest and posttest mean scores. Therefore, these results seem to suggest that the high ability pupils trained on synectics technique had more whole brain learning than those taught using conventional instructional method.

Research Question 3

What is the influence of gender on the whole brain learning mean scores of high ability pupils?

Table 2: Mean and Standard Deviation of Pretest-Posttest Scores of Gender on Whole Brain Self-Report Questionnaire

Gender	Pretest			Posttest		
	X	**N**	**SD**	**X**	**N**	**SD**
Male	2.83	9	0.17	2.78	9	0.34
Female	2.72	7	0.31	2.67	7	0.47
Total	**2.79**	**16**	**0.24**	**2.73**	**16**	**0.39**

X - Mean, N - Number of Participants, SD - Standard Deviation

Data on Table 2 above indicate that male high ability pupils obtained a pretest mean score of 2.83 with SD score of 0.17 and a posttest mean score of 2.78 with SD score of 0.34; while the female high ability pupils obtained a lower pretest mean score of 2.72 with SD score of

0.31 and a lower posttest mean score of 2.67 with SD score of 0.47. The low SD scores indicate a cluster of scores around the means, which further implies lesser difference in pretest and posttest scores of both male and female participants. However, the total pretest mean score of 2.79 with SD score of 0.24 and the total posttest mean score of 2.73 with SD score of 0.39 indicate that the male participants performed better than the females; hence they obtained more mean scores above the total pretest and posttest mean scores. Thus, these results seem to suggest that both at pre-test and posttest stages the male pupils had more whole brain learning than the female pupils.

Research Question 4

What is the difference in the creative production mean scores of high ability pupils exposed to training in mind mapping and those not exposed?

Table 3: Mean and Standard Deviation of Pretest-Posttest Scores on Creative Productivity Test Battery

Groups	**Pretest**			**Posttest**			**Mean Gain**
	X	**N**	**SD**	**X**	**N**	**SD**	
Mind Mapping	33.88	8	11.06	50.13	8	7.18	16.25
Synectics	15.88	8	5.14	34.75	8	9.77	18.87
Conventional Teaching	23.60	5	7.30	26.00	5	8.28	2.4
Total	**24.57**	**21**	**11.31**	**38.52**	**21**	**12.80**	**13.95**

X - Mean, N - Number of Participants, SD - Standard Deviation

Results on Tables 3 show that the high ability pupils in treatment group 1, trained in Mind mapping strategy obtained a pretest mean score of 33.88 with SD score of 11.06 and a posttest mean score of 50.13 with SD score of 7.18. Whereas the participants in the control group taught using conventional instructional method obtained a lower pretest mean score of 23.60 with SD score of 7.30 and a lower posttest mean score of 26.00 with SD score of 8.28. The high SD scores indicate a widespread of scores from the means, which further implies greater difference in pretest and posttest scores of participants in the mind mapping and control groups. Treatment group 1 (mind mapping) obtained higher mean gain score of 16.25 than 2.4 obtained by the control group. Furthermore, the total pretest mean score of 24.57 with SD score of 11.31 and the total posttest mean score of 38.52 with SD score of 12.80 obtained indicate that

participants trained in mind mapping performed better; hence they obtained more mean scores than those in the control group condition and above the total pretest and posttest mean scores. Therefore, these results seem to suggest that the high ability pupils trained on mind mapping strategy made more creative production than those taught using conventional instructional method.

Research Question 5

What is the difference in the creative production mean scores of high ability pupils exposed to training in synectics and those not exposed?

Results on Table 3 also show that the high ability pupils in treatment group 2, trained in the use of synectics technique obtained a pretest mean score of 15.88 with SD score of 5.14 and a posttest mean score of 34.75 with SD score of 9.77. Whereas participants in the control group taught using conventional instructional method obtained a higher pretest mean score of 23.60 with SD score of 7.30 and a lower posttest mean score of 26.00 with SD score of 8.28. The high SD scores indicate a widespread of scores from the means, which further implies greater difference in pretest and posttest scores of participants in treatment group 2 (synectics) and the control group. Also, treatment group 2 obtained a higher mean gain score of 16.25 than and 2.4 obtained by the control group. However, the total pretest mean score of 24.57 with SD score of 11.31 and the total posttest mean score of 38.52 with SD score of 12.80 seem to indicate that participants in synectics group did not perform well at pretest stage; hence they obtained a mean score lesser than those in the control group, and below the total pretest. But after training in synectics, treatment group 2 obtained higher posttest mean score than the control group, though still below the total posttest mean score. Therefore, these results seem to suggest that the high ability pupils trained in the use of synectics technique made more creative production than those taught using conventional instructional method.

Research Question 6

What is the influence of gender on the creative production mean scores of high ability pupils?

Table 4: Mean and Standard Deviation of Pretest-Posttest Scores of Gender on Creative Productivity Test Battery

Gender	Pretest			Posttest		
	X	**N**	**SD**	**X**	**N**	**SD**
Male	21.00	9	8.72	40.33	9	7.79
Female	29.86	7	15.39	45.14	7	15.26
Total	**24.88**	**16**	**12.48**	**42.44**	**16**	**11.47**

X - Mean, N - Number of Participants, SD - Standard Deviation

Data on Table 4 above indicate that male high ability pupils obtained a lesser pretest mean score of 21.00 with SD score of 8.72 and a lesser posttest mean score of 40.33 with SD score of 7.79 than the female high ability pupils that obtained a higher pretest mean score of 29.86 with SD 15.39 and a higher posttest mean score of 45.14 with SD score of 15.26. The high SD scores indicate a widespread of scores from the mean, which further implies great difference in pretest and posttest scores of both male and female participants. However, the total pretest mean score of 24.88 with SD score of 12.48 and the total posttest mean score of 42.44 with SD score of 11.47 indicate that the female participants performed better; hence they obtained higher mean scores than the males, and above the total pretest and total posttest mean scores. Thus, these results seem to suggest that the female high ability pupils made more creative production than their male counterparts.

Research Question 7

What is the difference in the brain dominance percentage ratings of high ability pupils?

Table 5: Pretest-Posttest Percentage Scores on Whole Brain Self-Report Questionnaire

	Pretest			Posttest		
	Left - Right		**Decision**	**Left - Right**		**Decision**
Mind Mapping Strategy						
1.	59	41	Left brained	54	46	Left brained
2.	65	35	Left brained	64	36	Left brained
3.	57	43	Left brained	54	46	Left brained
4.	59	41	Left brained	54	46	Left brained
5	65	35	Left brained	64	36	Left brained
6.	65	35	Left brained	56	44	Left brained
7.	57	43	Left brained	57	43	Left brained
8.	56	44	Left brained	53	47	Left brained
Synectics Technique						
9	58	42	Left brained	51	49	Left brained
10.	59	41	Left brained	55	45	Left brained
11.	62	38	Left brained	55	45	Left brained
12.	61	39	Left brained	61	39	Left brained
13.	57	43	Left brained	54	46	Left brained
14.	56	44	Left brained	51	49	Left brained
15.	50	51	Right brained	63	37	Left brained
16.	51	49	Left brained	67	33	Left brained
Conventional instruction						
17.	46	54	Right brained	48	52	Right brained
18.	59	41	Left brained	56	44	Left brained
19.	59	41	Left brained	63	37	Left brained
20.	62	38	Left brained	61	39	Left brained
21.	60	40	Left brained	60	40	Left brained

Results shown on Table 5 above seems to suggest that most high ability pupils remained left brain dominant irrespective of training in mind mapping and synectics. The pretest percentage scores indicate that 90.5 percent of participants in all group conditions (mind

mapping, synectics and conventional instruction) are left brain dominant. That is to say, whereas 9.5 percent of high ability pupils were right brain dominant at the pretest stage (one in control group and one in synectics treatment groups); only 4.8 percent of the participants became right brain dominant at the posttest stage. In other words, 95 percent of the total participants remained left brain dominant (the remaining twenty participants maintained left brained dominance). In other words, for participants in the mind mapping and synectics treatment groups, there is sixty-nine percent modulation of the posttest scores toward a right brain processing than those in the control group. Therefore, these results seem to suggest an inclination to a more integrated or whole brain learning state - a balance of the cognitive and creative brain hemispheres - due to training in mind mapping and synectics strategies.

Hypothesis 1

Training in mind mapping strategy has no significant effect on high ability pupils' whole brain learning as measured by mean scores on Whole Brain Self-Report Questionnaire.

Table 6: Analysis of Covariance of Mean Scores on Whole Brain Self-Report Questionnaire (Mind mapping x Gender)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected model	.236a	4	.059	.614	.665
Intercept	.314	1	.314	3.261	.109
Pretest	.075	1	.075	.780	.403
Mind mapping	.036	1	.036	.371	.559**
Gender	.030	1	.030	.316	.589**
Mind mapping * Gender	.014	1	.014	.144	.714**
Error	.770	8	.096		
Total	93.789	13			
Corrected Total	1.006	12			

a. R Squared = .235 (Adjusted R Squared = -.148)

*Significant at 0.05 level ** Not significant at 0.05 level

Data in Table 6 above indicate that training in mind mapping strategy had no significant effect on high ability pupilsô whole brain learning. This is because the f calculated value of .371 in respect of mind mapping is lesser than the f critical value of .559; and as such, not significant at 0.05 level of significance. Thus, the null hypothesis of no significant effect of mind mapping on high ability pupilsô whole brain learning is accepted. In other words, there is no significant difference in the whole brain learning mean scores of high ability pupils in treatment group 1 due to training in mind mapping.

Hypothesis 2

Training in synectics technique has no significant effect on high ability pupils' whole brain learning as measured by mean scores on Whole Brain Self-Report Questionnaire.

Table 7: Analysis of Covariance of Mean Scores on Whole Brain Self-Report Questionnaire (Synectics x Gender)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.120a	4	.030	.156	.955
Intercept	.089	1	.089	.463	.515
Pretest	.026	1	.026	.137	.721
Synectics	.003	1	.003	.013	.912**
Gender	.002	1	.002	.008	.929**
Synectics * Gender	.000	1	.000	.001	.971**
Error	1.541	8	.193		
Total	93.590	13			
Corrected Total	1.661	12			

a. R Squared = .072 (Adjusted R Squared = -.392)

*Significant at 0.05 level ** Not significant at 0.05 level

Data in Table 7 above indicate that training in synectics technique had no significant effect on high ability pupilsô whole brain learning. This is because the f calculated value of .013 in respect of synectics is lesser than the f critical value of .912; and as such, not significant at 0.05 level of significance. Thus, the null hypothesis of no significant effect of synectics on high ability pupilsô whole brain learning is accepted. In other words, there is no significant difference in the whole brain learning mean scores of high ability pupils in treatment group 2 due to training in synectics.

Hypothesis 3

Training in mind mapping strategy has no significant effect on high ability pupils' creative production as measured by mean scores on Creative Productivity Test Battery (CPTB).

Table 8: Analysis of Covariance of Mean Scores on Creative Productivity Test Battery (Mind Mapping x Gender)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	2409.554a	4	602.389	14.168	.001
Intercept	779.234	1	779.234	18.327	.003
Pretest	139.412	1	139.412	3.279	.108
Mind mapping	665.225	1	665.225	15.646	.004*
Gender	1.198	1	1.198	.028	.871**
Mind mapping * Gender	76.013	1	76.013	1.788	.218**
Error	340.138	8	42.517		
Total	23710.000	13			
Corrected Total	2749.692	12			

a. R Squared = .876 (Adjusted R Squared = .814)

*Significant at 0.05 level ** Not significant at 0.05 level

Data in Table 8 above indicate that training in mind mapping strategy had significant effect on high ability pupilsô creative production. This is because the f calculated value of 15.646 in respect of mind mapping is greater than the f critical value of .004; and as such, significant at 0.05 level of significance. Thus, the null hypothesis of no significant effect of mind mapping on high ability pupilsô creative production is rejected. In other words, there is significant difference in the creative production mean scores of high ability pupils in treatment group 3 due to training in mind mapping.

Hypothesis 4

Training in synectics technique has no significant effect on high ability pupils' creative production as measured by mean scores on Creative Productivity Test Battery (CPTB).

Table 9: Analysis of Covariance of Mean scores on Creative Productivity Test Battery (Synectics x Gender)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	904.357a	4	226.089	4.242	.039
Intercept	169.818	1	169.818	3.186	.112
Pretest	232.338	1	232.338	4.359	.070
Synectics	192.986	1	192.986	3.621	.094*
Gender	84.803	1	84.803	1.591	.243*
Synectics * Gender	19.265	1	19.265	.361	.564**
Error	426.412	8	53.302		
Total	13577.000	13			
Corrected Total	1330.769	12			

R Squared = .680 (Adjusted R Squared = .519)

*Significant at 0.05 level ** Not significant at 0.05 level

Data in Table 9 above indicate that training in synectics technique had significant effect on high ability pupilsô creative production. This is because the f calculated value of 3.621 in respect of synectics is greater than the f critical value of .094; and as such, significant at 0.05 level of significance. Thus, the null hypothesis of no significant effect of synectics on high ability pupilsô whole brain learning is rejected. In other words, there is significant difference in the creative production mean scores of high ability pupils in treatment group 4 due to training in synectics.

Hypothesis 5

Gender has no significant influence on whole brain learning of high ability pupils as measured by mean scores on Whole Brain Self-Report Questionnaire.

Table 10: Analysis of Covariance of Gender Mean scores on Whole Brain Self- Report Questionnaire (Treatments x Gender)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.135a	4	.034	.173	.948
Intercept	.354	1	.354	1.815	.205
Pretest	.059	1	.059	.305	.592
Treatments	.023	1	.023	.116	.740**
Gender	.040	1	.040	.206	.659**
Treatments * Gender	.021	1	.021	.106	.750**
Error	2.146	11	.195		
Total	121.637	16			
Corrected Total	2.281	15			

a. R Squared = .059 (Adjusted R Squared = -.283)

*Significant at 0.05 level ** Not significant at 0.05 level

Data in Table 10 above indicate that gender had no significant influence on whole brain learning of high ability pupils. This is because the f calculated value of .206 in respect of gender is lesser than the f critical value of .659; and as such not significant at 0.05 level of significance. Thus, the null hypothesis of no significant gender influence on high ability pupilsô whole brain learning is accepted. In other words, gender has no significant influence on whole brain learning of high ability pupils.

Hypothesis 6

Gender has no significant influence on creative production of high ability pupils as measured by mean scores on Creative Productivity Test Battery.

Table 11: Analysis of Covariance of Mean scores on Creative Productivity Test Battery (Treatments x Gender)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1382.794a	4	345.698	6.433	.006
Intercept	1687.405	1	1687.405	31.399	.000
Pretest	57.656	1	57.656	1.073	.323
Treatments	261.778	1	261.778	4.871	.049*
Gender	26.407	1	26.407	.491	.498**
Treatments * Gender	254.442	1	254.442	4.735	.052*
Error	591.144	11	53.740		
Total	30789.000	16			
Corrected Total	1973.937	15			

a. R Squared = .701 (Adjusted R Squared = .592)

*Significant at 0.05 level ** Not significant at 0.05 level

Data in Table 11 above indicate that gender had no significant influence on creative production of high ability pupils. This is because f calculated value of .491 is lesser than the f critical value of .498; and as such, not significant at 0.05 level of significance. Thus, the null hypothesis of no significant gender influence on high ability pupilsô creative production is accepted. In other words, gender is not a significant factor that influences high ability pupilsô creative production.

Hypothesis 7

There is no significant interaction effect of mind mapping, synectics and gender on whole brain learning of high ability pupils as measured by mean scores on Whole Brain Self-Report Questionnaire.

Data in Table 10 above indicate that there is no significant interaction effect of treatments (mind mapping and synectics) and gender on whole brain learning of high ability pupils. This is because the f calculated value of .106 is lesser than the f critical value of .750; and as such, not

significant at 0.05 level of significance. Thus, the null hypothesis of no significant gender influence on high ability pupilsô whole brain learning is accepted. In other words, whole brain learning of high ability pupils does not depend significantly on the interaction effect of treatment variables (mind mapping and synectics) and gender.

Hypothesis 8

There is no significant interaction effect of mind mapping, synectics and gender on creative production of high ability pupils as measured by mean scores on Creative Productivity Test Battery.

Data in Table 11 above indicate that there is significant interaction effect of treatments (mind mapping and synectics) and gender on creative production of high ability pupils. This is because the f calculated value of 4.735 is greater than the f critical value of .052; and as such, is significant at 0.05 level of significance. Thus, the null hypothesis of no significant interaction effect of treatments and gender on high ability pupilsô creative production is rejected. In other words, enhancement in creative production of high ability pupils depends significantly on the interaction of treatment variables (mind mapping and synectics) and gender.

Summary of the Findings

From the analyses of results presented in this chapter, the findings made are summarized as follows:

1. Training in mind mapping strategy has no significant effect on high ability pupilsô whole brain learning as measured by their mean scores.
2. Training in synectics technique has no significant effect on high ability pupilsô whole brain learning as measured by their mean scores.
3. Training in mind mapping strategy has significant effect on high ability pupilsô creative production as measured by their mean scores.
4. Training in synectics technique has significant effect on high ability pupilsô creative production as measured by their mean scores.
5 Gender has no significant influence on whole brain learning of high ability pupils as measured by their mean scores.
6 Gender has no significant influence on creative production of high ability pupils as measured by their mean scores.

7 There is no significant interaction effect of mind mapping, synectics and gender on whole brain learning of high ability pupils as measured by their mean scores.

8 There is significant interaction effect of mind mapping, synectics and gender on creative production of high ability pupils as measured by their mean scores.

9. Approximately ninety-one percent high ability pupils seem to remain left brain dominant irrespective of strategy training in mind mapping and synectics.

CHAPTER FIVE

DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

In this chapter, the discussion and interpretation of the results of the study are presented in the following sequence: discussion and interpretations of the findings, conclusions, education implications, recommendations, limitations, suggestions for further study, and summary of the study. Nonetheless, the research questions and hypotheses provided the bases for discussion of the major findings in the study.

Discussion and Interpretations of the Findings

- Effects of mind mapping on whole brain learning and creative production.
- Effects of synectics on whole brain learning, and creative production.
- Influence of gender on whole brain learning and creative production.
- Interaction effects of mind mapping, synectics and gender on whole brain learning and creative production.
- Effects of mind mapping and synectics on brain dominance.

Effects of Mind Mapping on Whole Brain Learning and creative production

The findings of the study on effect of mind mapping are mixed and contradictory. For instance, Tables 1 & 6 show that training in mind mapping has no significant effect on whole brain learning of high ability pupils, as indicated in their mean losses. This suggests that the Nigerian high ability pupils are given to the use of known conventional strategies, grossly stuck to the left brain processing skills than to unfamiliar technique like mind mapping. The pupilsô preference could be because mind mapping was an unfamiliar technique and involves right brain processing skills, which require concerted practice and experience; hence their reliance on conventional learning style. The conventional learning method simply requires immediate replication of what is taught within the knowledge realm, thereby limiting the pupilsô development of creativity and other brain potentials. Again, this response pattern could be due to many years of no exposure to education based on curriculum and instructional models for the gifted, reliance on the left brain learning style, rote learning, no exposure to problem solving projects, or consistent working in other settings outside the classroom or school premises.

However, this result is not surprising since most Nigerian regular schools would rather conventional teaching strategies and materials; though, inadequate for effective implementation of instructional programmes for high ability or gifted children. They still lack information in the processes of developing and applying developed individualized programme design for high

ability children. In other words, many regular teachers lack in-depth knowledge of the gifted and do not use instructional strategies that integrate the whole brain. Thus, high ability pupils would need a period of training longer than eight weeks in order to gradually develop representational skills and effect a significant balance in brain hemispheric preferences.

This research finding is consistent with some previous empirical studies conducted by Farrand, Hussain and Hennessy (2002); and Atance and Meltzoff (2005). For instance, Farrand, Hussain and Hennessy (2002) observed that the mind mapping technique had a limited but significant impact on memory recall in undergraduate students as compared to preferred study methods. Likewise, Atance and Meltzoff (2005) found that preschool aged children's ability to anticipate physiological states of the self was negatively affected by introducing items that were semantically associated with the scenarios but did not address the future state. They agreed on the explanation proffered by constructivist learning approach that children were more likely to use an incorrect map to predict behaviour if the represented object was missing instead of in a wrong location.

On the contrary, empirical results shown on Tables 3 & 8 indicate that the null hypothesis of no significant effect of mind mapping on creative production was rejected. This suggests that mind mapping has a significant effect on creative production of high ability pupils. The observed difference in the creative production of high ability pupils was due to training in mind mapping, which provides a universal key to unlocking and harnessing the potentials of the brain cortical skills by organizing graphically word, image, number, logic, rhythm, colour and shapes in a single representation of learning content. Mind mapping generally increases creativity of young children, permit a better understanding of childrenôs cognition by engaging the right and left brain hemispheric activities, facilitate the essential processes of visual coordination, and integration with other cognitive operations, which are essential to knowledge construction. Thus, high ability pupils would need training in the use of such integrative techniques as mind mapping to be able to consciously account, describe, replicate the thinking processes involved, make some creative products, and actualize the whole brain potentials.

This research finding on significant effect of mind mapping on creative production though supported by the results of empirical studies conducted by Nsikak-Abasi (1995), Chen (2007); and Abi-El-Mona and Adb-El-Khalick (2008), contradict the no significant effect of mind mapping on whole brain learning. Nsikak-Abasi (1995) examined the differential effectiveness of mind map as a method of note taking on Physics achievement. The result of the study revealed that mind map students performed significantly better than the conventional notes

students. The superiority of mind map over conventional note was traced to its ability to supply recognition cue during informational storage, which facilitates understanding, recall and greater achievement and creative writing. Chen (2007) examined the role of experience on 2.5 to 5 year old children's discovery of spatial mapping strategies and found that with experience, 3 to 4 year olds discovered a strategy for mapping corresponding locations that shared both featural and spatial similarities. When featural and spatial correspondences were placed in conflict, requiring children to negotiate both object-centered and location-centered mapping possibilities, 4 to 5 year olds proved capable of discovering a novel mapping strategy, abandoning an ineffective strategy, and generalizing the acquired strategy across analogous tasks. In the same vein, Abi-El-Mona and Adb-El-Khalick (2008) conducted a study to assess effect of using mind maps as a learning tool on eighth graders' science achievement, and observed it was a significant factor in the scholastic achievement of students in the experimental group.

Effects of training in Synectics on Whole Brain Learning and Creative Production

Research findings on effects of synectics made in the study are also mixed and contradictory. Empirical results on Table 1 and 7 show that the null hypothesis of no significant effect of synectics on whole brain learning was accepted. Therefore, training in synectics did not enhance significantly whole brain learning of high ability pupils, notwithstanding the observed mean gains. Conversely, results shown on Table 2 and 9 revealed that training in synectics did enhance significantly creative production of high ability pupils; as indicated by their mean gains scores. This later finding is not surprising since synectics helps students develop creative responses to problem solving, retain new information, assist in generating writing, explore social/disciplinary problems and create new products. It helps users break existing mindsets and internalize abstract concepts. Synectics works well with all ages, as well as those who withdraw from traditional methods; and is based on the notion that traditional thought should be challenged. However, the pupils require more time to make a convenient shift from conventional learning practice to the use of such new technique as synectics that involves making the familiar strange, and making the strange familiar, thereby giving rise to creative ideas; as metaphor and analogy are used to translate both principles into practical strategies.

Therefore, the researcher asserts notwithstanding the significant effect of synectics on creative production that the Nigerian type of educational system is still traditional, and does not seem to accommodate creative thinkers, as its conformist values and expectancies inhibits creative behaviours. Furthermore, the Nigerian regular classroom provides little opportunity for creative thinking. The materials presented to the pupils are finished products, providing very

little scope for high ability pupils to think critically and creatively. Thus, a longer period of training is requisite if sustainable and significant effect of synectics technique would be observed in optimizing the whole brain potentials of high schoolchilldren.

The research findings on significant effects of synectics on creative production though supported by some empirical research studies conducted by Gendrop (1996); Shreyashi (2008); Sesadeba (2008); and Madahi (2010), contradict no significant effect of synectics on whole brain learning. Gendrop (1996) investigated the effect of synectics on creative thinking, and found significant difference in originality only. Posttest mean scores revealed significant gains for the experimental group over the control group on all pretested creative abilities, which negate the findings of the present study. Nonetheless, several potential strengths and weakness in the reflective reasoning of nurses were also found. In line with Gendrop (1996), Shreyashi (2008) studied the impact of synectics model of teaching in life science to develop creativity. Among other findings, the results equally indicated that posttest scores of fluency, flexibility; originality and creativity were significantly different from pretest scores in experimental group, which implies that effects of synectics model and traditional method of teaching life science in development of creative thinking ability of students were significant.

