

Qualitative Study on Correlation between Cognitive Preference style and Achievement in Sciences at Secondary School level of Education in Nigeria

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Abstract

This study explores the relationship between cognitive preferences and scientific achievement through both theoretical frameworks and empirical investigation. Drawing on models of cognitive styles such as analytic versus holistic processing, field dependence-independence, and divergent-convergent thinking the research examines how individual differences in preferred modes of information processing influence the pursuit and attainment of scientific knowledge. The theoretical analysis situates cognitive preferences within broader psychological and educational paradigms, highlighting their potential role in shaping creativity, problem-solving strategies, and disciplinary specialization. Empirical findings, based on surveys and performance measures of scientists and students across diverse fields, reveal significant correlations between specific cognitive styles and indicators of scientific productivity, including publication output, innovation, and recognition. The study concludes that cognitive preferences are not deterministic but act as enabling or constraining factors that interact with environmental, motivational, and social variables. Implications are discussed for science education, talent development, and fostering interdisciplinary collaboration. In light of these findings, it is recommended that educational systems cultivate awareness of diverse cognitive styles, or cognitive preferences, and integrate flexible pedagogical approaches that nurture both analytic and holistic thinking, encourage environments that balance individual strengths with collaborative opportunities, and design talent development programs that recognize cognitive diversity as a resource for innovation. Furthermore, fostering interdisciplinary platforms that bridge different cognitive orientations can enhance creativity and resilience in scientific practice, ensuring that cognitive preferences are leveraged as assets rather than limitations in the pursuit of knowledge.

Key Words: Cognitive Preferences; Scientific Achievement; Cognitive Styles

Introduction

In recent years, an important characteristic of the new science curricula has seen an increased emphasis placed on concept formation, scientific principles, inquiry processes and critical thinking. The implicit in this approach is the assumption that the teacher and the way he deals with the curriculum may influence the students' cognitive styles. Evidences show that every individual differs substantially in his styles of thinking and experience (Heath, 1964; Messick, 1976; Bajah, 1981;

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Sawyer, 1987). It has been noted that study in cognitive styles area are today making considerable impact on science teaching, by revealing how people learn science (Busari,1991; Igwebuike,1991). Research has shown that cognitive style is different from intellectual abilities. According to Messick (1982), dimensions of intellectual ability refer to the content and level of cognition. Meanwhile, it refers to the questions of what? and how? What kind of information is being processed by what operation and in what form and how well? While, cognitive style refers to the manner or form of cognition. Witkin (1977) and Messick (1982) made further distinctions between cognitive styles and intellectual abilities. They all maintained that intellectual abilities are content or domain specific such as verbal or numerical, whereas cognitive styles cut across both ability and personality domains. The concept of cognitive styles is simply associated with the area of psychology known as psychological differentiation. This simply means that differences exist between individuals in relation to their psychological functioning. The two terms, cognitive preference and cognitive styles may be used interchangeably, hence the differences between the two is said to be artificial (Heath, 1964; Tamir, 1977). But, there is a slight difference between the two terminologies. In other words, a choice in each item in which options are provided reflects a cognitive preference, while the emergent dominant preference constitutes a style Heath (1964). Thus, this study investigated the concepts of cognitive preferences, scientific achievement as well as empirical studies conducted in these areas.

Methodology

The study design is qualitative approach which involved the use of documents. A qualitative approach where documents are used. The words used in searching the documents include: cognitive preferences, scientific achievement, cognitive styles, curriculum, cognition and science. The data bases use searching the articles include: ResearchGate; google scholar; Emerald; ProQuest among others. Initially, 55 articles were down loaded and filed in folder. The inclusion and exclusion caret aria were used. First, screening was done where the relevant articles related to this study were sorted and used in this study, whereas, the one irrelevant were not excluded in the study. Finally, 45 articles were found relevant and used the study, while the remaining 10 were discarded. Figure 1 below summarized the methodological flow.

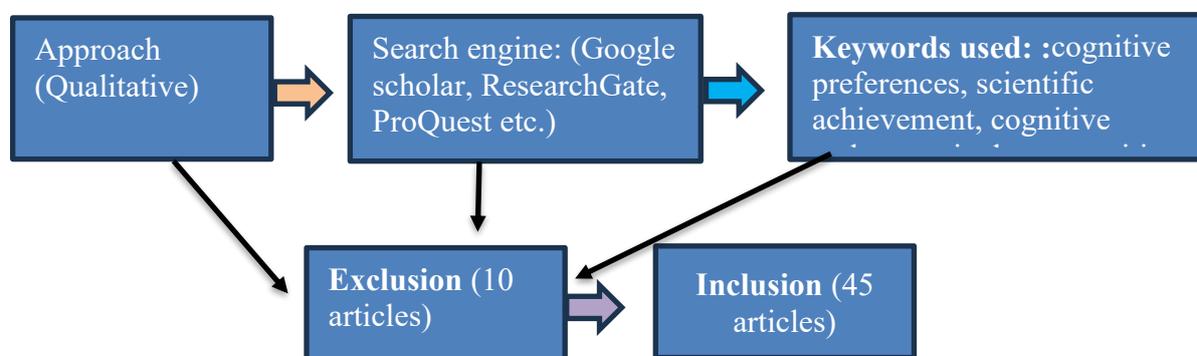


Figure 1. The methodological flow.