This research finding on significant effect of synectics on creative production, although supported by Gendrop (1996), Shreyashi (2008), Sesadeba (2008), and Madahi (2010); yet, is contradicted by some earlier studies conducted by Raul (1984); Gendrop (1996); Shreyashi (2008), and Ali and Roghieh (2009); and the no significant effect of synectics on whole brain learning. For instance, Raul (1984) studied the effects of a training intervention on dogmatism, flexibility, and attitudes of preservice students and observed no significant relationships between dogmatism and flexibility, dogmatism and attitudes, and flexibility and attitudes of preservice students, among other variables studied. Also, Gendrop (1996) investigated the effect of synectics on creative thinking and found that the differences in critical thinking, fluency, and flexibility were not significant. Thus, the findings revealed several potential strengths and a weakness in the reflective reasoning of nurses. In the same vein, Shreyashi (2008) studied the impact of synectics model of teaching in life science to develop creativity among pupils and found that fluency, flexibility, and originality were not significant in the control group. Ali and Roghieh (2009) studied effects of three methods of creativity development (brainstorming, forced association and synectics) in second grade guidance school students in Shahrekord and found that no significant difference between the three methods; in other words, none of the creativity methods was superior to the others.

Also, Sesadeba (2008) studied the effectiveness of synectics model of teaching in enhancing creativity, academic achievement and achievement motivation of learners. Making Familiar Strange (MFS) approach of synectics model of teaching was found to be effective in enhancing the creative thinking ability of the learners. However, it did not prove to be effective in enhancing the achievement motivation of the learners, and did not put any significant impact upon the achievement of the learners in the subject General science. Madahi (2010) observed a difference between the effects of brainstorming, synectics and deductive methods on creativity level of students. Compared with synectics method, brainstorming has a greater effect on student creativity, and synectics in turn improves this variable much more than the deductive method. However, there was no indication whether the observed difference was significant or not.

Influence of Gender on Whole Brain Learning and Creative Production

Empirical evidences shown on Table 10 and 11 indicate that gender had no significant influence on whole brain learning and creative production of high ability pupils. These results are quite revealing since sex roles and social expectancies have become persevering challenges to developing creativity. In some parts of Nigeria, while certain professions are sex linked and tend to inhibit creativity; the males had been seen as dominating access to many fields of human endeavour and controlling the standard of judging individualôs accomplishment. More so, though the sample schools were primary schools, no significant gender influence on whole brain learning and creative abilities observed could be ascribed to the pupilsô maturity level. The pupils were competitive and participative members of their class; they were not limited by stereotype related to gender. However, other attempts at interpreting gender influence argue that males and females do extremely well in different aspects of creativity. This observation could be altered when gender is examined separately, or different aspect of creativity measured. Also, dissimilarity may be possibly due to gender identity. In a nutshell, research findings on gender influence and creativity has been, and is still contradictory, variant, and inconclusive.

These research findings concur with other related empirical studies conducted by Nori (2002); Henderson (2003); Onu, Eze and Onuigbo (2008); Palaniappan (2000); Habibollah, Rohani, Tengku Aizan, & Jamaluddin (2009). For instances, Nori (2002) studied the sex differences and the type of relationship between creativity and academic achievement among high school students in Shiraz city. The analysis revealed that there was no significant relationship between creativity and academic achievement, but the result was different for both sexes. Henderson (2003) found no gender differences in self reported creative achievement of

247 inventors working in multinational firms who responded to a 90-question on-line survey. In another research investigation within area of the study, Onu, Eze and Onuigbo (2008) examined the effect of instruction on ideational fluency on creativity of schooling adolescents, and found no significant influence of gender on ideational fluency. This means that male students did not perform significantly better than females. Likewise, Palaniappan (2000) study found no gender difference for environmental sensitivity and initiative among Malaysian students. Palaniappan stated that there was no significant difference on the factor environmental sensitivity between males and females, while males obtained higher scores on initiatives than females. In the same vein, Lau and Li (1996) surveyed 212 gifted Chinese students to self assess their creativity, family hardiness, and emotional intelligence; and found no significant gender differences. Just like others, Habibollah, Rohani, Tengku Aizan, & Jamaluddin (2009) found no gender differences on the overall factor scores for both ówhat kind of person are youô and, ósomething about myselfô among Iranian students.

However, the findings of the study contradict some previous empirical research results conducted by Kim and Michael (1995); Ai (1999); Habibollah, Rohani, Tengku Aizan, & Jamaluddin (2009); and Habibollah, Rohani, Tengku Aizan, Jamaluddin and Vijay (2010) on influence of gender on whole brain learning, academic achievement, and creativity. Some of them found males significantly superior in creative activities, while others did not make such finding. For instance, Kim and Michael (1995) studied the relationship of creativity measures to school achievement and to preferred learning and thinking style in a sample of Korean high school students. It was concluded that Korean high school females may be expected to exhibit higher average levels of performance on verbal and visual creativity test than will their male counterparts. Irrespective of gender, but especially in the instance of females, those students classified as showing a learning or thinking style preference hypothesized to be associated with right brain dominance are likely to earn higher scores on creativity measures than those students classified as displaying a learning and thinking style preference hypothesized to correspond to either a left brain dominance or an integrated brain dominance.

Also, Ai (1999) studied Spanish studentsô relation between creativity and academic achievement. The results indicate that some differences exist between males and females on aspects of creativity related to academic achievement. For girls, elaboration related to four of the academic subject areas (Basque, Spanish, Social Science and English), and fluency related to Natural Science and Mathematics. For boys, flexibility was the predominant factor that related to all six academic subject areas. These differences may be explained by the different gender roles

for males and females in most countries; although creativity is shown to be related to academic achievement for gender. Habibollah, Rohani, Tengku Aizan, & Jamaluddin (2009) also observed that females scored significantly higher on environmental sensitivity than males, and males scored significantly higher on initiative. In the same vein, Habibollah, Rohani, Tengku Aizan, Jamaluddin and Vijay (2010) studied the relationship between creativity and academic achievement; and if the relationship differs between males and females. The results of the research indicate that there existed gender differences regarding specific aspects of creativity, in relation to academic achievement. Dissimilar aspects of creativity and achievement were found to be significant for males and females.

Interaction Effects of Mind Mapping, Synectics and Gender on Whole Brain Learning and Creative Production

Empirical evidences shown on Table 10 & 11 indicate that there is no significant interaction effects of treatments (mind mapping and synectics) and gender for whole brain learning of high ability pupils; though significant for their creative production. This is because high ability pupilsô whole brain learning did not depend significantly on interaction effects of treatments and gender of participants. On the contrary, high ability pupilsô creative production depended significantly on interaction effects of treatments and gender of participants. Thus, mind mapping, synectics and gender do interact relatively over the whole brain learning and creative production of high ability pupils.

These research findings concur with related empirical studies reviewed by Nori (2002); Henderson (2003); and Onu, Eze and Onuigbo (2008) that found no significant interaction effect of treatment variable and gender on creativity. Nori (2002) studied the sex differences and the type of relationship between creativity and academic achievement among high school students in Shiraz city. The analysis revealed that there was no significant relationship between creativity and academic achievement; though the result was different for both sexes. In the same vein, Onu, Eze and Onuigbo (2008) researched on effect of instruction in ideational fluency on creativity of schooling adolescents. The result of the study shows no significant interaction effect of gender and ideational fluency on creativity.

Furthermore, the findings of this study contradict the results of empirical researches conducted by Goldsmith and Matherly (1988); Gough (1992); Ai (1999); and Kim and Michael (1995). They observed significant interaction effects of treatments variables and gender on whole brain learning and creativity. Goldsmith and Matherly (1988) gave 118 college students three

self-report measures of creativity. The subjects also completed three self-report measures of self-esteem. There was a positive correlation between the self-report measures of creativity and the self-report measures of self-esteem, but the relationship was both stronger and more consistent for women than for men. This gender difference in the relationship between self-esteem and creativity confirmed a prediction based on a study by Forisha in 1978, which found that creative production in women was associated with sex role masculinity (a construct that includes the personality traits of competence and self-reliance). Likewise, Gough (1992) looked for correlations between professorsô assessments of psychology graduate studentsô creativity defined as the creative quality of the studentôs thinking and research in Psychology, and various personality and cognitive test scores. Overall, the patterns showed only minor differences. Not surprisingly, the creativity temperament scale was correlated with the creativity ratings of both women and men in the sample. Also, Kim and Michael (1995) studied the relationship of creativity measures to school achievement, and to preferred learning and thinking style in a sample of Korean high school students. It was concluded that Korean high school females may be expected to exhibit higher average levels of performance on creativity tests than will their male counterparts.

Effects of Mind Mapping and Synectics on Brain Dominance

Results on Table 5 suggest that approximately ninety-one percent of high ability pupils remained left brain dominant irrespective of training in mind mapping and synectics. However, modulation of the posttest scores toward the right brain processing observed seems to indicate an inclination toward integrated learning or whole brain state. This finding is not surprising though whole brain learning and high creativity found among most children before entering school comes down to ten percent at age of seven, five percent between ages of ten to twelve, and then only two percent at adulthood. This means that much of education is still focused on the left brain processing skills and preferences, to the neglect of the needs of the right brain dominant individuals, and of the whole brain potentials. Thus, a period of strategy training on mind mapping and synectics longer than eight weeks is requisite in order to effect an integrated brain learning state.

This research finding is consistent with earlier empirical researches conducted by Templeton and Jensen (1996); Witcher (2001); Campbell (2008); and Dejager (2008) who found that the effects of whole brain learning activities are not significant on brain dominance. Templeton and Jensen (1996) studied fourth graders, using the brain gym as a model for seven weeks and concluded that the overall classroom environment (traditional classroom) as perceived

by the students, had not improved. They also noted that the majority of the studentsô grades did not change positively or negatively. The results of the study do not support positive effects of using whole brain learning activities - brain gym - on student achievement. However, Templeton and Jenson equally observed that the students did feel better about themselves, having a way to improve their grades and behavior.

Witcher (2001) sought to determine whether whole-brain learning activities influenced emergent literacy skills. Witcher concluded that the findings of the study fail to support the overall effectiveness of brain gym exercises for enhancing the learning-to-read skills acquired by kindergarten pupils during one school year. Results of the study also did not support positive effects of using whole brain learning activities on emergent literacy skills. In the same vein, Dejager (2008) conducted an evaluation of brain gym as a technique to promoting whole brain learning and found no significant results, which indicate that the brain gym intervention did not have a measurable effect. However, the findings indicated that the learners improved on a physical, emotional and social level in terms of sensory integration, confidence, attitude, concentration and motivation.

On the other hand, the finding of the present study tends to contradict researches conducted by Campbell (2008); Khalsa (1986); Sifft and Khalsa (1991); and Kim and Michael (1995). For instance, Campbell (2008) examined if application of Ned Herrmannôs whole-brain model would affect violin teaching in any way; and observed a significant change in the playing of the majority of learners (three of the five). The learners, where significant changes were not apparent in their playing, indicated that their understanding of practicing methods and playing had increased. Also, Khalsa (1986) conducted a quantitative study using whole brain learning activities with learning disabled students. Result of the study suggests that whole brain learning activities may influence psychomotor skills even with learning disabled sample type. Likewise, Sifft and Khalsa (1991) researched on college students, the results indicated that the groups using whole-brain learning increased in their psychomotor skills, while the control group did not.

In line with Sifft and Khalsa (1991), Kim and Michael (1995) studied the relationship of creativity measures to school achievement and to preferred learning and thinking style in a sample of Korean high school students. They concluded that in Korean high school irrespective of gender, but especially in the instance of females, those students classified as showing a learning and thinking style preference hypothesized to be associated with right brain dominance are likely to earn higher scores on creativity measures than will those students classified as displaying a learning and thinking style preference hypothesized to correspond to either a left

brain dominance or an integrated brain dominance. In sum, these findings tend to suggest that despite the no significant findings made in this present study, whole brain learning could be improved.

Conclusions

In line with the research questions, hypotheses, and major findings illustrated under discussion and interpretations of findings, the researcher concludes as follows:

1. Training in mind mapping strategy has no significant effect on high ability pupilsô whole brain learning.
2. Training in synectics technique has no significant effect on high ability pupilsô whole brain learning.
3. Training in mind mapping strategy has significant effect on high ability pupilsô creative production.
4. Training in synectics technique has significant effect on high ability pupilsô creative production.
5 Gender has no significant influence on whole brain learning of high ability pupils.
6 Gender has no significant influence on creative production of high ability pupils.
7 There is no significant interaction effect of mind mapping, synectics and gender on whole brain learning of high ability pupils.
8 There is significant interaction effect of mind mapping, synectics and gender on creative production of high ability pupils.
9. Approximately ninety-one percent high ability pupils seem to remain left brain dominant irrespective of training in mind mapping and synectics (whole brain activities).

The researcher asserts that although the brain dominance of participants trained in the use of whole brain learning strategies (mind mapping and synectics) did not change altogether from the left to the right; yet, the modulation of their posttest percentage scores indicate an inclination toward a more integrated or whole brain state. Hence the present research study is aimed at infusing whole brain learning strategies into mainstream educational pedagogy, the treatment effects are then expected to integrate the cognitive functions of the left brain with the creativity and innovative skills of the right brain into a whole brain learning balance; and not just an inclination to the right brain dominance.

More so, the research training period lasting only eight weeks was inadequate for hemispheric shift or cultivating the skills of the unpreferred brain processing mode. This deduction may account for the lack of significant shift to whole brain learning. Also, the teachersô negative attitude and pupilsô unfamiliarity with the strategies could have equally affected the results; since whole brain learning activities are entirely new approach to teaching and learning. It could be concluded therefore that training in mind mapping and synectics techniques are capable of stimulating a whole brain state; and as such, can address effectively the vast array of learning difficulties, learning preferences, and harness the creative potentials in the regular classroom, when programmed for a period longer than eight weeks (perhaps for two academic terms or more).

Educational Implications

This study investigated the effects of mind mapping and synectics on the whole brain learning and creative production of high ability children. The major findings made suggest that the whole brain learning of high ability pupils in the Nigerian regular primary schools are not significantly affected by strategy training in mind mapping and synectics. This implies that the human resource potentials of high ability pupils in Nigerian regular schools are still grossly not maximized; hence the brainôs left and right hemispheres are not actively engaged in the learning process. This means therefore that much of educational pedagogy today relies on conventional instructional method, which is essentially left brain based; and ought to give way to whole brain learning approaches in order to create a learning community that understands and respects the learning preferences of high ability individuals, delivers learning based on individual uniqueness and learning styles, and enhance the utility of the whole brain potentials.

The result of this study also suggests that training in mind mapping strategy has significant effect on high ability pupilsô creative production, which implies that mind mapping increases creativity of young children, permit a better understanding of childrenôs cognition by engaging the right and left brain hemispheric activities, facilitates the essential processes of visual coordination, and integration with other cognitive operations, which are essential to knowledge construction. Mind mapping provides approach to breaking out of limited thinking and developing consistent fresh thinking patterns, generating fresh solutions to problems, and the ability to create processes, new products or services. This means that classroom teachers and special educators in regular schools could by infusing mind mapping strategy in instructional practices nurture and optimize creative potentials of high ability pupils.

The result of this study suggests that training in synectics technique has significant effect on high ability pupilsô creative production. This implies that high ability pupils in regular schools should not depend much on conventional methods of learning, which does not promote creativity. This then means that high ability pupilsô rare creative potentials could be harnessed by infusing synectics instructional technique in regular teaching delivery. Thus, this implies that for Nigeria as a nation to advance scientifically and develop technologically, regular teachers should increase classroomsô right-brain learning activities by incorporating more patterning, metaphors, analogies, role-playing, visuals, and movement into their reading, calculation, and analytical activities.

The result of this study suggests that gender has no significant influence on whole brain learning of high ability pupils. This implies that boys and girls performed and responded equally to the dependent measures and should be engaged together in whole brain learning activities and creative production. This means that high ability pupilsô sex, sex roles and social expectancies were not persevering challenge to developing creativity. In order words, neither males nor females have dominated access to creative accomplishment and whole brain learning.

The result of this study suggests that gender has no significant influence on creative production of high ability pupils. This implies that boys and girls did perform and respond equally to the dependent measures and should be trained together in order to enhance their creative production. Also, this finding means that high ability pupilsô sex, sex roles and social expectancies are not persevering challenges to developing creativity. In order words, male and female pupils should be trained equally; hence gender does not dominate access to creative accomplishment or influence whole brain learning.

The result of this study suggests that there is no significant interaction effect of mind mapping, synectics and gender on whole brain learning of high ability pupils, which implies that neither mind mapping, synectics nor gender are interdependent, or have correlative effects on the dependent measures. These findings further imply the possibilities of between group variance on the study, and implicitly recommend the use of the treatment variables in enhancing whole brain learning and creative production. This means that classroom teachers, parents, guardian and counselors, special educators should involve both boys and girls equally in whole brain learning activities and creativity.

The result of this study suggests that there is significant interaction effect of mind mapping, synectics and gender on creative production of high ability pupils, which implies that mind mapping, synectics and gender are interactive, interdependent and have correlative effects

on the dependent measure - creative production. This finding limits the possibility of between group variance on the study, and implicitly recommends the use of the treatment variables in training both boys and girls for enhanced creative production. This means that classroom teachers, parents, guardian and counselors, special educators should also involve both boys and girls equally in whole brain learning activities and creativity.

The result of this study suggests that approximately 91.5% high ability pupils seem to remain left brain dominant irrespective of training in mind mapping and synectics techniques. This finding of the study implies that the Nigerian regular school, by its traditional nature, is still committed to curriculum that seems intellectually based, formal in orientation, left brain styled instruction, and directed toward examinations. This means that the regular education does not provide enough challenges that integrate holistic, random, concrete, intuitive, nonverbal, and fantasy-oriented processing skills; and foster creativity in accommodating the precocity of high ability thinkers. Furthermore, since peopleôs learning styles match their thinking styles; all learning groups consist of people with different thinking style preferences, different ways of knowing and different learning styles. Therefore, the finding of this study implies the need to device learning programmes and curricula that are based on the right and left brain hemispheres in order to integrate the whole brain thinking activities of learners with diverse learning preferences.

The findings of this study suggest that schools do not give equal weight to arts, creativity, and the skills of imagination and synthesis for entrenching and infusing creativity into regular education. This obviously has implication for development of creative potentials of high ability children, which may limit their scientific and technological contributions to national development. The result of this study offers enrichment strategies for coping with the challenges posed by regular education through mainstreaming of high ability pupils, among other diverse learners in the Nigerian Universal Basic Education. Also, it provides relevant brain dominance information and whole brain learning strategies for teachers, curriculum planners and evaluators, and other allied professions with stake in development of the exceptional persons. And for parents, guidance/counselors, and other teaching professionals that need effective techniques for facilitating easy identification, placement, and training of children with learning preferences both at home and in school.

It also means that the age long reliance on conventional instructional method which is stuck at the left brain method of instruction at the expense of the right brain creativity and innovation should be reversed. Thus, authors, publishers of childrenôs educational textbooks,

instructional materials, and activity books should present ideas and tasks in ways that enhance the processing skills of the left brain: such as linear, sequential, symbolic, logical, verbal, and reality-based; as much as those of the right brainôs processing skills: holistic, random, concrete, intuitive, nonverbal, and fantasy-oriented.

Recommendations

Based on the findings of this study and its implications, the following recommendations are made.

1. The results of the study indicate that training in mind mapping strategy does not enhance significantly high ability pupilsô whole brain learning. Therefore, teachers should invest more time in equipping high ability pupils with graphic skills, involving the use of colours, pictures, numbers, letters, images, and shapes in knowledge construction; so to enable the maximization of the left and right brain potentials in the learning process. Also, teacher training institutions should infuse whole brain learning strategies and activities into relevant curricular. They should also build the capacity of their academic staff, teachers, pre-service and in-service students on the efficacy and use of whole brain learning strategies in maximizing brain potentials.
2. Hence training in synectics technique has no significant effect on high ability pupilsô whole brain learning, special educators, regular teachers, curriculum planners, parents, guardians/counselors and other allied professions should be sensitized on efficacy and use of whole brain learning approaches in fostering the whole brain (cognitive and creative potentials) of high ability children.
3. The results of the study indicate that training in mind mapping strategy enhance significantly high ability pupilsô creative production. Thus, classroom teachers and special educators in regular schools should infuse mind mapping strategy in instructional practices so to nurture the creative potentials of the high ability pupils.
4. Hence training in synectics technique has significant effect on high ability pupilsô creative production, teachers should increase classroomsô right-brain learning activities by incorporating more patterning, metaphors, analogies, role-playing, visuals, and movement into their reading, writing, calculation, and analytical activities. Authors and publishers of educational textbooks, activity books, and instructional materials should be urged by the government to infuse creativity

using synectics and other graphic tools (such as mind mapping) in designing and presenting ideas, facts and information.

5. Since gender does not influence significantly whole brain learning and creative production of high ability pupils; therefore, schools should involve equally high ability boys and girls in same training programme, which expose them to creative problem solving situations or activities demanding whole brain approach. The National Council for Exceptional Children in order to sensitize and build the capacity of special educators and regular teachers on application of the findings of this study should organize seminars, conferences and workshops for special educators and other professionals with vested interest in the education of special need children by.
6. Most high ability pupils seem to remain left brain dominant irrespective of training in mind mapping and synectics. Therefore, teachers should be acquainted with whole-brain learning approach if all learners with diverse learning styles must be taught and enabled to achieve their whole brain potential. Also, Federal and State Ministries of Education, and other stake-holders in education of high ability children should organize capacity building training to facilitate easy identification, placement, and training of high ability children; develop and implement individualized educational programme designs, and whole brain learning strategies. This is necessary since many regular teachers need to acquaint with these emerging techniques of whole brain education and creative production.

Limitations of the Study

The conclusions and the external validity of the findings of this study might have been affected by the following limitations.

1. Three regular teachers and three class assistants from three sample schools were used as trained instructor in this study. Variability in teacher effectiveness and instructional capacities could have affected the efficacious use of the training programmes, notwithstanding the preparatory workshop organized by the researcher.
2. The training period lasting for eight weeks is consistent with the duration of experiments in some other studies; but, seems too short to affect a shift in brain learning preferences.

3. The identification procedure used in this study might have ignored average performing pupils with special interests and abilities in vocational areas or the under achieving gifted pupils.
4. There is a possibility of between group variance in three sample schools used for experimental and control group conditions. Hence schools vary along many factors; such as administrative style, curriculum implementation, quality of teaching and effectiveness of teachers, among others, these sources of variance vary across schools, and might have confounded the learning process or products.
5. The number of tests and subtests used in this study are many, and might have led to test takers fatigue and disinterest.
6. Also, the items of the data collection instruments due to their many numbers might have become ambiguous, though they were taken by high ability pupils,
8. The online instrument - Right Brain versus Left Brain Creativity Test - used in analyzing the Whole Brain Self-Report Questionnaire data for brain dominance was designed to provide percentage result for only right and left brain processing of each test taker, not as a whole brain percentage score.
9. Attitude of teachers that assisted in the study, although supervised; yet, could have affected the diligent implementation of the training programmes and assessments.

In spite of the limitations pointed above, the study was able to establish the effects of mind mapping and synectics on whole brain learning and creative production of high ability children.

Suggestions for Further Studies

The findings of this study have aroused interest in some other areas for further research; such as:

1. Replication of the study on effect of mind mapping and synectics on whole brain learning and creative production of high ability pupils.
2. Replicating the study using other geo-cultural locations in Nigeria, to ascertain what would be the external validity and the effects of mind mapping and synectics on whole brain learning and creative production.
3. Examining the effect of mind mapping and synectics on whole brain learning and creative production of diverse learners.

4. Examining the effect of mind mapping and synectics on other cognition skills and creativity.
5. Examining the effect of other forms of whole brain learning activities on brain dominance and creative production.
6. Conducting a comparative study on effect of mind mapping and synectics on whole brain learning and creative production of overachieving and underachieving gifted pupils.
7. The use of a single instructor in executing the training programmes for treatments and control group conditions. Perhaps, variance due to differing instructorsô capacities would be controlled; thereby maximizing treatment effects.

Summary of the Study

This study investigated the effects of mind mapping strategy and synectics technique on whole brain learning and creative production of high ability pupils. The motivation for this study was derived from widespread underachievement of the rare potentials of high ability pupils not served in the regular school system. Reasons identified in reviewed literature for this problem are as follows: teacher inexperience in providing high ability pupilsô instructional needs, lack of skills in appropriate modification of curriculum, use of inadequate/inappropriate learning material, and left brain styled methods of instruction. On the other hand, many teachers lack in-depth knowledge of high ability pupils; and the processes of developing and applying developed individualized programme designs; while others lack exposure to education based on curriculum and instructional models for the high ability pupils. Hence, the needs to train high ability pupils in the use of mind mapping strategy and synectics technique, in order to integrate and harness their whole brain potentials in the learning process.

This study sought to determine nine specific purposes, seven research questions guided the stud, while eight hypotheses were formulated and tested at 0.05 probability level. The review of literature pertinent to the study was done under the following headings and subheadings: conceptual framework, theoretical framework, empirical studies, and summary of Literature review. Subheadings in conceptual framework are concept of ability, high ability children, concept of creativity, creative production, whole brain learning, whole brain creativity, mind-mapping, concept of synectics, and schematic diagram of conceptual framework. While the theoretical framework includes brain hemisphericity theory, ned herrmann's whole brain model, theory of multiple intelligences, enrichment triad model, synectics theory, cognitive,

constructivist theory, and strategy integration model; the Empirical studies covered the following topics: studies on whole brain learning, creative production, studies on mind mapping, studies on synectics, studies on high ability, gender differences in creativity, and summary of literature review.

The study is a quasi-experimental research, with a non-equivalent pretest posttest control group research design involving two treatments groups and a control group. One hundred and sixty-nine (169) high ability pupils surveyed in thirty-four government approved primary schools in Nsukka urban area using the validated identification instruments constituted the population of the study, while twenty-one of them identified in three sample schools constituted the sample size. The three sample schools were drawn using purposive sampling technique and randomly assigned to treatment conditions through simple random sampling technique of simple toss of the coin. Three primary six regular teachers and three class assistants at the sample schools were trained, and implemented the training programmes. Measures were adopted to ensure the control of potential extraneous variables capable of confounding the experiments, and the external validity of the study.

Three training programmes developed by the researcher on mind mapping, synectics and conventional instruction method were validated and used for training participants. Two test instruments: Creative Productivity Test Battery (CPTB) and Whole Brain Self-Report Questionnaire (WBSQ) were adapted and used for pretest and posttest data collection. While the original versions of the tests were used as pretest, the reshuffled and rearranged versions were used as posttest. The internal consistency reliability coefficients of the instruments were determined using the Cronbach procedure. The coefficient alpha of .66 was obtained on Creative Productivity Test Battery; while, coefficient alpha obtained on Whole Brain Self-Report Questionnaire - right brain subsection is .60; and .76 for the left brain subsection. The stability of Creative Productivity Test Battery subtests were estimated using Pearson Moment Correlation procedure.

Data collected from the study were analyzed using percentage, mean, standard deviation to answer the research questions; while the hypotheses were tested using Analysis of Covariance (ANCOVA) statistic at 0.05 level of significance.

The findings of the study indicate that:

1. Training in mind mapping strategy has no significant effect on high ability pupilsô whole brain learning as measured by their mean scores on WBSQ.

2. Training in synectics technique has no significant effect on high ability pupilsô whole brain learning as measured by their mean scores on WBSQ.
3. Training in mind mapping strategy has significant effect on high ability pupilsô creative production as measured by their mean scores on CPTB.
4. Training in synectics technique has significant effect on high ability pupilsô creative production as measured by their mean scores on CPTB.
5 Gender has no significant influence on whole brain learning of high ability pupils as measured by their mean scores on WBSQ.
6 Gender has no significant influence on creative production of high ability pupils as measured by their mean scores on CPTB.
7 There is no significant interaction effect of mind mapping, synectics and gender on whole brain learning of high ability pupils as measured by their mean scores on WBSQ.
8 There is significant interaction effect of mind mapping, synectics and gender on creative production of high ability pupils as measured by their mean scores on CPTB.
9. Approximately ninety-one percent high ability pupils seem to remain left brain dominant irrespective of (whole brain learning activities) training in mind mapping and synectics.

The major findings of the study as highlighted above were extensively discussed. The conclusions, the education implications and the recommendations were presented in line with the findings of the study, while the possible limitations of the study and suggestions for further studies were clearly streamlined.

REFERENCES

Abang, T. B. (2005). *The exceptional child: Handbook of special education*. Jos: Fab Educational Books.

Abi-El-Mona, I. & Adb-El-Khalick, F. (2008). *The Influence of mind mapping on eighth graders' science achievement.* Retrieved from http://www.accessmylibrary.com/article-1G1-189159358/influence-mind-mapping-eighth.html on 21/08/10.

Adesokan, E. O. (1990). *Giftedness: Developing the potential of the gifted and talented at home and at school*. Akure: Fagbamigbe Publishing Ltd.

Adeyanju, G. A. (2002). Creativity: Learning and learning style. Zaria: Isola and Sons

Ai, X. (1999). Creativity and academic achievement: An investigation of gender differences. Creativity Research Journal, 12(4), 329-337.

Akinboye, J. O. (2001). Creativity, innovation, and success. Ibadan: String-Holden

Akinlaye, F. A. (1996). Teacher-directed inquiry guided discussion and students learning outcomes in some aspects of social studies. Unpublished Ph.D Thesis. University of Ibadan.

Ali, A. S. & Roghieh, D. (2009). Comparison of the effect of three methods of creativity in Second grade guidance school students. *Iranian Journal of Psychiatry and* Development *Clinical Psychology*, 15(1), 57-62. Retrieved from http:/data/www/docs/icjournalmasterlist2/stopka.php.online.25 on 19/05/2010.

Alibaba Group. (2009). *Improve your thinking skills with mind mapping techniques*. Retrieved from http:/www.Alibaba.com on 23/12/09.

Aloe, A. A. (1986). Gifted and talented children in Nigeria. In V. C. Onu (2008). *A handbook on gifted education, creativity and thinking skills*. Nsukka: Multi-Educational Services Trust.

Ananga, S. (2009). *Whole brain thinking: How to get your right hemisphere in the picture*. Retrieved from http://www.ananga.squarespace.com/ selfgrowth.com on 09/12/09.

Anih, H. U. (2001). Evaluation of gifted education practices in Nigeria: A case study of Suleja academy. A Ph.D Thesis. University of Nigeria Nsukka.

Animasahun, R. A. (2002). *Effectiveness of six thinking hats and practical creativity in fostering positive life skills*. Ibadan: Maritime Press.

Anyakoha, E. U. (2006). Entrepreneursip education and wealth creation strategies: *Home Economics Research Association of Nigeria (HERAN).*

Asha, C. B. (1980). Creativity and academic achievement among secondary school children.

Asian Journal of Psychology and Education, 6, 1-4.

Avezah. (2009). *Are you ambidextrous or whole-brain thinker mind mapping to your rescue*. Retrieved from http://www.avezah.com on 10/10/2007.

Awanbor, D. (1989). An over view of current thinking on giftedness. In Onu, V. C. (2008). *A handbook on gifted education, creativity and thinking skills*. Nsukka: Multi-Educational Services Trust.

Behavioural Sciences. (1995). In Microsoft encarta 2009 [DVD]. Redmond, WA: Microsoft Corporation 2008.

Brooks, J. S. & Brooks, M. (1993). In search of understanding: the case of constructivist classrooms. In Ogbonna, C. C. (2003). *Effect of constructivist instructional approach on senior secondary school students' achievement and interest in mathematics.* Unpublished M.Ed Project of University of Nigeria Nsukka.

Buzan, T. (2009a). *How to make a mind map.* Berkshire: Illumine Limited, Vale House. Retrieved from http:\www.how to make a Mind Map.htm, http://www.illumine.co.uk on 23/12/09

Buzan, T. (2009b). *What is mind mapping? Saskatoon public schools*. Retrieved from http:\www.instructionalstrategiesonline-mindmapping.htm on 23/12/09.

Buzan, T. (2009c). *Mind maps*. Retrieved from http:/www.buzan@buzanworld.com on 23/12/09

Buzan, T. (1997). *The mind map*. London: Boo

Buzan, T. & Buzan, B. (1996). *The mind map book.* London: BBC Books

Buzan, T. (1993). *The mind map book*. Retrieved from http://www.brainchannels.mindmapping.htm/http://www.mind-map.com/mindmapping-an evolutionary breakthrough on 23/12/09. Plume, Published by the Penguine Group.

Bruce, J. & Martha, W. (1996). *Models of Teaching, 5th ed.* Boston: Allyn & Bacon

Callahan, C. M. (2009). *Education of gifted students*. Microsoft encarta 1993 ï 2008 Microsoft Corporation.

Calma, A. M. (2003). *A dictionary of Psychology*. Great Britain: Oxford University Press.

Campbell, V. (2008). *The implications of ned herrmann's "whole-brain" model for violin teaching: A case study*. Retrieved from http://hdl.handle.net/10019/1906 on 09/12/09

Chen, Z. (2007). Learning to map: Strategy discovery and strategy change in young children. *Developmental Psychology*, 43(2). 386-403.

Clemons, S. A. (2005). Encouraging creativity in online courses. *ITDL Journal*. Retrieved from http://www.itdl.org/Journal/Jan_05/article05.htm on 2/28/2006

Collangelo, N. & Davis, G. (1997). *Handbook of gifted education*. Allyn and Bacon

Couch, R. (1993). Synectics and imagery: Developing creative thinking through images. In Art, science & visual literacy: Selected readings from the annual conference of the international visual literacy association (24th, Pittsburgh, PA. September 30 - October 4, 1992). Retrieved from ERIC Document Reproduction Service No. ED 363 330; *http://www.edweb.sdsu.edu/courses/et650_online/mapps/synectics.html* on 19/05/2010.

Cristina, M. A. & Andrew, N. M. (2005). My future self: Young children's ability to anticipate and explain future states. *Cognitive Development*, 20 (3), 341-361.

Csikszentmihalji, M. (2001). *Creativity flow and psychology of discovery and inventory*. New York: Harper Ennia

Davis, G. A. (1992). *Creativity is forever (third edition)*. Dubuque, Iowa: Kendall. Hall Publishing Company.

De-Bono, E. (2001). *The direct teaching of creativity*. Retrieved from http://www.edwdbono.com/cort/forward.htm on 13/02/2007

Deaux, K. (1993). Commentary: sorry, wrong number: A reply to gentileôs call. *Psychological Science,* 4, 125-126.

DeJager, M. (2008). *An evaluation of brain gym as a technique to promote whole brain learning: A personal and professional perspective.* Retrieved from http://hdl.handle.net/10210/818 on 09/12/09

Dennison, P. E. & Dennison, G. E. (1989). *Brain gym (Teachers edition, revised).* Edu-Kinesthetics, Inc.

Detterman, D. K. (2009). *Intelligence*. Microsoft encarta. 1993-2008 Microsoft Corporation.

Duit, R. (1991). On the role of analogies and metaphors in learning science. *Research in Science Education*, 75, 649-672

Effiong, E. (2006). *Mass creativity: the only viable way forward for Africa*: A Paper presented at the invitational roundtable on African mass creativity and particularly development held at Institute of African Studies. University of Nigeria Nsukka on December 12.

Eisenstadt, J. M. (1966). Problem-solving ability of creative and non-creative college students. *Journal of Consulting Psychology*, 30(1), 81-83. Retrieved from psycinfo database record on 8/08/12

Eleweke, C. J. (2002). Issues and problems in the education of the deaf children in Nigeria. In Ali, A. & Okeke, B. A. Philosophy and education. Onitsha: Africana FEP Publishers Limited

Encyclopedia Americana International Edition. (1996). *Ability*. Connecticut: Grolier Incorporated

Eze, U. N. (1998). *Efficiency of training in organizational and comprehension monitoring strategies on academic achievement of secondary students.* An Unpublished Ph.D Thesis University of Nigeria, Nsukka.

Ezeh, D. N. (1992). *Effects of study questions as Advance organizer on students' achievement retention and Interest in Integrated Science.* Unpublished Ph.D Thesis. University of Nigeria Nsukka

Ezeh, D. N. (2005). *What to write and how to write: A step-by –step guide to educational research proposal and report*. Enugu: Pearls & Gold.

Ezeudu, F. O. (1995). *Effects of concept mapping on students' achievement, interest, and retention in selected units of organics chemistry*. Unpublished Doctoral Thesis of Department of Education University of Nigeria Nsukka.

Ezeugo, N. C. & Agwagah U. N. V. (2000). Effect of concept mapping on students achievement In algebra: Implications for mathematics education in the 21st century. *Journal of Mathematical Association of Nigeria, Abacus*, 25 (1), 1-13.

Farrand, P., Hussain, F. & Hennessy, E. (2002). The efficacy of the mind map study technique. *Medical Education*, 36 (5), 426ï 431

Federal Ministry of Education (FME). (2007). *9-year basic education curriculum: English Studies for primary 6.* Abuja: NERDC

Federal Government of Nigeria. (2004). *National policy on education-4th edition*. Lagos: NERDC

Federal Ministry of Education (FME). (1986). *Blue print on the education for the gifted and talented persons in Nigeria.* National planning committee 28th Nov. ï 5th Dec. Lagos: Federal Ministry of Education.

Federal Ministry of Education (FME). (1982). *National policy on education*. Lagos: Federal Ministry of Education

Federal Ministry of Education (FME). (1981). National policy on education (3rd edition). Lagos: NERDC

Finke, R. A. & Slayton, K. (1988). Explorations of creative visual synthesis in mental

imagery. In Kosslyn, S. M. & Rosenberg, R. S. (2001). *Psychology: The brain, the person, the world.* Boston: Allyn and Bacon.

Funderstanding. (2008a). *Right brain vs. left brain*. Retrieved from http:\rightbrainvsleft brain.htm on 09/12/09.

Funderstanding. (2008b). *Whole brain teaching*. Retrieved from http:\WholeBrain Teaching.htm on 09/12/09.

Gale Group. (2001). *Divergent thinking*: *Gale encyclopedia of psychology*. Retrieved from http://www.furnet.hturln on 01/08/2003.

Gardner, H. (1983). *Frames of mind: the theory of multiple intelligences*. New York: Harper and Row.

Gardner, H. (1993). *Creating mind: an anatomy of creativity seen through the lives of Freud, Einstein, Piccaso, Stravinsky, Elliot, Graham and Gandhi.* New York: Basic books

Gendrop, S. C. (1996). Effect of an intervention in synectics on the creative thinking of nurses. *Creativity Research Journal*, 9(1), 11 ï 19.

Glynn, S. M. (1989). The teacher with analogies (TWA) model: explaining concepts in Expositiory text. In Ogbonna, C. C. (2003). *Effect of constructivist instructional approach on senior secondary school students' achievement and interest in Mathematics.* Unpublished M.Ed Project of University of Nigeria Nsukka.

Goldsmith, R. E. & Matherly, T. A. (1988). Creativity and self-esteem: A multiple operationalization validity study. *Journal of Psychology*, 122, 47-56.

Gordon, W. J. J. (1961). *Synectics*. New York: Harper and Row.

Gough, H. (1992). Assessment of creative potential in psychology and the development of a Creative temperament scale for the CPI. In Baer, J. & Kaufman, J. C. (2006). Gender differences in creativity. *Journal of Creative Behaviour*, 2, 65-71.

Gross, M. U. M. (1992). The use of radical acceleration in cases of extreme intellectual precocity. In Woolfolk, A. E. (1995). *Educational psychology*. Boston: Allyn and Bacon.

Guilford, J. P. (1988). *The nature of human intelligence*. New York: McGraw-Hill

Habibollah, N., Rohani, A., Tengku Aizian, H., Jamaluddin, S. V. & Mallan, K. (2009). Gender differences in creative perceptions of undergraduate students. In Habibollah, N., Rohani, A., Tengku Azian, H., Jamaluddin, S. & Vijay, K. (2010). Relationship between creativity and academic achievement: A study of gender differences. *Journal of American*

Science, 6(1), 181-190. Retrieved from http://www.americanscience.org or editor@americanscience.org on 07/03/2011.

Habibollah, N., Rohani, A., Tengku-Azian, H., Jamaluddin, S. & Vijay, K. (2010). Relationship between creativity and academic achievement: A study of gender differences. *Journal of American Science,* 6(1), 181-190. retrieved from http://www.americanscience.org or editor@americanscience.org on 07/03/2011.

Hannaford, C. (1995). In *Whole-brain learning in a seventh grade math/science class*. Retrieved from http://www.facstaff.unca.edu/nruppert/research/wbl_study.Doc on 21/08/10

Harris, R. (1998). *Introduction to creative thinking*. Retrieved from http://www.virtualsalt.com on 06/03/2011

Helson, R. (1990). Creativity in women: outer and inner views over time. In Onu, V. C., Eze, U. N. & Onuigbo, L. N. (2008). Effect of ideational fluency on increasing creativity of students in Nigeria. *The Educational Psychologist*, 4 (1), 53-60.

Henderson, S. J. (2003). The correlates of inventor motivation, creativity and achievement. In Baer, J. & Kaufman, J. C. (2006). Gender differences in creativity. *Journal of creative behaviour*, 2, 65-71.

Hennessey, B. A. & Amabile, T. M. (2010). Creativity. *Annual Review Psychology*, 61, 569ï 98. Retrieved from www.annualreviews.org on 08/08/12

Hermann International. (2009). *The whole brain is a terrible thing to waste.* Retrieved from http:\herrmann internationalsolutionsforeducation.htm on 09/12/09.

Herrmann, N. (1996). *Theories of brain organization*. Retrieved from http:\modelsofthe brain.htm on 09/12/09. The Creative Brain Published by Brain Books.

Herrmann, N. (2000). *The theory behind the HBDI and whole brain technology.* Retrieved from http://www.herrmanninternational-theHBDIaccreditation process.htm on 09/12/09.

Hunt, A. & Begler, D. (2005). A framework for developing EFL reading vocabulary. In Onuigbo, L. (2007). Effects of elaborative rehearsal and self-questioning strategies on reading comprehension of the visually impaired. *Unpublished Ph.D Thesis*. University of Nigeria, Nsukka.

Hyperdictionary. (2009). Ability. Retrieved from http://www.hyperdictionary/ability.htm on 08/08/12

Ifedi, C. (1986). Education for gifted children. In Onu, V. C. (2008). *A handbook on gifted education, creativity and thinking skills*. Nsukka: MultiEducational Services Trust.

Imoko, B. I. (2005). *Effect of concept mapping on students' achievement and interest in trigonometry.* Unpublished Doctoral Thesis University of Nigeria Nsukka.

International Culinary Schools. *The right brain vs left brain creativity test*. The art institute of Vancouver. Retrieved from http://www.wherecreativitygoestoschool.com/vancouver/left_right/rb_test.htm on 08/03/2013

Iordaah, T. A. (2009). *Effect of a cognitive research trust training programme on creative thinking among secondary school students*. An Unpublished Doctorate Thesis. University of Nigeria, Nsukka.

Irele, V. T. (2009). *Evaluation of the administrative and instructional procedures in gifted education programmes at Federal Government Academy Suleja Nigeria 1992-2006.* An Unpublished Doctorate Thesis. University of Ibadan

Jacobs, B. (2006). *Development creativity*. Retrieved from http://www.developingcreativity.htm on 08/12/2006

James, M. (2009). *Whole brain thinking in business.* Retrieved from http://www.articlesbase.com/leadership-articles/whole-brain-thinking-in-business-810922.html; http://www.wholebrainthinkinginbusiness.htm on 09/12/09.

Jones, E. D. & Southern, W. T. (1991). Conclusions about acceleration: echoes of a debate. In Woolfolk, A. E. (1995). *Educational psychology*. Boston: Allyn and Bacon.

Joyce, B., Weil, M. & Calhoun, E. (2004). Synectics: the arts of enhancing creative thought. In *Models of teaching* (7th ed). Boston: Pearson Education, Inc. Pg 155-186

Junaid, M. I. (2008). Reforming education: the Nigerian experience. In Ezeh, D. N & Nkedi (ed) education sector reform in Nigeria. *Institute of Education.* TIMEX.

Kalu, W. J. (1996). Special areas of needs in the growth and development of the gifted child. *Journal of Issues in Special Education*, 3(1), 165-172

Kalu, W. J. (2002). Landscape of gifted education practices and achievements in Nigeria. *Nigerian Journal of Gifted Education*, 1 (1).

Kaufman, J. C., Baer, J. & Gentile, C. A. (2004). Differences in gender and ethnicity as measured by ratings of three writing tasks. *Journal of Creative Behavior,* (39), 56-69.

Khalsa, G. C. K. (1986). *Whole-brain learning in a seventh grade math/science class*. Retrieved from http://www.facstaff.unca.edu/nruppert/research/wbl_study.Doc on 21/08/10

Kipperman, D. & Linder, D. (1995). Cerebral flatulence. EdTec 670 cardboard cognition. Retrieved from http://edweb.sdsu.edu/courses/edtec670/Cardboard/card/c/CerebralFlat.html on 19/05/2010.

Kim, J. S. & Michael, W. B. (1995). The relationship of creativity measures to school chievement and to preferred learning and thinking style in a sample of Korean high students. *Educational and Psychological Measurement*, 15, (1), 60-74.

Koch, L. (2005). *Whole brain learning is a new frontier for science*. Retrieved from http:/www.santacruz Sentinel,ca/truthforce!wholebrainlearningisanew frontierforscience.htm on 09/12/09

Kosslyn, S. M. & Rosenberg, R. S. (2001). *Psychology: the brain, the person, the world.* Boston: Allyn and Bacon.

Kulik, J. A. & Kulik, C. C. (1991). Effects of ability grouping on secondary school students: a metaanalysis of evaluation findings. *American Educational Research Journal*, 19 (3), 415-428

Lau, S. & Li, W. L. (1996). Peer status and perceived creativity of Chinese children: Are popular children viewed by peers and teachers as creative? *Creativity Research Journal,* 9, 347-352.

Lazear, D. (1999). *Eight ways of knowing*. USA: Skylight Training and Publishing Inc.

Learning Strategies Development. (2006). *Whole brain learning: brain research and memory.*\ Retrieved from http:\www.wholebrainlearning.htm on 09/12/09.

Leischner, Chris. (2003). *Mind mapping*. Retrieved from http://www.northernfamilyhealthsociety.com on 09/12/09.

Lenz, B. K., Ellis, E. S. & Scanlon, D. (1996). Teaching learning strategies to adolescents and adult with learning disabilities. Austin, TX: PRO-ED

Mba, V. K. & Aboullahi, A. (1985). The relative effectiveness of the use of subsumption model and learning hierarchy in high school biology instruction: an investigation. *Journal of Science Teachers Association of Nigeria*, 23, 1 & 2.

Madahi, J. K. (2010). Comparison of effectiveness of the three methods of brainstorming, Synectics and deductive on increasing creative thought in female students. *INTED2010 Proceedings,* 72-72. Retrieved http://.library.iated.org/view/Madahi2010.com on 19/05/2010

Maker, C. J. (1982). An experimental programme for young children. In Onu, V. C. (2001).

Effects of bloom's taxonomy based teaching strategy on high ability children cognitive skills. Unpublished Doctoral Thesis. University of Nigeria Nsukka.

McEwen, W. D. (1995). Connecting right and left-brain: increasing academic performance of African American students through the arts. Paper presented at the *Annual Meeting of the National Alliance of Black School Educators* on November 15, 1995 at 25th, Dallas, TX.

McGrail, L. (2005). *Modifying regular classroom curriculum for gifted and talented students.* Waco: Prufrock Press Inc.

Mitchell, B. M. (1984). An update on gifted and talented education in the U. S. In Woolfolk, A. E. (1995). *Educational psychology*. Boston: Allyn and Bacon.

Money Instructor. (2009). *Whole brain learning: A classroom guide to whole brain learning*. Retrieved from http:\wholebrainlearninglessonplan,thinking theorytraining,teachingstudentsactivityworksheets.htm on 09/12/09.

Morelock, M. J. and Feidman, D. H. (1992). The assessment of giftedness in preschool children. In Woolfolk, A. E. (1995). *Educational psychology*. Boston: Allyn and Bacon.

Mouchiroud, C. & Bernoussi, A. (2008). An empirical study of the construct validity of social creativity. *Journal of Learning and Individual Differences,* 18(4), 372-380. Retrieved from http://www.elsevier.com on 08/08/12

Naiman, L. (2007). *Whole-brain thinking: a balanced approach to developing creativity and innovation.* Retrieved from www.creativityatwork.com/http:\creativityatworkwhole-brainthinking.htm on 11/06/2007. Linda Naiman & Assoc. Inc.

NICHY News Digest. (1997). *Intervention for students with learning disabilities*. Retrieved from http://www./nichcyorg.pubs/biblio/bib14xthtm February 6, 2006.

Nori, Z. (2002). Gender differences in creativity, academic achievement (mathematic, science and language of literature) among high school in city Shiraz, Iran. University of Shiraz. In Habibollah, N., Rohani, A., Tengku Azian, H., Jamaluddin, S., Vijay, K. (2010). Relationship between creativity and academic achievement: A study of gender differences. *Journal of American Science,* 6 (1), 181-190. Retrieved from http://www.americanscience.org or editor@americanscience.org on 07/03/2011.

Nsikak, A. U. (1995). *Effects of note taking (conventional and mind map) on achievement in physics*. Unpublished M.Ed Project. University of Nigeria, Nsukka.

Nworgu, B. G. (1991). *Educational research: Basic issues & methodology*. Owerri: Wisdom Publishers Limited.

Nworgu, B. G. (2005). Types and uses of some inferential statistical tools in educational

research. In *What to write and how to write: A step-by-step guide to educational research proposal and report.* D. N Eze (Ed). Enugu: Pearls and Gold.

Onu, V. C. (2001). *Effects of bloom's taxonomy based teaching strategy on high ability children cognitive skills*. Unpublished Doctoral Thesis. University of Nigeria, Nsukka.

Onu, V. C. (2002). Gifted education practices in the Nigerian schools: The past, the present and the future. *The Exceptional Child*, 6(4), 131-136.

Onu, V. C. (2005). Developing the whole brain: implications for programming in early childhood education. *The Exceptional Child: The Journal of the National Council for Exceptional Children, 8 (2), 55-63.*

Onu, V. C. (2006). Developing creativity and problem solving skills for entrepreneurship. *Home Economics Research Association of Nigeria*, 81-98.

Onu, V. C. (2007a). Effect of Bloomôs taxonomy based teaching strategy on high ability learnersô cognitive skills in Nigeria. *In* E. D Ozoji & J. M Okuoyibo (Eds.*) The practice and future of special needs education in Nigeria*. Jos: Deka, 308-323.

Onu, V. C. (2007b). Creativity and Nigerian youths. *Mass Creativity & African Development*, 40 - 57

Onu, V. C. (2007c). Creativity and entrepreneurships: Solutions to poverty eradication. *Home Economics Research Association of Ghana* (HERAH), June 14-16

Onu, V. C. (2008). *A handbook on gifted education, creativity and thinking skills*. Nsukka: Multi Educational Services Trust.

Onu, V. C., Eze, U. N. & Onuigbo, L. N. (2008). Effect of ideational fluency on increasing creativity of students in Nigeria. *The Educational psychologist*, 4 (1), 53-60.

Okediadi, N. O. (1990). *Some factors associated with the expression of giftedness among primary schools pupils in Onitsha Urban*. Unpublished M.Ed Project. University of Nigeria, Nsukka.

Okeke, B. A. (2001). *Essentials of special education*. Nsukka: Afro Orbis Publication Ltd.

Ozioko, J. N. N. (2006). Promoting entrepreneurship through developing creativity. *Journal of Home Economics Research Association (JHER)*, Vol. 7 Special edition, 164-170.

Palaniappan, A. K. (1994). *A study of creativity and academic achievement among form four Malaysian students*. Unpublished Doctoral Thesis, University of Malaya, KL

Palaniappan, A. K. (2000). Sex differences in creative perceptions of Malaysian students. *Percept Mot Skills*, 91 (3 pt 1), 970 ï 972.

Passuello, L. (2007). *What is mind mapping and how to get started immediately?)*. Retrieved

from http:\www.whatismindmappingandhowtogetstarted immediately.htm on 23/12/09.

Paul, M. *Triune mode.* Retrieved from http://www.kheper.auz.com/gaia/intelligence/MacLean.htm on 09/12/09

Pazzaglia, F. & DeBeni, R. (2006). *Are people with high and low mental rotation abilities differently susceptible to the alignment effect?* National Center for Biotechnology Information, U.S. National Library of Medicine

Pressley, M., VanEtten, S., Yokoi, L., Freebern, G., & VanMeter, P. (1998). The metacognition of college studentship: A grounded theory approach. In Hacker, D. J., Dunlosky, J. & Graesser, A. C. (Eds.). *Metacognition in theory and practice*. Mahwah NJ: Erlbaum

Raj, V. (2007). *Developing whole-brain thinking through mind mapping technique*. Retrieved from http://ezinearticles.com/?developing-whole-brain-thinking-through-mindmapping-technique&id=711331 on 12/23/2009.

Raul, A. C. (1984). Effects of a training intervention on dogmatism, flexibility, and attitudes of preservice students. *ETD collection for University of Nebraska - Lincoln.* Retrieved from http://digitalcommons.unl.edu/dissertations/AAI8423770 19/05/2010

Renzulli, J. S. & Reis, S. M. (1997). *The schoolwide enrichment model: A how to guide for educational excellence*. Connecticut: Creative Learning Press, Inc.

Reynolds, M. C. & Birch, W. J. (1988). Adaptive mainstreaming: a primer for teachers and principals (3rd ed). In Woolfolk, A. E. (1995). *Educational psychology*. Boston: Allyn and Bacon.

Rhodes, M. (1961). An analysis of creativity. *Phi Delta Kappan*, 42, 305-310.

Rich, M. (2007). *Left brain, right brain, whole brain? An examination into the theory of brain lateralization, learning styles and the implications for education.* Retrieved from http://www.singsurf.org/brain/rightbrain.php/Rich Morris rich@singsurf.org. on 09/12/09

Richardson, T. M. & Benbow, C. P. (1990). Long term of acceleration on the socio-emotional adjustment of mathematically precocious youths. In Woolfolk, A. E. (1995). *Educational psychology*. Boston: Allyn and Bacon.

Roukes, N. (1997). *Stimulating creativity in design*. Retrieved from http://designsynectics.stimulatingcreativity/indesign.htlm on 21/08/10

Runco, M. A. (1986a). Predicting childrenôs creative performance. *Psychological Reports,* 59, 1247- 1254.

Runco, M. A. & Albert S. R. (2005). Parentôs personality and creative potential of exceptionally gifted boys. *Creative Research Journal*, 17(4), 355-367.

Schunk, D. H. and Rice, J. M. (1989). Learning goals and childrenôs reading comprehension. *Journal of Reading Behaviour*, 21(3), 279-293

Sesadeba, P. (2008). Effectiveness of synectics model of teaching in enhancing creativity, academic achievement and achievement motivation of learners. *E-journal of All India Association for Educational Research (EJAIAER)*, 20(3 & 4). Retrieved from http://effectivenessofsynecticsmodeofteachinginenhancingcreativity.academicachievementandachievementmotivationofearn.htm on 19/05/2010

Shaun, K. (2002). Education for the whole brain. *Diplomate, American Board of Psychiatry and Neurology*. World Prosperity, Ltd. Retrieved from http:\www.educationforthewholebrain.htm on 23/12/09.

Shreyashi, P. (2008). Impact of synectics model of teaching in life science to develop creativity among pupils. *E-journal of All India Association for Educational Research (EJAIAER)*, 20 (3 & 4). Retrieved from pupils.htm on 19/05/2010 http://impactofsynecticsmodelofteachinginlifesciencetodevelopcreativityamongpupils.org

Simonton, D. K. (1997). Creative productivity: a predictive and explanatory model of career trajectories and landmark. In Kosslyn, S. M. & Rosenberg, R. S. (2001). *Psychology: The brain, the person, the world.* Boston: Allyn and Bacon.

Simonton, D. K. (June, 2000). Creative development as acquired expertise: Theoretical issues and an empirical test. *Developmental Review*, 20(2), 281-318. Retrieved from http://www.sciencedirect.com/science/journal/02732297

Sperry, R. W. (1961). *Cerebral organization and behavior: The split brain behaves in many respects like two separate brains, providing new research possibilities*. Retrieved from http://www.sciencemag.org/content/133/3466/1749 on 29/06/2013

Sternberg, R. J. (1996). *How to develop student creativity*. Retrieved from http://www.howto developstudentcreativity.htm on 08/12/2006

Sternberg, R. J. & Lubart, T. I. (1995). *Defying the crowd: Cultivating creativity in a culture of conformity*. New York: Free press.

Sue, L. (2007). *Brain dominance in education whole brain teaching and learning.* Retrieved from http:\braindominance.htm on 11/06/2007

Summers, G. (2009). *Brain dominance whole brain vs. split brain theory psych-k*. Retrieved on http://www.whole brainvssplitbrain-theorypsych-k.htm on 09/12/2009

Syque. (2010). *Synectics*. Retrieved from http://www.mycoted.com/Synectics on 21/08/10

Tami, C. *ETE 653 – Instructional strategies & design.* Retrieved from http://edweb.sdsu.edu/courses/et650_online/mapps/synectics.html; http://www.synectics.com/html_version/about.htm on 27/06/2010

TELL. (May 17, 2006). *Why students fail*. 44-45.

Templeton, R. S. & Jensen, R. A. (1996). *Whole-brain learning in a seventh grade math/science class*. Retrieved from http://www.facstaff.unca.edu/nruppert/research/wbl_study.Doc on 21/08/10

Toga, A. W. (2009). *The brain*. Microsoft encarta. 1993-2008 Microsoft corporation.

Tomlinson-Keasey, C. (1990). Developing our intellectual resources for the 21st century: educating the gifted. *Journal of Educational Psychology*, 82, 399-403

Torrance, E. P. (1986). Teaching creative and gifted learners. In Woolfolk, A. E. (1995). *Educational psychology*. Boston: Allyn and Bacon.

Trevor M. (2009). *The mind creativity and synectics*. Retrieved from http://edweb.sdsu.edu/courses/ET650_online/mapps/synectics.html on 21/08/10

Vincent, J. (2014). *Men have bigger brains than women, research reveals.* Retrieved from http://www.independent.co.uk/news/science/men-have-bigger-brains-than-women-research-reveals-9124103.html on 16/02/2014

Walberg, H. J. & Stariha, W. E. (1992). Productive human capital: learning, creativity and eminence. *Creativity Research Journal*, 5, 323-340

Walker, D. M. (1995). *Connecting right and left brain: Increasing academic performance of African American students through the arts.* Retrieved from ERIC document reproduction service no. ED 363 330; http://www.edweb.sdsu.edu/courses/et650_online/mapps/synectics.html on 19/05/2010

Wang, W., Lee, C. & Chu, Y. (2010). A brief review on developing creative thinking in young children by mind mapping. Retrieved from www.ccsenet.org/ibr *International Business Research*, 3 (3), July on 12/03/2011.

Wikipedia. (2009). *Mind map*. Retrieved from http://en.wikipedia.org/wiki/mindmapmindmap on 23/03/09. The Wikimedia Foundation, Inc

Wikipedia. (2010). *Synectics*. Retrieved from http://en.wikipedia.org/wiki/synectics on 21/08/2010

Wilson, S. H., Greer, J. F. & Johnson, R. M. (1973). Synectics, a creative problem solving technique for the gifted. *The Gifted Child* Quarterly, 17, 260-266

Williams, L.V. (1986). *Metaphor: Advantages of metaphorical teaching; using metaphor in the classroom. Teaching for the two-sided mind*. New York: Simon & Schuster, Inc.

Witcher, S. H. (2001). In *Whole-brain learning in a seventh grade math/science class*. Retrieved from http://www.facstaff.unca.edu/nruppert/research/wbl_study.Doc on 21/08/10

Wood, O., Rosenburg, M. & Carran, D. (1993). The effects of tape recorded self instruction cues on the mathematics performance of students with learning disabilities. *Journal of Learning Disabilities*, 26 (4),250-258, 269.

Woolfolk, A. E. (1995). *Educational psychology*. Boston: Allyn and Bacon.

Word Juxtapoz. (2009). *How to become a creative genius.* Retrieved from http://www.host@wordjuxtapoz.com./http://www.boost.creativitywholebrainpuzzles,riddlesforeducatorstrainersstudents.htm on 23/12/09.

Yu, G., Horan, R., Mamas, M. & Weisshaar, B. (2004). Recovering creativity: For personal evolution, industry, and society. *Journal of Youth Studies*, 7(2), 1-10.

Zenasni, F., Besançon, M. & Lubart, T. (2004). *Creativity and tolerance of ambiguity: An empirical study.* Laboratoire Cognition et Comportement Université René Descartes ï Paris 5. Retrieved from franckz@free.fr, zenasni@igr.fr, maud_besancon@hotmail.com, todd.lubart@univ-paris5.fr on 08/08/12

APPENDIX A

Letter to Instruments and Programmes' Validators

Department of Educational Foundations,
University of Nigeria,
Nsukka.
29/06/2011.

Dear Sir/Madam,

I am conducting a research on *the effects of mind mapping and synectics on whole brain learning and creative production of high ability children*. Therefore, I request your assistance in validating the adapted research instruments and the instructional programmes developed for the study.

Find enclosed the research questions, hypotheses, the test blueprints, the original and draft copies of the tests, the scoring guide, and the instructional programmes.

Kindly, delete, review, add or modify the instruments, as you consider necessary in terms of each itemôs clarity, appropriateness of language and expressions to the respondents. Your candid suggestion will be greatly appreciated.

Thank you for the anticipated assistance.

Yours faithfully,

Agbo, O. E

APPENDIX B

Letter to Head Teachers of Urban Primary Schools

Department of educational foundations,
University of Nigeria,
Nsukka.
December 24th, 2012.

Dear Sir/Madam,

I am conducting a doctoral research on the effects of mind mapping and synectics on whole brain learning and creative production of high ability pupils, which involves identification and training of high ability pupils in thirty-four (34) primary schools in Nsukka urban.

Therefore, I request your assistance in providing me with data on high ability pupils in your primary six grade/class using the following criteria:

1. Pupils that obtained 80% and above in first term achievement test scores aggregate.
2. Pupils identified with other special abilities based on teachersô nomination using Identification Instrument 1 attached herewith.

Thank you for the anticipated assistance.

Yours faithfully,

é é é é é é é é é .
Agbo, Okechukwu. E
PG/Ph.D/09/50887

é é é é é é é é é é é
Dr (Mrs.) Onu, V. C
Supervisor

APPENDIX C

Identification Instruments

Test Score Nomination

(Adapted version of High Ability Talent Pool Composition)

Approximately 50% of the talent pool	*Approximately 50% of the talent pool*
Step 1	*Step 2*
Test Score Nomination Adjusted from 99 percent to 80 percent (Automatic and based on first term achievement test aggregate)	Teacher Nomination (Automatic)
Total talent pool consist of approximately 15% of the general population	

Teacher Nomination Form

Please, *note that information required herein is exclusively for academic research purpose.*

1 ***School***_____ 2. **Teacher's *Name***_____

3 ***Pupil's Name***_____ 4 ***Class***_____ 5 ***Age*** _____

6 ***Sex***: Male_____ Female _____ 7 ***Date***_____

8 Average scores for current school year:

English Language & Verbal _____

Social Studies _____

Mathematics & Quantitative _____

Primary Sciences _____

9 Why do you think this pupil should be included among high ability children? (You may wish to list examples of ideas, projects, creative performances, etc.)

_____

_____

_____

_____

Interests

Please indicate the areas of interest that the pupil has displayed in your class this year. If you have noticed other specific topics, please note this in the column entitled ôotherô.

Skill	High	Average	Low	Skill	High	Average	Low
Fine Art				Music			
Sciences				Drama			
Creative writing				Math & Quantitative			
Social Studies				English & Verbal			
Manual Skills				Other			

Curricular Strength Areas

Please indicate the subject areas in which the pupil has demonstrated proficiency

English & Verbal _____ Mathematics & Quantitative _____

Sciences _____ Social Studies_____

Adapted by Renzulli and Reis (1997) from Charlottesville, VA Public Schools

APPENDIX D

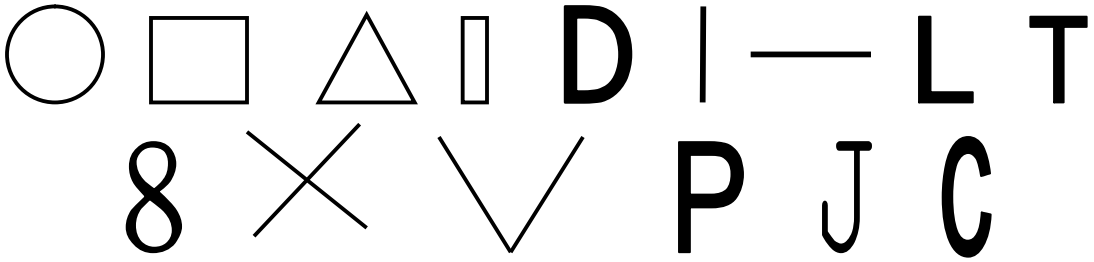
Creative Productivity Test Battery

***Instruction*s**

- Answer all the questions by writing on the answer scripts attached.
- Kindly fill in your personal data in the spaces provided below.
- Duration: 1 hour

Pupil's Name _____ Sex _____ Date _____

1 Create at least ten recognizable forms or objects by combining the set of simple shapes provided below.



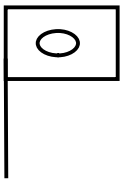
Example: On a given trial, three of the shapes were selected to form the figure presented below.

FLAG

Line

Circle

Square



2 State at least ten interesting and unusual uses of common objects such as expired and condemned car tyres.

3 State at least ten interesting and unusual ways of improving your school, so that it will be more interesting and enjoyable for children to play.

4 Write a story about *the beginning of the end.*

5 Compose at least a two-stanza poem on *the beginning of the end.*

APPENDIX E

The Reshuffled Creative Productivity Test Battery

Instruction

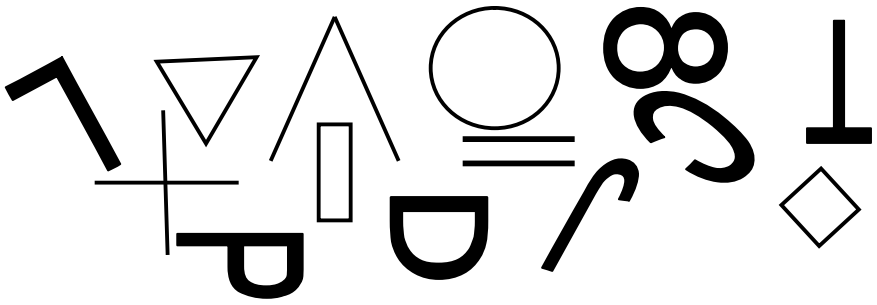
- Answer all the questions by writing on the answer scripts attached.
- Kindly fill in your personal data in the spaces provided below.
- Duration: 1 hour

Pupil's name _____ Sex _____ Date _____

1 Compose at least two-stanza poem on *beginning of the end*.

2 State at least ten interesting and unusual uses of common objects such as expired and condemned car tyres.

3 Create at least ten recognizable forms or objects by combining the set of simple shapes provided below.



4 State at least ten interesting and unusual ways of improving your school, so that it will be more interesting and enjoyable for children to play in.

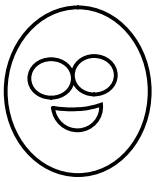
5 Write a story about *the b*eginning of the end.

APPENDIX F

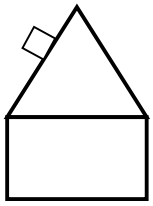
The Scoring Guide for Creative Productivity Test Battery

1 **Test of Visual Synthesis** developed by Finke and Slayton (1988) involves a set of simple shapes given to participant and asked to combine the shapes mentally to create a recognizable form or object. The first stage involves mental play with images of the forms by rotation, size adjustment, and repositioning; the second stage involved recognizing what a combination of the forms could represent. Participants were more creative if they combined shapes without particular goal in mind at the outset, attempting an interpretation only after producing novel combinations. Each original product attracts 5 marks, while commonplace product ranges between 4 to 1 marks.

<u>Smiley</u>
Circle
Letter D
Number 8



<u>House</u>
Square
Square
Triangle



<u>Ice cream cone</u>
Circle
Letter V
Letter C

Ref. Finke, R. A. & Slayton, K. (1988). Explorations of creative visual synthesis in mental imagery. In Kosslyn, S. M. & Rosenberg, R. S. (2001). *Psychology: the brain, the person, the world.* Boston: Allyn and Bacon.

The following three test tasks are limited to items from a *demonstrator form* of the Torrance Creative Thinking Test (TCTT) developed by E. P Torrance to communicate the nature of the published tests without compromising or invalidating them.

Ref. Torrance, E. P. *Examples and rationales of test tasks for assessing creative abilities. Creative Education Foundation, Inc. and the Journal of Creative Behaviour.*

2 **Unusual Uses Task** ï the unusual uses task calls for interesting and unusual uses of common objects such as worn out car tyres. Each original idea attracts 5 marks, while commonplace product ranges between 4 to 1 marks. Note, *originality connotes unusual or infrequently seen products in a universe of products made by people with similar experience and training.*

3 **Product Improvement Task** ï the product improvement task calls for the production of clever, interesting and unusual ways of modifying a childôs school, so that it will be more interesting and more enjoyable for children to play in. Each original idea attracts 3 marks, while commonplace product has 1 mark. Note, *originality connotes unusual or*

infrequently seen products in a universe of products made by people with similar experience and training.

4. **Imaginative Stories Test** - calls for writing imaginative stories about animals, concepts and people having some divergent characteristics. Participants are asked to write on the beginning of the end.
5. **Poem composition Test -** ability to write simple poems that fit different purposes. Note: items 4 & 5 were assessed using the form provided below.

APPENDIX G

Student Product Assessment Form

Summary Sheet

Name (s) _____ Date_____
Location _____ School _____
Teacher _____ Grade _____ Sex _____
Product (Title and /or brief description) _____

Number of weeks students worked on product _____

Factors		Rating	Not Applicable
1.	Early Statement of Purpose é é é é é é é .	_____	_____
2.	Problem Focusingé é é é é é é é é é é .	_____	_____
3.	Level of Resourcesé é é é é é é é é é é	_____	_____
4.	Diversity of Resourcesé é é é é é é é ..	_____	_____
5.	Appropriateness of resourcesé é é é é é é .	_____	_____
6.	Logic, Sequence and Transitioné é é é é é .	_____	_____
7.	Action Orientationé é é é é é é é é é ...	_____	_____
8.	Audienceé é é é é é é é é é é é é é é .	_____	_____
9.	Overall Assessmenté é é é é é é é é é é	_____	_____
	A. Originality of the ideaé é é é é é é .	_____	_____
	B. Achieved objectives stated in the plan...	_____	_____
	C. Advanced familiarity with the subjecté	_____	_____
	D. Quality beyond age/grade level é é é ..	_____	_____
	E. Care, attention to details, etcé é é é ...	_____	_____
	F. Time, effort, energyé é é é é é é é	_____	_____
	G. Original contributioné é é é é é é ..	_____	_____

Comments:

Person completing this form: _____

Rating Scales:	Factors 1-8	Factors 9A-9G
	5 ï To a great extent	5 = Outstanding
	3 ï Somewhat	4 = Above average
	1 ï To a limited extent	3 = Average
		2 = Below average
		1 = Poor

Adapted by Renzulli and Reis (1997) from Charlottesville, VA Public Schools

APPENDIX H

Frequency Table of Creative Productivity Test Battery

Visual Synthesis Responses

S/N	*Idea Description*	*Frequency*	*Remark*
1	House	10	1 mark
2	Bat	1	5 marks
3	Shirt	1	5 marks
4	Cap	1	5 marks
5	Ball	2	4 marks
6	Table	1	5 marks
7	Spade	1	5 marks
8	Sign board	4	1 mark
9	Van	2	5 marks
10	Box	3	3 marks
11	Arrow	6	1 mark
12	Tyre	1	5 marks
13	Road sign	2	4 marks
14	Umbrella	13	1 mark
15	Flag	2	4 marks
16	Drum	1	5 marks
17	Human figure	2	4 marks
18	Scissors	1	5 marks
19	TV	2	4 marks
20	Radio	3	3 marks
21	English letter	1	5 marks
22	Book	2	4 marks
23	Scissors	1	5 marks
24	Ear ring	1	5 marks
25	Traffic light	5	Commonplace
26	Math shapes	9	1 mark
27	Chair	3	3 marks
28	Fishing hook	1	5 marks

29	Cross	5	1 mark
30	Spoon	1	5 marks
31	Ear	1	5 marks
32	Mirror	6	1 mark
33	Bag	1	1 mark
34	Javelin	1	5 marks
35	Magnifying Lens	2	4 marks
36	Car	1	5 marks
37	Orange	10	1 mark
38	Jack	1	5 marks
39	Sweet	4	1 mark
40	Ice cream	2	4 marks
41	Wind vane	1	5 marks
42	Pot	2	4 marks
43	Hair ribbon	1	5 marks
44	Window	2	4 marks

Number of commonplace ideas = 10; Number of Original ideas = 34

Unusual Uses Responses

S/N	*Idea Description*	*Frequency*	*Remark*
1	Spare	1	Original
2	Snake dispeller	1	Original
3	Decoration	6	Commonplace
4	Slippers	2	Commonplace
5	Weight lifting	1	Original
6	Repairing tyres	1	Original
7	Roasting	1	Original
8	Play	1	Original
9	Erosion control	2	Original
10	Paint mixture	1	Original

Number of commonplace ideas = 2; Number of original ideas = 8

Product Improvement Responses

S/N	*Idea Description*	*Frequency*	*Remark*
1	Play equipment	3	Commonplace
2	Play ground	7	Commonplace
3	Growing grass	2	Original
4	Football field	1	Original
5	Artistic drawings on school walls	1	Original
6	Friendly social environment	2	Original
7	Swimming pool	1	Original
8	Toys	1	Original
9	Communication	2	Original
10	Good teaching	2	Original
11	Expanding the school compound	1	Original
12	Sanitation	1	Original
13	Painting school	1	Original
14	Providing a canteen	1	Original
15	Removing sharp objects	1	Original
16	Class control	1	Original
17	Discipline	1	Original
18	Motivation	1	Original
19	Hard work	1	Original
20	Eating lunch together	1	Original
21	Ban on pupilsô use of cash in school	1	Original
22	Financial support from parents	1	Original
23	Decoration of school field	1	Original
24	Security wall	1	Original
25	Music instrument	1	Original

Number of commonplace ideas = 2; Number of original ideas = 23

APPENDIX I

Whole Brain Self-Report Questionnaire

INSTRUCTION: Note that information required herein is only for academic research purpose. To enable the researcher achieve the set objectives; please give honest responses indicative of your experiences. Using the scale provided below, kindly ***fill*** in the spaces or ***tick*** the appropriate rating of your preferred way of thinking and doing things.

PERSONAL DATA

1 School_____ 2 Class_____ 3 Age _____

4 Sex: *Male* _____ Female _____

RATING SCALE Always ï 4, Sometimes ï 3, Occasionally - 2, Rarely - 1

S/N	Item Description	4	3	2	1
01	I prefer to be advised alone				
02	I need complete quietness to read or study				
03	I usually do things in a planned, systematic way				
04	I like being in a group				
05	I have the ability to listen to music or television and study at the same time				
06	I enjoy learning or solving math				
07	I day dream				
08	I prefer being taught with visible examples				
09	I prefer listening to music with strong loud beat.				
10	When I want to use something, I read the directions first.				
11	I can easily remember verbally written material.				
12	I enjoy interacting with others.				
13	I become uneasy during long oral explanations.				
14	I enjoy joking around.				
15	When I set goals, it keeps me from wasting time.				
16	I enjoy learning algebra (Math that uses letters & signs instead of numbers & values)				
17	I am organized.				
18	I like to write or read imaginary or unreal story.				
19	I organize things to show connection and order.				
20	I like to read.				
21	I like summarizing than working on details				
22	I do well at solving math problems on angles & shapes, connected by lines, surfaces & objects.				
23	When I experience confusion, I go on courageously without thinking about it				
24	I would do well at investigating crimes.				
25	I like instructions that are spoken				
26	In giving directions, I prefer to draw a map than to				

	explain verbally how to get somewhere.				
27	I easily forget time when am busy on a work.				
28	I do well at things involving music such as playing an instrument or singing.				
29	I do not like to joke around or play games.				
30	I like straight, well-arranged assignments more than essay or indirect assignments.				
31	People consider me absentminded.				
32	The things that I have specifically studied are the only things that I will usually remember.				
33	I often do things without planning.				
34	I enjoy drawing.				
35	I can solve problems immediately and not know why my answer is correct.				
36	I like listening to old musical tunes.				
37	I demonstrate with hands when I want to explain myself				
38	I enjoy creating my own drawings and images.				
39	When I have to make tough decisions, I write down the advantages and disadvantages				
40	I am not sure if my thoughts and actions can be influenced by someoneôs control.				
41	I have thought of becoming a poet, politician, architect, or dancer.				
42	I think that keeping to a timetable is un interesting.				
43	I like getting all of the points before I make any decisions.				
44	I do well at expressing myself in words.				
45	I enjoy writing or reading real life stories.				
46	When I am trying to go somewhere, I am usually late.				
47	I do not like to follow instruction.				
48	When I lose something, I retrace my steps and try to remember where I saw it last.				
49	I make and keep lists of things to do each day				
50	When I forget someone's name, I go through the alphabet until I remember it				
51	I have thought about becoming a lawyer, librarian, mathematician, lab scientist, or doctor.				
52	When I look at a person, I am able to tell if the person is guilty or not.				
53	I like to learn or discover thing myself through the method of experimentation.				
54	I do well at spelling.				

APPENDIX J

Reshuffled Whole Brain Self-Report Questionnaire

Note that information required herein is only for academic research purpose. To enable the researcher achieve the set objectives; please give honest responses indicative of your experiences.

INSTRUCTION: Using the scale provided below, kindly ***fill*** in the spaces or ***tick*** the appropriate rating of your preferred way of thinking and doing things.

PERSONAL DATA

1 School_____ 2 Class_____ 3 Age _____

4 Sex: *male* _____ female _____

RATING SCALE Always ï 4, Sometimes ï 3, Occasionally - 2, Rarely - 1

S/N	Item Description	4	3	2	1
1	I do well at spelling.				
2	I like to learn or discover thing myself through the method of experimentation.				
3	When I look at a person, I am able to tell if the person is guilty.				
4	I have thought about becoming a lawyer, librarian, mathematician, lab scientist, or doctor.				
5	When I forget someone's name, I go through the alphabet until I remember it				
6	I make and keep lists of things to do each day				
7	When I lose something, I retrace my steps and try to remember where I saw it last.				
8	I do not like to follow instruction.				
9	When I am trying to go somewhere, I am usually late.				
10	I enjoy writing or reading real life stories.				
11	I do well at expressing myself in words.				
12	I like getting all of the points before I make any decisions.				
13	I think that keeping to a timetable is uninteresting.				
14	I have thought of becoming a poet, politician, architect, or dancer.				
15	I am not sure if my thoughts and actions can be influenced by someoneôs control.				
16	When I have to make tough decisions, I write down the advantages and disadvantages				
17	I enjoy creating my own drawings and images.				
18	I demonstrate with hands when I want to explain myself				
19	I like listening to old musical tunes				
20	I can solve problems immediately and not know why my answer is correct.				

21	I enjoy drawing.				
22	I often do things without planning.				
23	The things that I have specifically studied are the only things that I will usually remember.				
24	People consider me absentminded.				
25	I like straight, well-arranged assignments more than essay or indirect assignments.				
26	I do not like to joke around or play games.				
27	I do well at things involving music such as playing an instrument or singing.				
28	I easily forget time when am busy on a work.				
29	In giving directions, I prefer to draw a map than to explain verbally how to get somewhere.				
30	I like instructions that are spoken				
31	I would do well at investigating crimes				
32	When I experience confusion, I go on courageously without thinking about it				
33	I do well at solving math problems on angles & shapes, connected by lines, surfaces & objects.				
34	I like summarizing than working on details				
35	I like to read.				
36	I organize things to show connection or order.				
37	I like to write or read imaginary or unreal story.				
38	I am organized.				
39	I enjoy learning algebra (Math that uses letters & signs instead of numbers & values)				
40	When I set goals for myself, it helps me to keep from wasting time.				
41	I enjoy joking around.				
42	I become uneasy during long oral explanations.				
43	I enjoy interacting with others.				
44	I can easily remember verbally written material.				
45	When I want to use something, I read the directions first.				
46	I prefer listening to music with strong loud beat.				
47	I prefer instructions with visible examples				
48	I day dream				
49	I enjoy solving or learning math				
50	I have the ability to listen to music or television and study at the same time				
51	I prefer to be in a group				
52	I usually do things in a planned, systematic way				
53	I need complete quietness to read or study				
54	I prefer to be advised alone				

APPENDIX K

Whole Brain Processing Skills

Symbolic processing is a method associated with the left hemisphere that is used in processing the information of pictures and symbols. The majority of functions associated with academics involve symbols such as letters, words, and mathematical notations. This process is what aids one to excel in tasks such as linguistics, mathematics, and memorizing vocabulary words and mathematical formulas.

Verbal processing is a method used by the left hemisphere to process thoughts and ideas with words. For example, through verbal processing, a left-brained person giving directions may say, "From this point continue east for two miles and turn north onto Bellevue Road. Continue north on Bellevue Road for seven miles and turn west on Main Street". With verbal processing, exact, logical directions are given in a sequential manner compared to a right-brained person who, in giving the same directions, would use more visual landmarks.

Sequential processing is a method used by the left hemisphere for processing information in order from first to last. Information is processed in a systematic, logical manner. Sequential processing can interpret and produce symbolic information such as language, mathematics, abstraction, and reasoning. This process is used to store memory in a language format. Activities that require sequential processing include spelling, making a "to-do" list, and many aspects of organization.

Linear processing is a method by the left hemisphere to process information. In this process, the left-brain takes pieces of information, lines them up, and proceeds to arrange them into an order from which it may draw a conclusion. The information is processed from parts to a whole in a straight, forward, and logical progression.

Logical processing is a method that is used by the left hemisphere to take information piece by piece and put it all together to form a logical answer. When information is received through reading or listening, the left hemisphere will look for different bits of information that will allow it to produce a logical conclusion. This aspect of the left hemisphere is what aids in solving Math problems and science experiments.

Reality-based processing is used by the left hemisphere as a method for processing information with a basis on reality. This processing tool focuses on rules and regulations. An example of this would be how a left-brained person would completely understand the repercussions of turning in a late assignment or failing a test. A left-brained person also usually easily adjusts to changes in their environment.

Random processing is a method used by the right hemisphere for processing information without priority. A right-brained person will usually jump from one task to another due to the random processing by their dominant right hemisphere. Random processing is, of course, the opposite of sequential processing therefore making it difficult for right-brained individuals to choose to learn in sequence. In order to overcome this, a right-brained person may want to attempt to learn sequence by using colors since the right hemisphere is sensitive to color. For example, associating the first step with green, the second step with blue, and the last step with red. Consistently using the same sequence, this strategy can be applied to many tasks involving sequence.

Concrete processing is a method associated with the right hemisphere, used for processing things that can be seen or touched. It processes much of the information received from real objects. For example, a right-brained person is not just satisfied that a mathematical formula may work, but will want to know why it works. A strongly concrete person often finds it easier to solve a mathematical problem by "drawing it out" because it allows them to visualize it. The more a concrete person can *visualize* something the easier it is for them to understand it.

Holistic processing is a method used by the right hemisphere to process information from whole to parts. A right-brained person, through holistic processing, is able to see the big picture first, but not the details that accompany it. A strongly holistic person may often find that prior to listening to a lecture given by an instructor; they must first read the chapter so to understand better what the lecture is about. This function is also what provides visual spatial skills. It also aids in tasks such as dancing and gymnastics. Through holistic processing, memory is stored in auditory, visual, and spatial modalities

Intuitive processing is a method that is used by the right hemisphere to process information based on if it "feels" right or not. For example, a right-brained person may choose an answer on a test because they had a "gut" feeling and often they will be correct. Another example of this is how a right-brained person will know the correct answer to a math problem but will not understand the procedure of how they arrived at the correct answer. A right-brained person will usually have to start with the answer and work their way backwards in order to be able to see and understand the parts and process that create the whole.

Fantasy-oriented processing is used by the right hemisphere as a method for processing information with creativity. It focuses much less on rules and regulations than the processing method of a left-brained person. Due to the fantasy-oriented processing mechanism of a right-brained person, they do not adjust well to change. Instead of adapting to the change in the

environment, a right-brained person attempts to change it back to the way they liked it. But fantasy-oriented processing also provides the advantage of creativity to right-brained individuals, and since emotion is integral of the right side of the brain, anything a fantasy-oriented person becomes involved in emotionally will aid their ability to learn.

Nonverbal processing is a method used by the right hemisphere to process thoughts with illustrations. Reliance on this method is why it is occasionally difficult for right-brained people to "find the right words" in certain situations. A right-brained person cannot just read or hear information and process it, but first must make a mental video to better understand the information they have received. For example, through nonverbal processing, a person giving directions may say, "Continue going straight until you see a big, red-brick courthouse. At the courthouse turn right, and go down that street for a couple of miles until you se a gray stone church which will be on your right. Straight across from the church is the road to the left you need to take." With nonverbal processing, the directions that are given are extremely visual compared to the exact, sequential directions that would be given by a left-brained person.

APPENDIX L

Population of Primary Six Pupils in Nsukka Urban Schools – 2012/2013 Academic Year

N/S	*Name of Schools*	*Nos*	*N/S*	*Name of Schools*	*Nos*
01	Sancta Maria Primary School	68	19	Central School I	25
02	Enugu Road Prim School I	30	20	Central School II	14
03	Enugu Road Prim School II	36	21	Union Primary School I	49
04	Pax Vobis Primary School	24	22	Union Primary School II	37
05	Good Shepherd Prim. School	15	23	Sunrise Primary School	17
06	Jesus Saves Primary School	15	24	Onward Intõl School	24
07	Christ Liveth Primary School	-	25	Agu-Achara Pri School	36
08	Our Lady of Seat of Wisdom	-	26	Christ the Same P/S	14
09	Amicus Primary School	22	27	Christ the Found P/S	29
10	Goshen Primary School	11	28	Central School Onuiyi	16
11	Township Primary School I	29	29	Community P/S Onuiyi	16
12	Township Primary School II	29	30	Holy Infant Pri School	25
13	Urban Primary School I	8	31	Hilcrest Primary School	119
14	Urban Primary School II	16	32	Univ Staff School UNN	30
15	Model Primary School I	67	33	El-Tabera Prim School	19
16	Model Primary School II	59	34	Shalom Intõl School	48
17	Model Primary School III	58	35	Paraclete P/S Obukpa	23
18	Model Primary School IV	54	36	CPS, Ihe-Owerri	20
				Total	***1,102***

Nos = Population

APPENDIX M

Population of High Ability Pupils in Nsukka Urban Schools – 2012/2013 Academic Year

N/S	*Name of Schools*	*Nos*	*N/S*	*Name of Schools*	*Nos*
01	Sancta Maria Primary School	13	19	Central School I	5
02	Enugu Road Prim School I	5	20	Central School II	None
03	Enugu Road Prim School II	5	21	Union Primary School I	6
04	Pax Vobis Primary School	5	22	Union Primary School II	5
05	Good Shepherd Prim. School	None	23	Sunrise Primary School	5
06	Jesus Saves Primary School	3	24	Onward Intõl School	4
07	Christ Liveth Primary School	-	25	Agu-Achara Pri School	6
08	Our Lady of Seat of Wisdom	-	26	Christ the Same P/S	2
09	Amicus Primary School	5	27	Christ the Found P/S	2
10	Goshen Primary School	3	28	Central School Onuiyi	4
11	Township Primary School I	2	29	Community P/S Onuiyi	2
12	Township Primary School II	9	30	Holy Infant Pri School	5
13	Urban Primary School I	None	31	Hilcrest Primary School	12
14	Urban Primary School II	2	32	Univ Staff School UNN	6
15	Model Primary School I	5	33	El-Tabera Prim School	4
16	Model Primary School II	12	34	Shalom Intõl School	13
17	Model Primary School III	3	35	Paraclete P/S Obukpa	6
18	Model Primary School IV	9	36	CPS, Ihe-Owerri	1
				Total	***169***

Nos = Population

APPENDIX N

Blue Print on Developing Creative Productivity Test Battery

Content Area	*Task Description*	*Test Item*
Visual Synthesis	Ability to combine simple shapes mentally and create a recognizable form or object.	1
Product Improvement Task	Ability to produce clever, interesting and unusual ways of improving an object or thing	1
Unusual Uses Task	Ability to produce interesting and unusual uses of common objects or things	1
Imaginative Story	Ability to write imaginative story about animals, concepts or people having some divergent characteristics	1
Poem composition	Ability to write simple poems that fit different purposes	1
Total		**5**

APPENDIX O

The Blue Print on Whole Brain Self-Report Questionnaire

The Left Brain *Processing Skills*	*Linear*	*Sequential*	*Symbolic*	*Logical*	*Verbal*	*Reality based*	**TL**
Test items	1,10,30	3,15,17,19, 49,54, 48	6,32	16,20,22,24,43,51	11,25, 50,44	2,29,39, 40,45	
Total Number	**3**	**7**	**2**	**6**	**4**	**5**	**27**
Percentage	**5.6**	**13**	**3.7**	**11**	**7.4**	**9.3**	**50**
The Right Brain *Processing Skills*	*Holistic*	*Random*	*Concrete*	*Intuitive*	*Non verbal*	*Fantasy based*	
Test items	4,9,21, 36,41	5,27,33,42,46,47,53	34,38	12,14,23,28,35,52	8,13,26 37	7,18,31	
Total Number	**5**	**7**	**2**	**6**	**4**	**3**	**27**
Percentage	**9.3**	**13**	**3.7**	**11**	**7.3**	**5.6**	**50**

APPENDIX P

Guide to Training of Research Assistants

Week 1

In the first week, the researcher visited sample schools to introduce himself to staff of the schools and to seek for support. In the schools, primary six teachers and their class assistants were trained as research assistants. The trainees were given the training programmes to study in view of their training. The training programmes provided guides on steps involved in teaching the lessons, and administration of the instrument. The training took place in each school because it was difficult to gather all the research assistants in one place. The training lasted for three hours per week. The researcher modeled repeatedly the procedure of instructional programme for the research assistants in experimental and control groups. Later, he took the research assistants through guided practices based on lower grade content and then grade appropriate content.

Week 2

In the second week of the training, each research assistant was asked to do practical exercises so as to provide necessary feedback on mastery of the training programme. The research assistants were made to stand before the researcher and teach the programme content. Thus, through the teaching practice each of the research assistants gained mastery of the relevant skills and effected the necessary corrections arising thereby. The researcher also urged them to be elaborate during the lessons and ensure that each lesson does not exceed the stipulated duration of 35 minutes.

APPENDIX Q

MIND MAPPING STRATEGY TRAINING PROGRAMME

Introduction Phase

Week 1/Session 1

Class: Primary six

Subject: English Composition

Topic: Introduction

Duration: 35 minutes

Average age: 10 years +

Date:

Specific Objectives: at the end of the lesson, the pupils should be able to do the following:

1 build rapport with the instructor

2 explain the purpose of the programme

3 state the guiding rules of the programme

Instructional Procedure

Content	***Teacher Activities***	***Pupils Activities***	***Strategy***	***Evaluation***
Introduction	The instructor introduces himself to the pupils.	The pupils introduce themselves in turn.	Self introduction	What is your name?

Purposes of the programme	The instructor explains the purpose of the training in mind mapping as follows: • to facilitate the processes of visual coordination and integration with other cognitive operations, which are essential to knowledge construction and individual expression of creativity. • Facilitate concept clarity. • Maximize the ability of logical analyzing and reasoning of the left-brain and creative thinking, and memory of the right brain. • Collect, organize and summarize large amount of information. • Learn to solve problems in a new and creative way. • Clearly define the central idea in a given passage. • Assists in linking key ideas easily. • Positions all basic information on one page. • Assists in making remembering and revision more efficient.	As the instructor explains, the pupils ask questions for further clarification	Explanation, planned repetition, questioning, clarification, reinforcement	Explain the purposes of the programme

Guiding rules of the programme	The instructor explains to the pupils the guiding rules for the instructional programme, thus: • Lessons hold during the English Composition periods each week. • The programme will last for eight weeks. • Participation is compulsory for all pupils. • Duration of the lesson is 35 minutes. • Pupils must be ready to actively participate during the lessons. • Pupils are to provide themselves packets of crayon or marker pens, and plain sheets of papers.	The pupils listen and ask questions for clarification where necessary.	Explanation, planned repetition, questioning, clarification, reinforcement	State the guiding rules for the programme
Scheduling of the programme	The instructor with the class teacher choose a convenient time for the training periods per week	The pupils confirm if the suggested time is convenient. Thus, the time is set for the training.	Negotiation, questioning, clarification	What is the time for the programme?
Conclusion	The instructor summarizes the session and highlights the necessary materials that the pupils should bring to the next training session.	The pupils ask questions for further clarification and copy the summary note.	Planned repetition, summarization	

Guided Practice on Mind Mapping: Modeling Phase

Week 1/ Session 2

Class: Primary six

Subject: English Composition

Topic: Marriage

Duration: 35 minutes

Average age: 10 years +

Date:

Specific Objectives: at the end of the session, the pupils should be able to do the following.

1 Identify the characteristics of marriage by prewriting activity

2 Use an image or picture to represent marriage

3 Represent the main themes/attributes of marriage with an image or write it in capital.

4 Connect the main themes to the central image

5 Connect the sub themes to the main themes or attributes

6 Draw an image to represent the sub themes

7 Beautiful the map by the use of colours and other artistic expressions

8 Write a descriptive essay using the mind map produced.

Instructional materials: copy of the training programme on mind mapping, chalk, chalkboard, a chart showing the steps of mind mapping, packets of crayon, permanent marker and sheets of A4 papers.

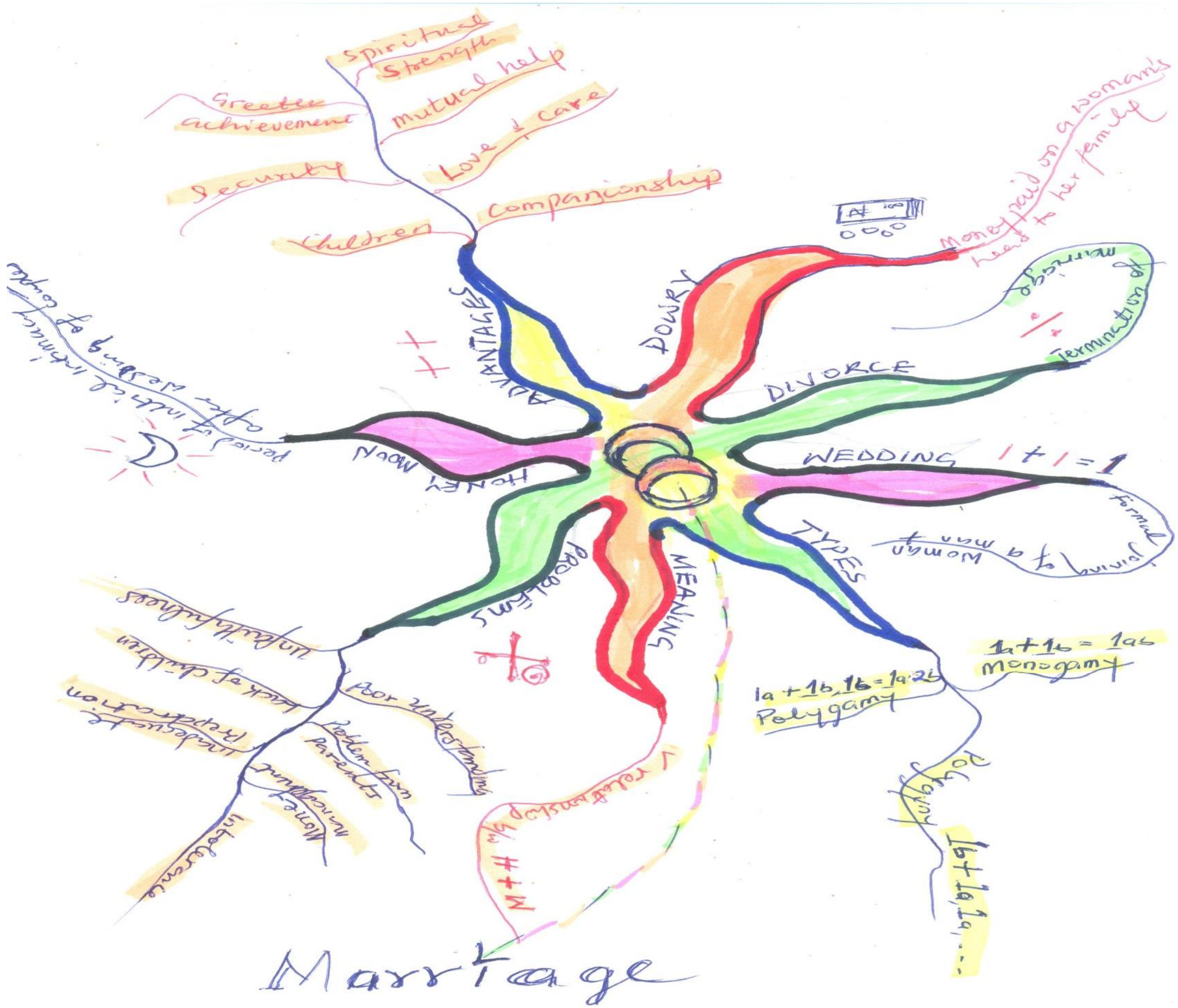
Entry behaviour: the pupils have learnt how to draw several images.

Instructional Procedure

Content	*Teacher Activities*	*Pupils Activities*	*Strategy*	*Evaluation*

Introduction	As soon as the instructor writes the topic of the day ómarriageô on the chalkboard, he asks the pupils to explain and identify the characteristics of the topics.	Pupils explore in depth the attributes of the central topic	Explicit Instruction, Explanation, Questioning	
Step 1 Pre-writing Activity	As the pupils describe marriage, the instructor writes the key words on the chalkboard.	The pupils ask questions, and identify the main theme, sub themes, key concepts and words.	Reinforcement, listing, clarification, group work	What are the characteristics of marriage?
Step 2 Making a central image	*Use an image or picture for the central idea*. The instructor models the process of mind mapping by writing the main topic at the center of a blank A4 paper. He makes two wedding rings as *central image* to represent the topic, using at least three colours and keeping the height and width of the central image proportionate to the size of the paper.	The pupils put an A4 paper horizontally and write the main topic at the center. The pupils find a suitable image to represent the central topic.	Illustration, drawing, sketching	Draw an image to represent the central topic
Step 3 Representing the main themes	The main themes around the central image are like the chapter headings of a book. The instructor print *meaning, types, dowry, wedding, honey moon, divorce, advantages and problems in CAPITALS or draw an image*, place it on a line of the same length. He explains that central lines are thick, curved and organic, like arm joining the body, or a branch of a tree to the trunk. *Use one key word per line*	The pupils print the main themes in upper case letters and draw an image beside each theme.	Illustration, drawing, sketching, labeling	Draw an image to represent the main themes
Step 4 Connecting the main themes	The instructor connects the main branches to the two wedding rings and connects the second and third level branches to the first and second levels respectively.	The pupils connect the main branches to the central image.	Illustration, drawing, sketching	Connect the main branches to the central image

Step 5 Connecting the sub themes	The instructor connects the sub themes (words or images) to the main themes that triggered them. Remember: lines connect are thinner, words are still printed but may be in lower case.	At sub-branch, that is the second level, the pupilsô link words or images to the main themes or branches.	Illustration, drawing, sketching, labeling	Link the words or images to the main branches
Step 6 Representing the sub themes	The instructor adds a third or fourth level of data; using images as much as possible, instead of, or in addition to words, thinking freely.	The pupils creatively use images instead of, or in addition to words thinking freely	Illustration, drawing, sketching, labeling	Draw an image to represent the sub themes
Step 7 Adding Artistic dimension	The instructor adds new dimension to their mind map. Boxes add depth around a word or image. To emphasis some important points, make the branches curved rather than straight-lined. The instructor encloses the branches of the mind map with *outlines in colour;* hug the shape tightly; use different colours, and styles. Making the mind map a little more *beautiful and colourful*. He adds a little *humour, exaggeration or fun..*	The pupils would add artistic or aesthetics dimension to the map The pupils enclose branches of a mind map with outlines in colour, bringing in artistic expression that best describe the themes.	Illustration, drawing, sketching, labeling, painting.	Make the map beautiful through the use of colours and other artistic expressions
Writing Activity	The instructor asks the pupils to use the topical mind map produced in writing a descriptive essay on marriage custom in their communities.	Pupils write a descriptive essay on marriage custom, edit and revise the draft using the graphic organizer.	Group work, questioning, explanation, illustration, composition	Write a descriptive essay on marriage custom
Conclusion	The instructor assesses the essay written using the mind maps produced under guided practice, make further clarification and then give the pupils more contents to mind map.	The pupils ask questions were necessary and write down the assignment, which they submit next class.	Planned repetition, clarification, correction, reinforcement	


Spiritual
Strength
mutual help
Greater achievement
Love & care
Security
Companionship
Children
ADVANTAGES
DOWRY
Money paid on a woman's head to her family
termination of marriage
DIVORCE
WEDDING
1+1=1
HONEY MOON
TYPES
MEANING
PROBLEMS
1a+1b = 1ab
Monogamy
Polygamy
unfaithfulness
lack of children
Poor understanding
Problem from Parents
intolerance
Marriage

Pupil Directed Practice on Mind Mapping

Week 2/ Session 3

Class: Primary six

Subject: English Composition

Topic: My class teacher

Duration: 35 minutes

Average age: 10 years +

Date:

Specific Objectives: at the end of the session, the pupils should be able to do the following.

1 Identify the characteristics of the class teacher by prewriting activity
2 Use an image or picture to represent the class teacher
3 Represent the main themes/attributes with an image or write it in capital.
4 Connect the main themes to the central image
5 Connect the sub themes to the main themes or attributes
6 Draw an image to represent the sub themes
7 Beautiful the map by the use of colours and other artistic expressions
8 Write a descriptive essay using the mind map produced.

Instructional materials: lesson note on mind mapping, chalk, chalkboard, a chart showing the seven steps of mind mapping, packets of crayon, permanent marker and sheets of A4 papers.

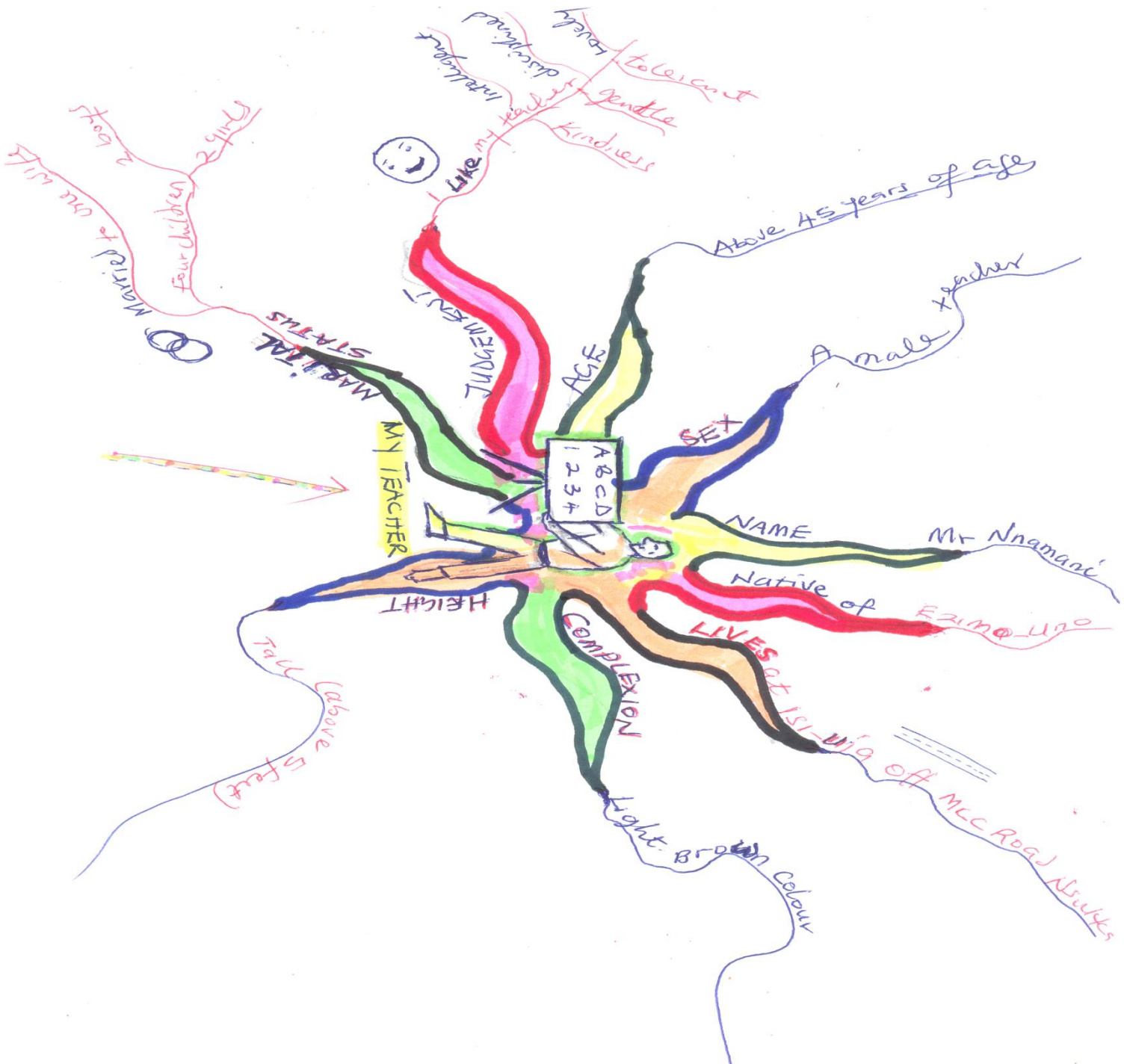
Entry behaviour: the pupils have learnt already the steps in making a mind map

Instructional Procedure

Content	*Teacher Activities*	*Pupils Activities*	*Strategy*	*Evaluation*

Step 1 Pre-writing Activity	As soon as the instructor writes the topic of the day on the chalkboard ôMy class teacherô, he asks the pupils to explore in depth the attributes of the central topic and the themes. The instructor writes on the chalkboard key points and assigns pupils to work in small, cooperative groups.	Pupils explore in depth the attributes of the themes. They identify the main theme, sub themes, key concepts and words.	Questioning, reinforcement, explicit instruction, explanation, outlining clarification, group work	What are the characteristics of your class teacher
Step 2 Making a central image	*Use an image or picture for the central topic/idea*. The instructor asks the pupils to write the main topic at the center of A4 paper, make a *central image* to represent the topic, use at least three colours, and keep the height and width of the central image proportionate.	The pupils put an A4 paper horizontally and write the main topic at the center. The pupils find a suitable image to represent the central topic.	Illustration, drawing, sketching	Draw any suitable image or picture to represent the central topic
Step 3 Representing the main themes or attributes	The main themes around the central image are like the chapter headings of a book. The instructor asks the pupils to *print these words in CAPITALS or draw an image*, place on a line of the same length. The central lines are thick, curved and organic, like the arm joining the body, or a branch of a tree to the trunk. *Use one key word per line*	The pupils print the main themes in upper case letters and draw an image beside each theme.	Illustration, drawing, sketching, labeling	Draw any appropriate image to represent the main themes
Step 4 Connecting the main themes or attributes	*The instructor asks the pupils to connect the main branches* to the central image and connect the second and third level branches to the first and second levels respectively.	The pupils connect the main branches to the central image.	Illustration, drawing, sketching	Connect with lines the main themes to the central topic
Step 5 Connecting the sub themes	The instructor asks the pupils to link the words or images to the main branch that triggered them. Remember: lines connect are thinner, words are still printed but may be in lower case.	At sub-branch, that is the second level, the pupilsô link words or images to the main themes or branches.	Illustration, drawing, sketching, labeling	Connect with lines the sub themes to the main themes or attributes

Step 6 Representing the sub themes	*The instructor asks the pupils to add a third or fourth level of data*; use images as much as possible, instead of, or in addition to words generated by free thought.	The pupils by thinking freely use images, instead of, or in addition to words	Illustration, drawing, sketching, labeling	Use images to represent the themes at third/fourth levels of data
Step 7 Adding Artistic dimension	*The instructor asks the pupils to add new dimension* to their mind map. Boxes add depth around a word or image. To emphasis some important points, make the branches curved rather than straight-lined. *The instructor asks the pupils to enclose branches of their mind map with outlines in colour;* hug the shape tightly; use different colours, and styles. Make each mind map a little more *beautiful and colourful*. Add a little *humour, exaggeration or fun* wherever necessary.	The pupils would add artistic or aesthetics dimension to the map The pupils enclose branches of their mind map with outlines in colour, bringing in artistic expression that best describe the themes.	Illustration, drawing, sketching, labeling, painting.	Add funny, beautiful, colourful and other creative features to the map
Writing Activity	The instructor asks the pupils to use the topical mind map produced in writing a descriptive essay on My class teacher. He/she presents his/her model mind map on the topic for comparism.	Using their mind maps, the pupils write a descriptive essay on *my class teacher,* edit and revise the draft.	Group work, questioning, explanation, illustration composition	Write a descriptive essay on marriage custom
Conclusion	The instructor assesses the essay written using the mind maps produced under guided practice, make further clarification and then give the pupils more contents to mind map.	The pupils ask questions were necessary and write down the assignment, which they submit next class.	Planned repetition, clarification, correction, reinforcement	


I like my teacher
intelligent
disciplined
loving
tolerant
gentle
kind
JUDGEMENT
Above 45 years of age
AGE
A male teacher
SEX
ABCD
1 2 3 4
NAME
Mr Nnamani
Native of
Ezinachi
LIVES at Isi-Uzo off MCC Road Nsukka
MARITAL STATUS
Married
one wife
two children
MY TEACHER
HEIGHT
Tall
Above 5 feet
COMPLEXION
Light Brown Colour

Grade Appropriate Practice on Mind Mapping

Week 2 / Session 4

Class: Primary six

Subject: English Composition

Topic: My school

Duration: 35 minutes

Average age: 10 years +

Date:

Specific Objectives: at the end of the session, the pupils should be able to do the following.

1. Identify the characteristics of my school by prewriting activity
2. Use an image or picture to represent my school
3. Represent the main themes/attributes with an image or write it in capital.
4. Connect the main themes to the central image
5. Connect the sub themes to the main themes or attributes
6. Draw an image to represent the sub themes
7. Beautiful the map by the use of colours and other artistic expressions
8. Write a descriptive essay using the mind map produced.

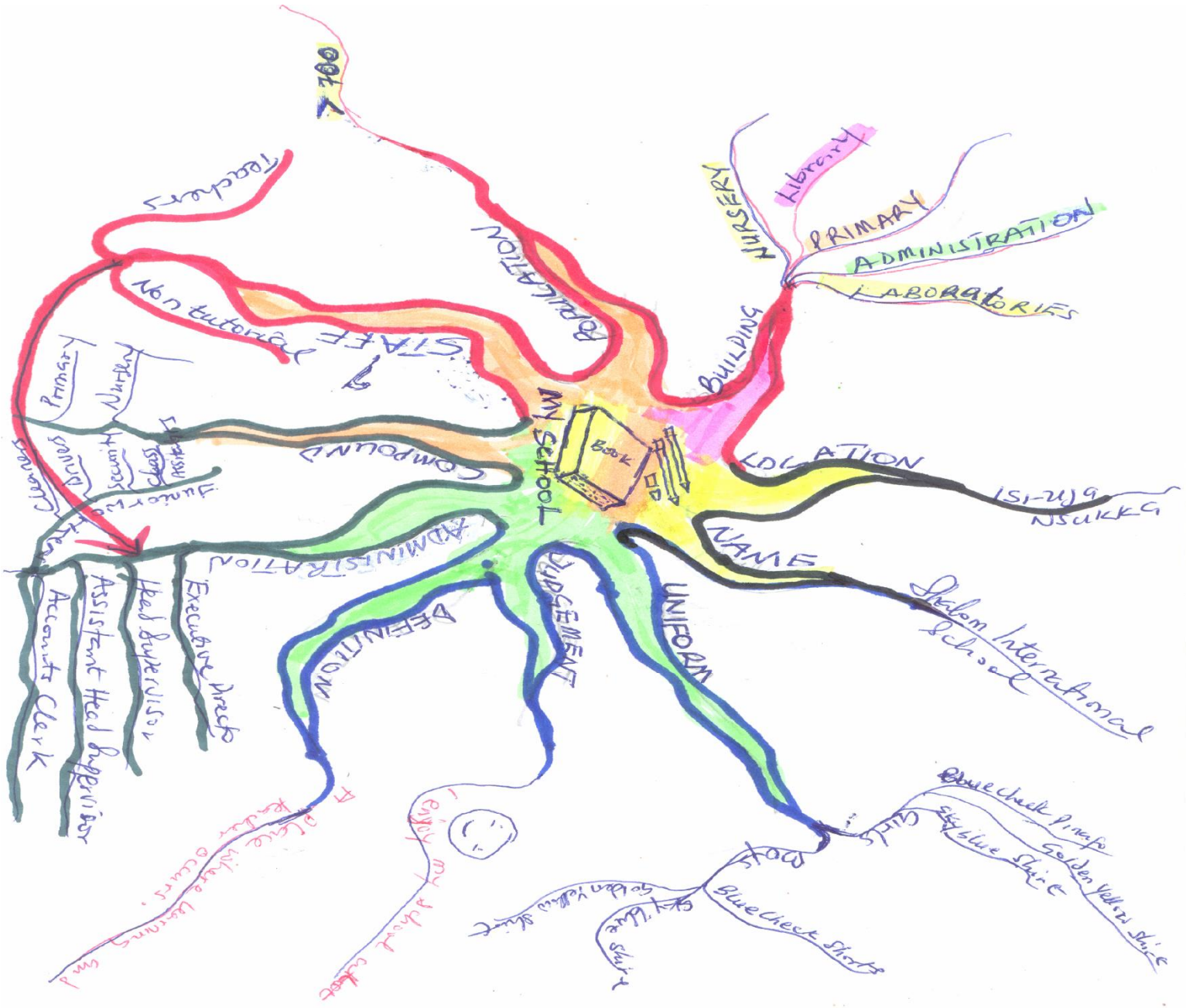
Instructional materials: lesson note on mind mapping, English Composition textbook 5, chalk, chalkboard, a chart showing the seven steps of mind mapping, packets of crayon, permanent marker and sheets of A4 papers.

Entry behaviour: the pupils have learnt already the steps in making a mind map

Instructional Procedure

Content	*Teacher Activities*	*Pupils Activities*	*Strategy*	*Evaluation*
Step 1 Pre-writing Activity	As soon as the instructor writes the topic of the day on the chalkboard, he provides the class Primary 6 English composition topic ómy schoolô and the pupils explore in depth the attributes of the central topic and the themes. The instructor writes on the chalkboard key words as the pupils working in small, cooperative groups mention them.	Pupils read the content and explore in depth the attributes of the themes. They identify the main theme, sub themes, key concepts and words.	Questioning, reinforcement, explicit instruction, explanation, outlining, clarification, group work	Describe your my school
Step 2 Making a central image	The instructor asks the pupils to find and draw a suitable image to represent the central topic on a horizontally placed A4 paper.	The pupils put an A4 paper horizontally and write the main topic at the center. The pupils find and draw a suitable image to represent the central topic.	Illustration, drawing, sketching	Draw any suitable image or picture that represent the central topic
Step 3 Representing the main themes or attributes	The instructor asks the pupils to print the main themes or draw an image to represent them. Use one key word per line	The pupils print the main themes in upper case letters and draw an image beside each theme.	Illustration, drawing, sketching, labeling	Draw any appropriate image to represent the main themes
Step 4 Connecting the main themes or attributes	The instructor asks the pupils to connect the main branches to the central image and connect the second and third level branches to the first and second levels.	The pupils connect the main branches to the central image.	Illustration, drawing, sketching	Connect with lines the main themes to the central topic
Step 5 Connecting the sub themes	The instructor asks the pupils to link the words or images to the main branch that triggered them. Remember: lines connect are thinner, words are still printed but may be in lower case.	At sub-branch, that is the second level, the pupilsô link words or images to the main themes or branches.	Illustration, drawing, sketching, labeling	Connect with lines the sub themes to the main themes or attributes

Step 6 Representing the sub themes	The instructor asks the pupils to add a third or fourth level of data; use images as much as possible, instead of, or in addition to words generated by free thought.	The pupils by thinking freely use images, instead of, or in addition to words	Illustration, drawing, sketching, labeling	Use images to represent the themes at third/fourth levels of data
Step 7 Adding Artistic dimension	The instructor asks the pupils to add new dimension to their mind map. Boxes add depth around a word or image. To emphasis some important points, make the branches curved rather than straight-lined. The instructor asks the pupils to enclose branches of their mind map with outlines in colour; hug the shape tightly; use different colours, and styles. Make each mind map a little more beautiful and colourful. Add a little humour, exaggeration or fun wherever necessary.	The pupils would add artistic or aesthetic dimension to the map. The pupils enclose branches of their mind map with outlines in colour, bringing in artistic expression that best describe the themes.	Illustration, drawing, sketching, labeling, painting.	Add funny, beautiful, colourful and other creative features to the map
Writing Activity	The instructor asks the pupils to use the topical mind map produced in writing a descriptive essay on my school. He/she presents his/her model mind map on the topic for comparism	Using the graphic organizer, the pupils write a descriptive essay on my school, edit and revise the draft.	Questioning, explanation, illustration, Composition	Write a descriptive essay on my school.
Conclusion	The instructor assesses the essay written using mind maps produced under grade appropriate practice, make further clarification and then give the pupils more contents to mind map.	The pupils take corrections, ask questions were necessary, and copy assignments.	Planned repetition, clarification, correction, reinforcement	


MY SCHOOL
Book
BUILDING
NURSERY
Library
PRIMARY
ADMINISTRATION
LABORATORIES
LOCATION
NAME
Shalom International School
UNIFORM
Blue Check Pinafo
Sky Blue Shirt
Golden Yellow Shirt
Blue Check Shirt
Sky Blue Shirt
Golden Yellow Shirt
SHOES
BADGEMENT
DEFINITION
ADMINISTRATION
Executive Head
Head Supervisor
Assistant Head Supervisor
Accounts Clerk
COMPOUND
Primary
Nursery
Junior Secondary
Senior Secondary
STAFF
Non tutorial
Tutorial
Teachers
POPULATION
700

Week 3/Session 5

Class: Primary six

Subject: English Composition

Topic: The law court

Duration: 35 minutes

Average age: 10 years +

Date:

Specific Objectives: at the end of the session, the pupils should be able to do the following.

1 Identify the characteristics of the law court by prewriting activity

2 Use an image or picture to represent the law court

3 Represent the main themes/attributes with an image or write it in capital.

4 Connect the main themes to the central image

5 Connect the sub themes to the main themes or attributes

6 Draw an image to represent the sub themes

7 Beautiful the map by the use of colours and other artistic expressions

8 Write a descriptive essay using the mind map produced.

Instructional materials: lesson note on mind mapping, chalk, chalkboard, a chart showing the seven steps of mind mapping, packets of crayon, permanent marker and sheets of A4 papers.

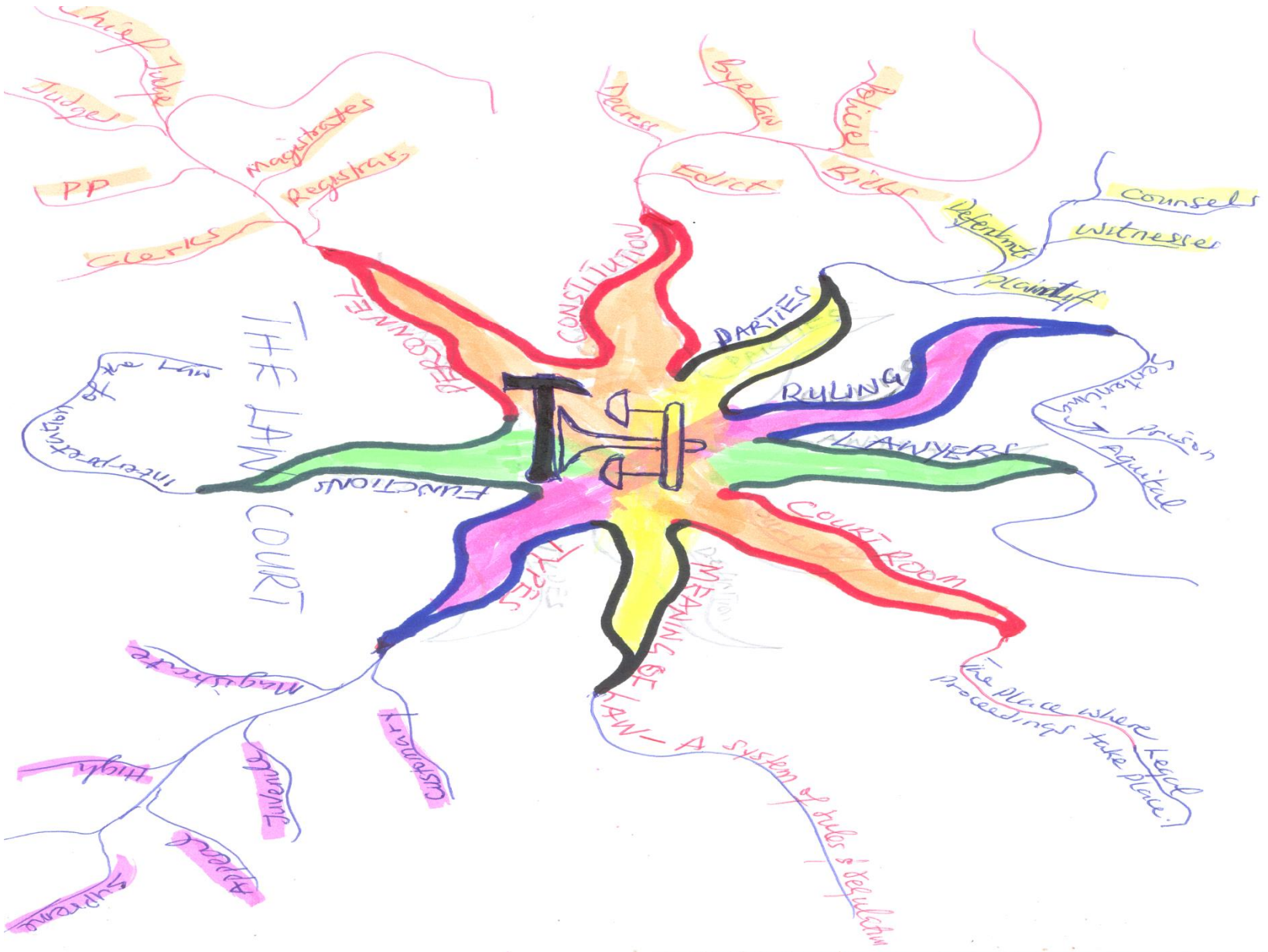
Entry behaviour: the pupils have learnt already the steps in making a mind map

Instructional Procedure

Content	***Teacher Activities***	***Pupils Activities***	***Strategy***	***Evaluation***

Step 1 Pre-writing Activity	The instructor writes the topic of the day ćthe law courtô on the chalkboard. He leads the pupils to explore in depth the attributes of the central topic and the themes. The instructor writes on the chalkboard key words as the pupils working in small, cooperative groups mention them.	Pupils read the content and explore in depth the attributes of the themes. They identify the main theme, sub themes, key concepts and words.	Questioning, reinforcement, explicit instruction, explanation, outlining, clarification, group work	Describe the law court
Step 2 Making a central image	The instructor asks the pupils to find and draw a suitable image to represent the central topic.	The pupils put an A4 paper horizontally and write the main topic at the center. The pupils find a suitable image to represent the central topic.	Illustration, drawing, sketching	Draw any suitable image or picture to represent the central topic
Step 3 Representing the main themes or attributes	The instructor asks the pupils to print the main themes or draw an image to represent them and to *use one key word per line*	The pupils print the main themes in upper case letters and draw an image beside each theme.	Illustration, drawing, sketching, labeling	Draw any appropriate image to represent the main themes
Step 4 Connecting the main themes or attributes	*The instructor asks the pupils to connect the main branches* to the central image and connect the second and third level branches to the first and second levels respectively.	The pupils connect the main branches to the central image.	Illustration, drawing, sketching	Connect with lines the main themes to the central topic
Step 5 Connecting the sub themes	The instructor asks the pupils to link the words or images to the main branch that triggered them. Since lines connect are thinner, words are still printed but may be in lower case.	At the sub-branch, i.e the second level, the pupilsô link words or images to the main themes or branches.	Illustration, drawing, sketching, labeling	Connect with lines the sub themes to the main themes or attributes
Step 6 Representing the sub themes	*The instructor asks the pupils to add a third or fourth level of data*; to use images as much as possible, instead of, or in addition to words generated by free thought.	The pupils by thinking freely use images, instead of, or in addition to words	Illustration, drawing, sketching, labeling	Use images to represent the themes at third/fourth levels of data

Step 7 Adding Artistic dimension	*The instructor asks the pupils to add new dimension* to their mind map. Boxes add depth around a word or image. To emphasis some important points, make the branches curved rather than straight-lined. *The instructor asks the pupils to enclose branches of their mind map with outlines in colour;* hug the shape tightly; use different colours, and styles. Make each mind map a little more *beautiful and colourful*. Add a little *humour, exaggeration or fun* wherever necessary.	The pupils would add artistic or aesthetics dimension to the map The pupils enclose branches of their mind map with outlines in colour, bringing in artistic expression that best describe the themes.	Illustration, drawing, sketching, labeling, painting.	Add funny, beautiful, colourful and other creative features to your map
Writing Activity	The instructor asks the pupils to use the topical mind map produced in writing a descriptive essay on the law court. He/She presents his/her model mind map on the topic for comparism.	Using the graphic organizer, the pupils write a descriptive essay on the law court, edit and revise the draft.	Questioning, explanation, illustration, composition	Write a descriptive essay on the law court
Conclusion	The instructor assesses the essay written using the mind maps produced under grade appropriate practice, make further clarification and then give the pupils more contents to mind map.	The pupils take corrections, ask questions were necessary, and copy assignments given.	Planned repetition, clarification, correction, reinforcement	


THE LAW COURT
CONSTITUTION
PERSONNEL
FUNCTIONS
PARTIES
RULING
LAWYERS
COURT ROOM
MEANING OF LAW
LAWS
Chief Judge
Judge
PP
Clerks
Magistrates
Registrars
Decree
Edict
Byelaw
Bylaw
Bills
Defendants
Plaintiff
Counsels
Witnesses
Sentences
Prison
Acquittal
Interpretation of the Law
Magistrate
High
Juvenile
Customary
Appeal
Supreme
A system of rules & regulations
The place where legal proceedings take place.

Week 3-5 /Session 6-9

Class: Primary six

Subject: English Composition

Topics: My country Nigeria, Christianity, Christmas holiday, the football game

Duration: 35 minutes

Average age: 10 years +

Date:

Specific Objectives: at the end of the session, the pupils should be able to do the following.

1 Identify the characteristics of each central topic by prewriting activity
2 Use an image or picture to represent each central topic
3 Represent the main themes/attributes with an image or write it in capital.
4 Connect the main themes to the central image
5 Connect the sub themes to the main themes or attributes
6 Draw an image to represent the sub themes
7 Beautiful the map by the use of colours and other artistic expressions
8 Write a descriptive essay using the mind map produced.

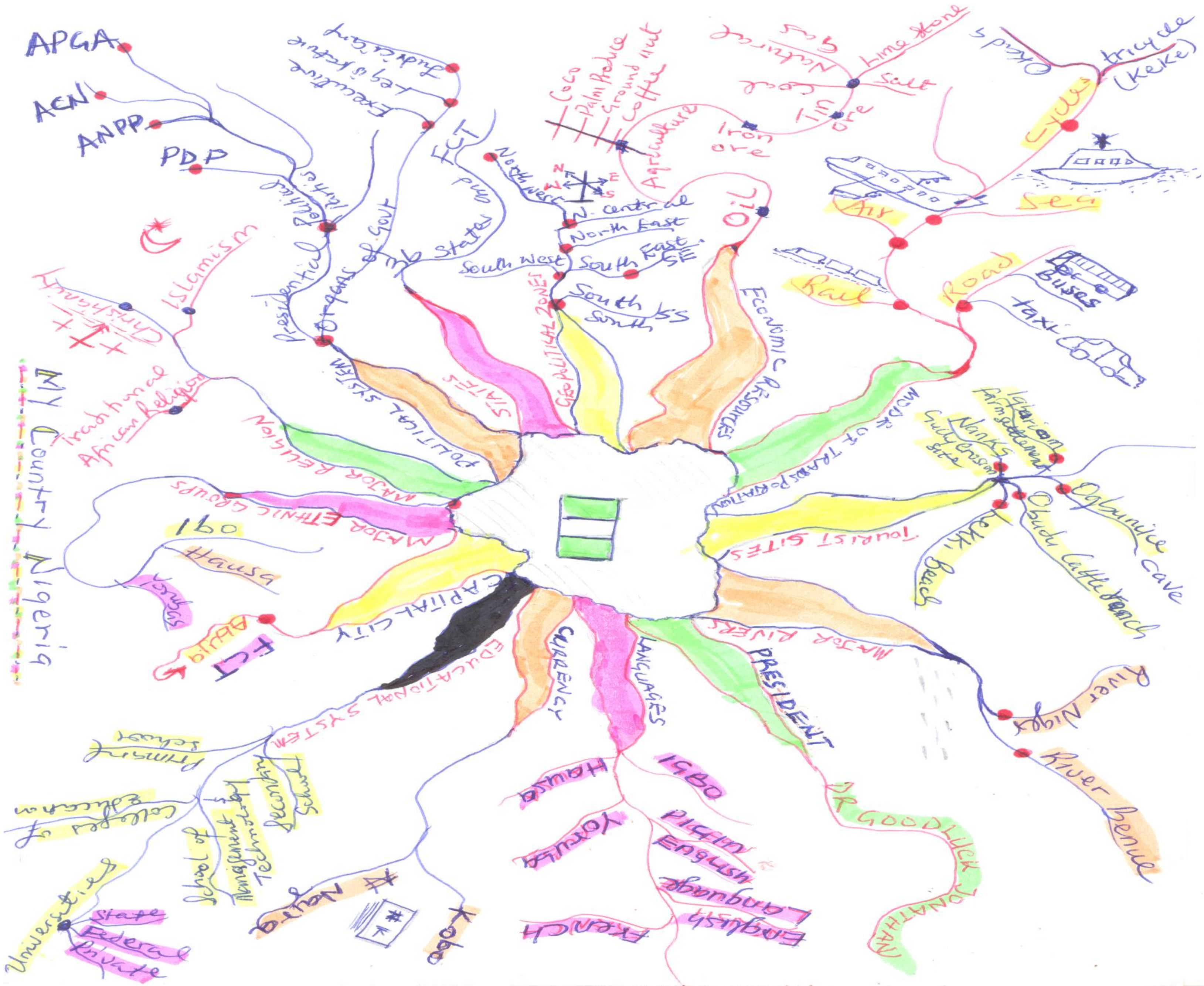
Instructional materials: lesson note on mind mapping, chalk, chalkboard, a chart showing the seven steps of mind mapping, packets of crayon, permanent marker and sheets of A4 papers.

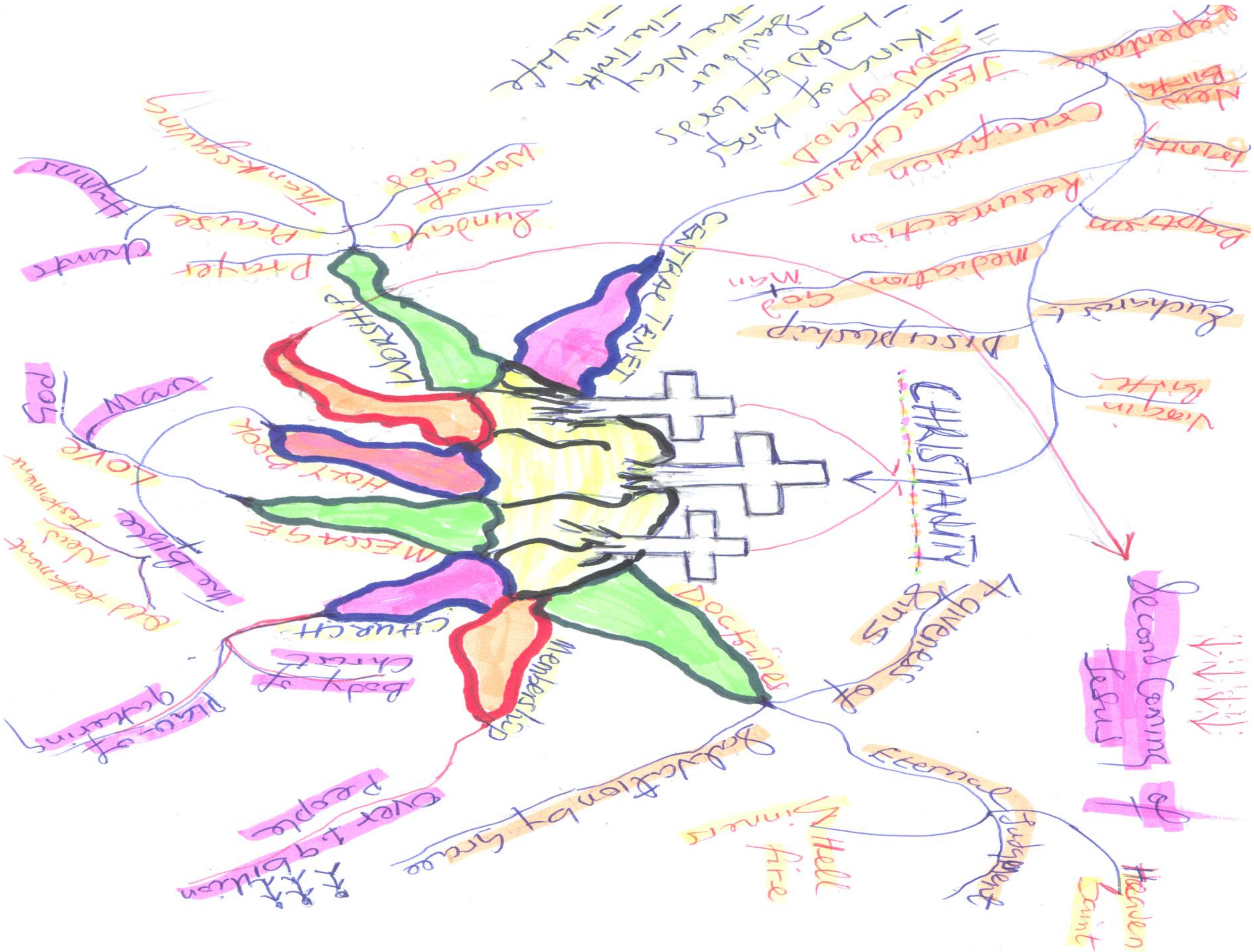
Instructional Technique: explicit instruction, verbal rehearsal, guided practice, guided practice, questioning, explanation, illustration and planned repetition.

Entry behaviour: the pupils have learnt already the steps in making a mind map

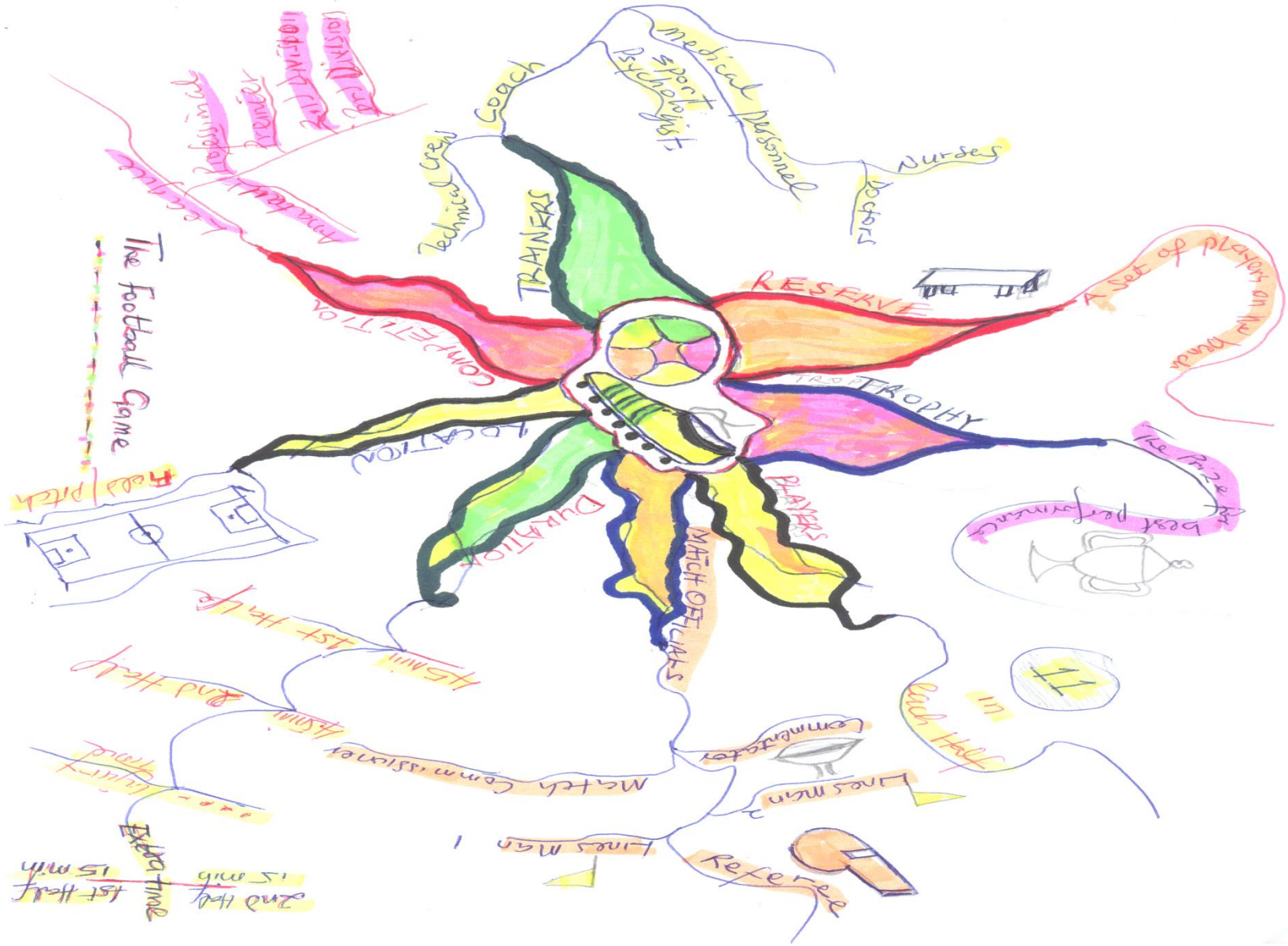
Instructional Procedure

Content	*Teacher Activities*	*Pupils Activities*	*Strategy*	*Evaluation*
Pre-writing Activity	For each week, the instructor writes the topic of the day on the chalkboard. He leads the pupils to explore in depth the attributes of each topic and the themes. The instructor writes on the chalkboard words as the pupils working in small, cooperative groups mention them. He explains the words and answers pupilsô questions. With the pupils identifies the main theme, sub themes, key concepts and words.	Pupils explore in depth the attributes of the themes and attempt an explanation. The pupils identify the main theme, sub themes, and key words.	Questioning, reinforcement, explicit instruction, explanation, outlining, clarification, group work	
Applying the mind mapping processes	The instructor asks the pupils to make a mind map following the processes applied in previous lesson.	The pupils apply the mind mapping steps in producing maps on each of the topics.	Illustration, drawing, sketching, labeling, Painting	
Writing Activity	The instructor asks the pupils to use the mind maps produced each week in writing a descriptive essay on each of the topical contents for weeks 6 to 9 of the third termôs scheme of work. He/She presents his/her model mind maps on the topic for comparism	Using the graphic organizer, the pupils write a descriptive essay on the topics, edit and revise the drafts before submitting for assessment.	Questioning, explanation, illustration, composition	Write a descriptive essay My country Nigeria, Christianity, Christmas holiday, the football game
Conclusion	The instructor assesses the mind maps produced for each of the topics, makes further clarification, correction and then ask the pupils to attempt producing mind map summary of termôs work.	The pupils ask questions were necessary, and copy the assignment given.	Planned repetition, clarification, correction, reinforcement	


MY Country Nigeria
APGA
ACN
ANPP
PDP
Political Parties
Presidential
Organs of Govt
Executive
Legislative
Judiciary
FCT
36 States
POLITICAL SYSTEM
STATES
GEOPOLITICAL ZONES
North West
N. central
North East
South East SE
South West
South South SS
Agriculture
Coco
Palm Produce
Ground nut
Coffee
Iron ore
Tin ore
Coal
Salt
Lime stone
Natural Gas
OIL
ECONOMIC RESOURCES
Cycles
Okada
tricycle (Keke)
Air
Sea
Rail
Road
Buses
taxi
MODE OF TRANSPORTATION
TOURIST SITES
Lekki Beach
Obudu Cattle Ranch
Ogbunike cave
MAJOR RIVERS
River Niger
River Benue
PRESIDENT
DR GOODLUCK JONATHAN
LANGUAGES
Hausa
IGBO
Yoruba
Pigin English
English Language
French
CURRENCY
Naira
Kobo
EDUCATIONAL SYSTEM
Primary School
Secondary School
Colleges of Education
School of Management Technology
Universities
State
Federal
Private
CAPITAL CITY
FCT
Abuja
MAJOR ETHNIC GROUPS
Ibo
Hausa
Yoruba
MAJOR RELIGION
Islamism
Christianity
Traditional African Religion


CHRISTIANITY
CENTRAL TENET
WORSHIP
MESSAGE
Holy Book
CHURCH
Membership
Doctrines
Prayer
Praise
Sunday
Word of God
thanksgiving
hymns
chants
Jesus Christ
Son of God
King of Kings
Lord of Lords
Saviour
the Way
the Truth
the Life
Repentance
New Birth
Lent
Crucifixion
Resurrection
Baptism
Mediation
God
Man
Eucharist
Discipleship
Virgin Birth
Forgiveness of Sins
Second Coming of Jesus
Salvation by Grace
Eternal Judgement
Hell fire
Sinners
Heaven
Saint
Over 1.9 billion people
Place of gathering
Body of Christ
The Bible
Old testament
New testament
Love
God
Man


CHRISTMAS HOLIDAY
CHRISTMAS DATE
25 Dec.
LOCATION
PLACES VISITED
BEGAN
ACTIVITIES
ENDING
DID YOU ENJOY IT?
PEOPLE VISITED
MEANING OF CHRISTMAS
HOLIDAY


The Football Game
Medical Personnel
Coach
Technical Crew
Doctors
Nurses
TRAINERS
RESERVE
A set of players on the Pitch
TROPHY
The Prize for best performance
PLAYERS
MATCH OFFICIALS
11
Each Half
Lines Men 2
Lines Men 1
Referee
Commentators
Match Commissioner
Assistant
1st Half
2nd Half
Extra Time
1st Half 15 min
2nd Half 15 min

Week 5 /Session 10

Class: Six

Subject: English Composition

Topic: Revision

Duration: 35 minutes

Average age: 10 years +

Date:

Specific Objectives: at the end of the session, the pupils should be able to do the following.

1 Make a list of topics done in English Composition for the term

2 Apply the steps of making mind map on the termôs content

3 Sketch an integrative mind map of the termôs content

Instructional materials: lesson note on mind mapping, chalk, chalkboard, a chart showing the seven steps of mind mapping, packets of crayon, permanent marker and sheets of A4 papers.

Instructional Technique: explicit instruction, verbal rehearsal, guided practice, guided practice, questioning, explanation, illustration and planned repetition.

Entry behaviour: the pupils have learnt already the steps in making a mind map

Instructional Procedure

Content	*Teacher Activities*	*Pupils Activities*	*Strategy*	*Evaluation*
Introduction	The instructor tells the pupils that the dayôs lesson is revision of the entire exercise on the use of mind mapping. He asks the pupils to list all the topics studied in English Composition for the term	The pupils list the entire topics done in English Composition for the term.	Questioning, reinforcement, explanation, outlining, clarification, group work, reinforcement	
Applying the mind mapping processes	The instructor asks the pupils to rehearse the steps in making a mind map. As they attempt, he asks the pupils to make a mind map of the termôs content in English Composition.	The pupils rehearse the steps in mind mapping and apply them on the termôs content in English Composition.	Verbal rehearsal, illustration and planned repetition	
Conclusion	The instructor assesses the integrative mind map produced on the topics learnt. He makes further clarification, correction and then informs the pupils of the on coming test and the need to use the revision mind map.	The pupils ask questions were necessary, and prepare for the on coming test using the revision mind map.	Planned repetition, clarification, correction, reinforcement	

APPENDIX R

SYNECTICS TRAINING PROGRAMME

Introduction Phase

Week 1/Session 1

Subject: English Composition

Topic: Introduction

Class: Six

Duration: 35 minutes

Date:

Specific Objectives: At the end of the session, the pupils should be able to do the following:

1 Build rapport with the instructor

2 Explain the purpose of the programme

3 Mention the guiding rules of the programme

Instructional Procedure

Content	***Teacher Activities***	***Pupils Activities***	***Strategy***	***Evaluation***
Introduction	The instructor introduces himself to the pupils and requests that the pupils introduce themselves in turn. The instructor informs the pupils that they will be learning a strategy that would enable them develop their potentials to think creatively in English composition.	The pupils listen and introduce themselves in turn.	Reinforcement, self introduction,	Please could you tell me your names in turn
Purposes of the programme	The instructor explains synectics as a teaching approach using metaphors and analogies, a tool that help pupils gain new insights and perspectives for use in the writing process. He presents the purpose of the lessons as follows:	The pupils listen and ask questions were necessary.	Explanation, planned repetition, questioning, clarification	Explain the purpose of the programme

	• To provide an approach to creative thinking that depends on looking at what appears on the surface as unrelated phenomenon and draws relevant connection. • To help break existing mindsets and internalize abstract concepts. • To produce practical problem stating and solving with creative solution • To encourage divergent thinking • To develop new/multidimensional perspectives and frameworks for creative thinking • To stimulate exploration, comparison of elements, and identification of idea • To enhances personal flexibility and creativity • Joins together ñdifferent, apparently irrelevant elementsò The instructor then gives the pupils time to ask questions for further clarification.			
The guiding rules of the programme	The instructor explains to the pupils the guiding rules for the instructional programme. • Lessons hold during the English Composition periods each week • The programme will last for the next eight weeks • Participation is compulsory for all pupils • Duration of the lesson is 30 minutes • Pupils are expected to actively participate during the lessons	The pupils listen, contribute, and ask questions were necessary.	Explanation, planned repetition, questioning, clarification, reinforcement	Mention the guiding rules for the programme

Scheduling of the programme	The instructor with the class teacher and the pupils choose a convenient time for the training programme	The pupils confirm if the suggested time is convenient. Thus, the time is set for the training.	Negotiation, questioning, clarification	What time is the programme?
Conclusion	The instructor asks pupils for questions in order to make further clarification, after which he summarizes the session.	Pupils ask questions and copy the list of materials to provide for next session.	Planned repetition, summarization	

Guided Practice Synectics Excursion: Modeling Phase

Week 1/ Session 2

Class: Six

Subject: English Composition

Topic: Marriage

Duration: 35 minutes

Date:

Specific Objectives: at the end of the session, the pupils should be able to do the following:

1 Describe the topic

2 Create direct analogies

3 Describe personal analogies

4 Identify compressed conflicts

5 Create a new direct analogy

6 Review the original topic and produce a product or description that uses the ideas generated in the process.

Instructional materials: lesson note on synectics, English Composition textbook 5, chalk, chalkboard, a synectics flow chart, and sheets of A4 papers.

Entry behaviour: the pupilsô have written many English Composition topics.

Instructional Procedure

Content	*Teacher Activities*	*Pupils Activities*	*Strategy*	*Evaluation*
Topic description	The instructor writes on the chalkboard the dayôs lesson. He describes and defines Synectics, and then uses a simple example to model the steps in the Synectics lesson. The instructor presents a topic on marriage	The pupils reflect on and discuss the topic. They list words on the chalkboard that relates to the topic. They compare two seemingly unlike	Group discussion, explanation, spring boarding, questioning	When I say marriage, what words come to your mind?

	and asks the pupils to describe it by writing freely two paragraphs in two pages.	words used to describe the topic.		
Direct analogies	The instructor then introduces an unrelated category (e.g., plant, animal or experience), and ask the pupils to state how marriage and the choice category are related.	The pupils take turns in writing the group responses into the category/template on the board. They choose one out of the lot; for example, *trinity*, orange, salvation; and call out key words that seem related to it.	Comparison, questioning, dramatization	Marriage is like what plant, animal or experience?
Personal analogies	The instructor explains that personal analogy is created when one puts oneself in the place of a problem. That is taking over the viewpoint. The instructor asks the pupils to become and describe trinity. Make a list of at least 10 ways marriage and trinity is alike.	The pupils choose one of the options, pretend to be trinity, and describe how they feel and think in writing (first-person). For instance, sacred, united, powerful, successful, purity, spiritual, blissful, intercourse, eternity, life, heavenly, health, safety	Analogy, comparison, dramatization	Describe the concept trinity. How would it feel to be triune?
Compressed conflicts	The instructor explains that compressed conflict is the third kind of creative connection making, which involves formulating two-word description using opposites, or conflicting elements, within the pair. The instructor asks the pupils to look at the words generated under direct analogies and personal analogies, and find two words that are opposites (fight each other). He picks one of the examples and pupils describe it in	Pupils then use the ñfeelingsò list of words to combine the ones that ñseem to argue with each other and describe them. Words outside the combinations are erased, leaving only the ñcompressed conflictsò list. Example, fleshly spiritual	Contrasting	Pair words from the marriage and trinity list that seem to fight each other. How is - and - different and why?

	detail. The pupils connect personally with the metaphor generated, and then explore emotions, feelings, explanations of reasons for selecting the metaphor.			
New direct analogy	The instructor asks the pupils to look at words on the board and see if there is anything else about the original topic. The instructor asks the pupils to select something that is described by the paired words	The pupils create a new direct analogy, by selecting something new that is described by the paired words. For instance, the fleshly spiritual is like an evening breeze	Questioning	Fleshly spiritual is like what and why?
Process Review and Creative Production	The instructor asks the pupils to review the original topic and make a description using the words/ideas generated in the process.	The pupils review the original topic and write a poem using the analogies or words generated.	Planned repetition, questioning	Write a poem on marriage
Evaluate	The instructor evaluates the entire activity and poems composed by the pupils. Afterward, he tells the pupils to write an essay on marriage, and submit next class.	Pupils reflect on and edit their poems together with the instructor. They write and submit during the next class an essay on marriage, utilizing all the generated ideas.	Summary, home work	Write essay on marriage.

Pupil Directed Synectics Excursion

Week 2/ Session 3

Class: Six

Subject: English Composition

Topic: My class teacher

Duration: 35 minutes

Date:

Specific Objectives: at the end of the session, the pupils should be able to do the following:

1 Describe the topic

2 Create direct analogies

3 Describe personal analogies

4 Identify compressed conflicts

5 Create a new direct analogy

6 Review the original topic and produce a product that uses the ideas generated in the process.

Instructional materials: lesson note on synectics, English Composition textbook 5, chalk, chalkboard, a synectics flow chart, and sheets of A4 papers.

Entry behaviour: the pupilsô have written composition about themselves.

Instructional Procedure

Content	*Teacher Activities*	*Pupils Activities*	*Strategy*	*Evaluation*
Topic description	The instructor starts the lesson by telling the pupils that they will compose a poem on the topic teacher. He asks them to describe My class teacher by writing two paragraphs in two pages. He encourages them to write	The pupils reflect, discuss and write on the topic given. They also list words on the chalkboard that relate to the topic. The pupils to compare two seemingly unlike words used to	Explanation, group discussion, questioning, reinforcement	When I say teacher, what words come to your mind?

	freely.	describe the topic.		
Direct analogies	He then introduces an unrelated category (e.g., plant, animal or experience), and ask the pupils to state how My class teacher and the choice category is related.	The pupils look around their surrounding and choose one; for example, mother hen and call out key words that seem related to it.	Comparison, dramatization questioning illustration	My class teacher is like what plant or animal?
Personal analogies	The instructor asks the pupils to become and describe mother hen. Make a list of at least 10 ways teacher and mother hen is alike.	The pupils describe and pretend to be a mother hen, state how they feel and think in writing (first-person). They list such traits as suspicious, old, oversensitive, fearful, energetic, tireless, tactful, wise, talkative, workaholic, fighter, discipline, itinerant, protective, fearful, caring, a leader, incubator, hatchery & aggressive	Questioning, comparison, illustration	Describe a mother hen. How do you feel being a mother hen?
Compressed Conflicts	The instructor asks the pupils to look at direct analogy and personal analogy, and find two words that seem to fight each other. He selects one of the examples, while the pupils describe that example in detail.	Pupils then use the ñfeelingsò list of words to combine the ones that seem to argue with each other, and describe them. Example, aggressive ï discipline	Comparison, contrasting, explanation, illustration	How is aggressive and discipline different and why?
New direct analogy 1	The instructor asks the pupils to look at words on the board and see if there is anything else about the original topic. He asks the pupils to create an analogy that connects the original topic to one of the new words.	The pupils create a new direct analogy, by selecting something new that is described by the paired words. For instance, aggressive discipline is like military training.	Comparison, contrasting, explanation, illustration	Aggressive - discipline is like what and why?
New direct analogy 2	The instructor asks the pupils to tell something more about an aggressive discipline. Apply more attributes to the conflicting words.	The pupils identify more attributes of the identified conflict. Aggressive discipline is like automated engine.	Comparison, contrasting, explanation, illustration	What else can be an aggressive discipline?
Process Review and Creative Production	The instructor ask the pupils to look at everything on the board and see if there is anything else to say about the teacher. He asks the pupils to write a poem	The Pupils review the original topic. Using the analogies and words (ideas) generated, they write a poem on My class teacher.	Planned repetition, questioning, verbal rehearsal	Using ideas generated, write a poem on My class

	about My class teacher using the generated words on the board or any additional descriptive words.			teacher.
Evaluation	The instructor evaluates the entire activity and poems composed by the pupils. Afterward, he gives the pupils assignment to write an essay on My class teacher, which he evaluates and clarifies where necessary.	Pupils reflect on and edit the poems together with the instructor. They write an essay my class teacher.	Summary, group work	Write an essay on My class teacher.

Grade Appropriate Synectics Excursions

Week 2/ Session 4

Class: Six

Subject: English Composition

Topic: My school

Duration: 35 minutes

Date:

Specific Objectives: at the end of the session, the pupils should be able to do the following:

1 Describe the topic

2 Create direct analogies

3 Describe personal analogies

4 Identify compressed conflicts

5 Create a new direct analogy

6 Review the original topic and produce a product that uses the ideas generated in the process.

Instructional materials: lesson note on synectics, English Composition textbook 5, chalk, chalkboard, a synectics flow chart, and sheets of A4 papers.

Entry behaviour: the pupilsôhave written composition about themselves.

Instructional Procedure

Content	*Teacher Activities*	*Pupils Activities*	*Strategy*	*Evaluation*

Topic description	The instructor starts the lesson by telling the pupils that they will compose a poem on the topic *My School*. He asks them to describe their school by writing two paragraphs in two pages. He encourages them to write freely.	The pupils reflect, discuss and write on the topic given. They also list words on the chalkboard that relate to the topic. The pupils compare two seemingly unlike words used to describe the topic.	Explanation, group discussion, questioning, reinforcement	When I say my school, what words come to your mind?
Direct analogies	The instructor introduces an unrelated category (e.g., plant, animal, experience or anything unrelated to the original topic), and ask the pupils to state how the school and the choice category is related.	The pupils look around their surrounding and choose one; for example, umbrella tree and call out key words that seem related to it.	Comparison, dramatization questioning, illustration	My school is like what plant or animal?
Personal analogies	The instructor asks the pupils to become and describe umbrella tree. Make a list of at least 10 ways my school and the umbrella tree is alike.	The pupils describe and pretend to be the umbrella tree, and state how they feel or think in writing (first-person). They list such traits as quiet, cool, shelter, spread branches, hierarchical structure, fruiting, nutritious, well-rooted, integrated, uni-colour, leaf shading, temporal, plucked, organized, growth,	Questioning, comparison illustration	Describe an umbrella tree. How do you feel being an umbrella tree?
Compressed Conflicts	The instructor asks the pupils to look at direct analogy and personal analogy, and find two words that seem to fight each other. He selects one of the examples, while the pupils describe that example in detail.	Pupils then use the ñfeelingsò list of words to combine the ones that seem to argue with each other, and describe them. Example, fruiting - shading	Comparison, contrasting, explanation illustration	How is fruiting and shading different and why?
New direct analogy 1	The instructor asks the pupils to look at words on the board and see if there is anything else about the original topic. He asks the pupils to create an analogy that connects the original topic to one of the new words.	The pupils create a new direct analogy, by selecting something new that is described by the paired words. For instance, fruiting shading is like the reproductive cycle	Comparison, contrasting, explanation illustration	Fruiting - shading is like what and why?
New direct analogy 2	The instructor asks the pupils to tell something more about shading fruiting, and apply more attributes to the conflicting	The pupils identify more attributes of the identified conflict. Fruiting - shading is like a production	Comparison, contrasting, explanation,	What else can be an fruiting - shading?

	words.	industrial.	illustration	
Process Review and Creative Production	The instructor ask the pupils to look at everything on the board and see if there is anything else to say about the my school. He asks the pupils to write a poem about my school using the generated words on the board or any additional descriptive words.	The Pupils review the original topic. Using the analogies and words (ideas) generated, they write a poem on my school.	Planned repetition, questioning, verbal rehearsal	Using available information, write a poem on my school.
Evaluation	The instructor evaluates the entire activity and poems composed by the pupils. Afterward, he asks the pupils to write an essay on my school evaluates the creative products and makes clarification where necessary.	Pupils reflect on and edit the poems together with the instructor. They write an essay assigned to them as homework utilizing all the generated ideas.	Summary, group work	Write an essay on my school.

Week 3/ Session 5

Class: Six

Subject: English Composition

Topic: Appreciated nuisance

Duration: 35 minutes

Date:

Specific Objectives: at the end of the session, the pupils should be able to do the following:

1 Describe the topic

2 Create direct analogies

3 Describe personal analogies

4 Identify compressed conflicts

5 Create a new direct analogy

6 Review the original topic and produce a product that uses the ideas generated in the process.

Instructional materials: lesson note on synectics, English Composition textbook 5, chalk, chalkboard, a synectics flow chart, and sheets of A4 papers.

Instructional Techniques: explicit instruction, verbal rehearsal, questioning, explanation, illustration and planned repetition.

Entry behaviour: the pupilsôhave written composition about themselves.

Instructional Procedure

Content	***Teacher Activities***	***Pupils Activities***	***Strategy***	***Evaluation***
Topic description	The instructor starts the lesson by telling the pupils that they will compose a poem on the topic *an appreciated nuisance*. He asks them to describe *an appreciated nuisance* by writing two paragraphs in two pages. He	The pupils reflect, discuss, clarify and write on the topic given. They also list words on the chalkboard that relate to the topic. The pupils compare and explain two seemingly	Explanation, group discussion, questioning, reinforcement	When I say *appreciated nuisance*, what words come to your

	encourages them to define the key words as they write freely.	unlike words used to describe the topic.		mind?
Direct analogies	The instructor introduces an unrelated category (e.g., plant, animal, experience or anything unrelated to the original topic), and ask the pupils to state how the school and the choice category is related.	The pupils look around their surrounding, choose for example, rain, and call out key words that seem related to it.	Comparison, dramatization questioning, illustration	*Appreciated nuisance* is like what?
Personal analogies	The instructor asks the pupils to become and describe rain, make a list of at least 10 ways *an appreciated nuisance* and the rain is alike.	The pupils describe and pretend to be the rain, and state how they feel or think in writing (first-person). They list such traits as cool, muddy, slippery, herald joy, life, growth, water, flood, fun, blessing, common cold, erosion, refreshing	Questioning, comparison illustration	Describe the rain. How do you feel being the rain?
Compressed Conflicts	The instructor asks the pupils to look at direct analogy and personal analogy, and find two words that seem to fight each other. He selects one of the examples, while the pupils describe it in detail.	Pupils then use the ñfeelingsò list of words to combine the ones that seem to argue with each other, and describe them. Example, *erosive - blessing*	Comparison, contrasting, explanation illustration	How is *erosion and blessing* different and why?
New direct analogy 1	The instructor asks the pupils to look at words on the board and see if there is anything else about the original topic. He asks the pupils to create a new analogy that connects the original topic to one of the new words.	The pupils create a new direct analogy, by selecting something new that is described by the paired words. For instance, *Erosive blessing* is like drug	Comparison, contrasting, explanation illustration	*Erosive blessing* is like what and why?
New direct analogy 2	The instructor asks the pupils to tell something more about *erosive blessing* and apply more attributes to the conflicting words.	The pupils identify more attributes of the identified conflict. *Erosive blessing* is like the law court.	Comparison, contrasting, explanation, illustration	What else can be an *erosive blessing*?

Process Review and Creative Production	The instructor ask the pupils to look at everything on the board and see if there is anything else to say about an appreciated nuisance. He asks the pupils to write a poem using the generated words on the board or any additional descriptive words.	The Pupils review the original topic. Using the analogies and words (ideas) generated, they write a poem on an appreciated nuisance.	Planned repetition, questioning, verbal rehearsal	Using available information, write a poem on an appreciated nuisance.
Evaluation	The instructor evaluates the entire activity and poems composed by the pupils. Afterward, he asks the pupils to write an essay on an appreciated nuisance, which he evaluates and makes clarification where necessary.	Pupils reflect on and edit their poems together with the instructor. They write an essay assigned to them as homework utilizing all the generated ideas.	Summary, group work	Write an essay on an appreciated nuisance.

Week 3-9/ Session 6-9

Class: Six

Subject: English Composition

Topics: Nervous calm, friendly beast, creative destruction, and comfortable burden

Duration: 30 minutes

Date:

Specific Objectives: at the end of the session, the pupils should be able to do the following:

1 Describe the topic

2 Create direct analogies

3 Describe personal analogies

4 Identify compressed conflicts

5 Create a new direct analogy

6 Review the original topic and produce a product that uses the ideas generated in the process.

Instructional materials: lesson note on synectics, English Composition textbook 5, chalk, chalkboard, a synectics flow chart, and sheets of A4 papers.

Instructional Techniques: explicit instruction, verbal rehearsal, questioning, explanation, illustration and planned repetition.

Entry behaviour: the pupilsôhave written composition about an appreciated nuisance.

Instructional Procedure

Content	***Teacher Activities***	***Pupils Activities***	***Strategy***	***Evaluation***
Topic description	The instructor presents the following topics: nervous calm, friendly beast, creative destruction, and comfortable burden one per week; and asks the pupils to compose poems on them. He asks them to describe each topic	The pupils reflect, discuss and write on the topic given. They also list words on the chalkboard that relate to each topic. The pupils compare two seemingly unlike words used to	Explanation, group discussion, questioning, reinforcement	When I say ---- ----, what words come to your mind?

	by writing two paragraphs in two pages. He encourages them to write freely.	describe each topic.		
The synectics process	The instructor just like in other sessions guides the pupils through the synectics excursion.	As the instructor transfers the leadership of the process, the pupils take turn as they practice on appropriate content material. They also edit the products in line with the instructorôs corrections and ask questions where necessary.	Comparison, dramatization questioning, illustration, explanation, contrasting	
Evaluation	The instructor evaluates the entire activity and poems composed by the pupils on each topic. Afterward, he asks the pupils to write an essay on the given topics. He evaluates the creative products and makes clarification where necessary.	Pupils reflect on and edit the poems together with the instructor. They write an essay assigned to them as homework utilizing all the generated ideas.	Summary, group work, Questioning	Write an essay on ...?
Conclusion	The instructor tells the pupils to prepare for test on the use of this technique in answering English Composition questions next class.	Pupils draft, edit, revise and publish their thematic essay. Thus, they prepare for the oncoming test.	Planned repetition, summary	

Week 5 /Session 10

Class: Six

Subject: English Composition

Topic: Revision

Duration: 35 minutes

Average age: 10 years +

Date:

Specific Objectives: at the end of the session, the pupils should be able to do the following.

1 Describe the topic

2 Create direct analogies

3 Describe personal analogies

4 Identify compressed conflicts

5 Create a new direct analogy

6 Review the original topic and produce a product that uses the ideas

Instructional materials: training programme on synectics, chalk, chalkboard, a chart showing the steps in synectics excursion, packets of crayon, permanent marker and sheets of A4 papers.

Instructional Technique: explicit instruction, verbal rehearsal, guided practice, guided practice, questioning, explanation, illustration and planned repetition.

Entry behaviour: the pupils have learnt already the steps in making a synectics process

Instructional Procedure

Content	***Teacher Activities***	***Pupils Activities***	***Strategy***	***Evaluation***

Introduction	The instructor tells the pupils that the dayôs lesson is revision of the entire activities on the use of synectics. He asks the pupils to list all the topics studied in English Composition for the term.	The pupils list the entire topics done in English Composition for the term.	Explanation, group discussion, questioning, reinforcement	
Applying the synectics process	The instructor asks the pupils to rehearse the synectics process. As they attempt, he reminds the pupils that it revolves on making a strange topic familiar or the familiar one strange. Thus, creating something new.	The pupils rehearse the synectics process and promise to apply them on the termôs content in English Composition.	Comparison, dramatization, questioning, illustration, contrasting,	
Conclusion	The instructor makes further clarification, correction and then informs the pupils of the on coming test and the need to use the synectics technique in writing.	The pupils ask questions were necessary, and prepare for the on coming test.	Planned repetition, summary	

APPENDIX S

CONVENTIONAL INSTRUCTIONAL PROGRAMME

Week 1/Session 1

Subject: English Composition

Topic: Rapport Building

Class: Six

Duration: 35 minutes

Date:

Specific Objectives: At the end of the session, the pupils should be able to do the following:

1 Build rapport with the instructor

2 Explain the purpose of the programme

3 Mention the guiding rules of the programme

Instructional Procedure

Content	***Teacher Activities***	***Pupils Activities***	***Strategy***	***Evaluation***
Introduction	The instructor introduces himself to the pupils and requests that the pupils introduce themselves in turn. The instructor informs the pupils that they will be having lesson sessions on English composition.	The pupils listen and introduce themselves in turn.	Reinforcement, self introduction,	Please could you tell me your names in turn
Purposes of the programme	The instructor explains the purpose of the lessons as follows: to teach pupils how to write composition on given topics. The instructor then gives the pupils time to ask questions for further clarification.	The pupils listen and ask questions were necessary.	Explanation, planned repetition, questioning, clarification	Explain the purpose of the programme

The guiding rules of the programme	The instructor explains to the pupils the guiding rules for the instructional programme. • Lessons hold during the English Composition periods each week • The programme will last for the next eight weeks • Participation is compulsory for all pupils • Duration of the lesson is 30 minutes • Pupils are expected to actively participate during the lessons	The pupils listen, contribute, and ask questions were necessary.	Explanation, planned repetition, questioning, clarification, reinforcement	Mention the guiding rules for the programme
Scheduling of the programme	The instructor with the class teacher and the pupils choose a convenient time for the lesson	The pupils confirm if the suggested time is convenient. Thus, the time is set for the training.	Negotiation, questioning, clarification	What time is the programme?
Conclusion	The instructor asks pupils for questions in order to make further clarification, after which he summarizes the session.	Pupils ask questions and copy the list of materials to provide for next session.	Planned repetition, summarization	

Weeks 1 - 10

Subject: English Composition

Topics: Marriage, my teacher, my school, the law court, my country Nigeria, Christianity, Christmas holiday, the football game

Class: Six

Duration: 35 minutes

Date:

Specific Objectives: At the end of the lesson, the pupils should be able to do the following:

1. Identify the major parts of a composition essay
2. Describe a given composition topic
3. Write an introduction of a given topic
4. Use adverbial question forms in writing the body.
5. Conclude by stating how they feel, give reasons for their judgment
6. Write a composition on a given topic

Instructional Procedure

Content	***Teacher Activities***	***Pupils Activities***	***Strategy***	***Evaluation***
Introduction	The instructor introduces each topic for the weeks by writing it on the chalkboard and informs the pupils that they would write a composition at the end.	The pupils listen and ask questions for clarification where necessary.	Explanation, Questioning	Read the topic on the chalkboard?
Parts of a composition	The instructor states the major parts of a composition essay as follows: the beginning/introduction, the middle/body, and ending/conclusion	The pupils together with their instructor note the major parts of an essay.	Explanation, Questioning, Planned repetition	What are the parts of a composition essay?
The Beginning or Introduction	The instructor asks the pupils to describe the given topic. As they attempt, he writes the key words on the chalkboard. The instructor asks	The pupils provide a varied description of the topic. Each pupil reads	Explanation, Questioning	Describe and explain the key words.

	the pupils to begin a composition by explaining in writing the key terms or concepts already noted.	out to the entire class his own description of the topic and explanation of some key words.		
The middle or Body	At this point, the instructor asks the pupils to use the adverbial guideline, such as: *what, who, where, when, why and how* in developing questions around the given essay topic.	The pupils write a descriptive essay as they state what the topic is all about, who the characters are, where and when the event took place, give reasons and explain them well.	Explanation, Questioning	What are the adverbial guidelines?
The Ending or Conclusion	At this point, the instructor asks the pupils to conclude by stating the ending of the story. As the pupils attempt, the instructor explains that the ending part requires the pupils to state how they feel about a given story, with reasons.	The pupils make judgment about the story and state the reasons for their feelings.	Explanation, Questioning,	How do you feel about the events and persons in the story and why?
Evaluation	The instructor asks the pupils to use the identified features and write an essay on the topic lesson.	The pupils use the features and write a composition.	Explanation, Questioning	Write essay on the topic lesson.
Conclusion	The instructor collects the answer scripts, marks and makes corrections. He asks the pupils to note down the corrections.	The pupils observe the corrections and ask questions were necessary.	Clarification, Questioning, Planned repetition	