Conceptual Definition of Cognitive Preferences

Heath (1964) defined cognitive preference as the internal unseen mode of an individual that leads to exhibiting the cognitive styles which can be seen externally while; Massick (1976) defined cognitive style as a consistent way a person has of organising and processing information and experience. Witkin (1977) also defined cognitive style as characteristics and consistent mode of processing information, constructing relationship and solving problems. But Reissman (1966) was one of the first to emphasise the importance of cognitive styles. He traced that each individual has a distinct style of learning in much the same way that each individual has a distinct personality. Reissman (1966) believed that differences in cognitive styles reflect differences in personality; He mentioned that cognitive styles are developed early in life as a result of a combination of predisposition and environmental experiences. Witkin (1977) stated that the relationship between one's cognitive style and one's subject interest serve as a guidance tool for the students and counsellors, who assist students in selecting suitable career choices. In Nigeria, the definition of cognitive style has also been preferred among which are: Shuaibu and Ogunsola (1982) defined cognitive style in science as the mode of presentation of scientific information which



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the individual student would find easy to remember. Omoifo (1986) also defined it as individual preferences or tasks. This suggested that “modes” primarily are regarded as preference while the “body” preference which is the characteristics of an individual is referred to Style. From the above definitions, the most important thing to note is that they all stressed the way and manner individual processed information. But all these definitions and differences in cognitive styles and intellectual abilities have limited educational value unless and until they can be integrated with the science teaching education programmed to improve teaching-learning processes. Secondary school education at senior level in science education has witnessed a lot of curricula development activities. Universities and colleges complain about insufficient science entrant and blamed the secondary school teachers. The pressure on secondary schools offering is justified by the notion that science secondary student’ cognitive traits have certain educational implications to the present day school curriculum; the fact is that no matter how the school curriculum is designed or developed, it may not be successful without proper implementation. For an effective learning to be achieved the senior secondary school curriculum is expected to reflect the four modes of cognitive preferences (Recall, Application, Principle and Questioning) because a student who is said to have one mode of cognitive preference does not mean that he does not possess the other modes (Tamir, 1982). It has been suggested by Muhammad and Hano (2012) that, Government should consider all secondary schools in the designing and developing secondary school curriculum, and enough instructional materials should be provided to enhance learning. Heath (1964) was the founder of cognitive preference, He defined cognitive preference as the internal unseen mode of an individual that leads to exhibiting the cognitive styles which can be seen externally while; Witkin (1977) on the other hand, defined cognitive style as characteristics and consistent mode of processing information, constructing relationship and solving problems. Muhammad (2009) traced the four classes of cognitive preferences postulated by Heath 1964 which Heath called them “Four cognitive preferences fields”. These four modes of attending to scientific information are:- **Recall (R)**: This is a mode in which students merely remember facts or statements associated with a topic without questioning and not bothered about application; **Principles (P)**: It is a mode whereby students are interested in the basic upon which such facts are built i.e. principles involved in the topic; **Applications (A)**: In this mode, the students show interest in the usefulness of the topic being presented to them, and a preference for scientific information in view of its emotional applicability in a general social or scientific context; **Critical Questioning (Q)**: This is a mode by which learner is expected to choose his goal, work out strategies for the attainment of goal, manipulate and control his environment. Questioning is a preference for critical questioning or criticism of scientific information as regards to its completeness, general validity or limitation. Apart from Heath (1964) the cognitive preferences have been recognised by other researchers such as Kampa and Dube (1973), Tamir (1978), Jungwirth (1980), Messeng (1980), Ogunsola and Shuaibu (1983), Abah and Jegede (1990), Wasagu (1991), Muhammad (2009), Mckay and Alwi (2011), Novak (2009), Reuven and Palaniappan (2010) and Zhidong (2013) among others. The available literature on Cognitive Preferences and Scientific achievement is reviewed under the following headings: A review of cognitive preferences and scientific achievement; A review of cognitive styles and Academic achievement

Empirical Studies on Cognitive Preferences

In addition, the word cognition refers to the mental process in the brain used to gain knowledge and comprehension of the outside world (Gibbs 2009), while, cognitive preference is an internal unseen mode of individual that lead to existing cognitive styles which can be seen externally (Heath 1964), in other words Witkin (1976) considered cognitive preferences as intellectual style of an individual upon the presentation of a cue with several responses available that refer to specific mental choices, this choices are the Recall (R); Application (A); Principle (P) and Questioning (Q) as proposed by (Heath 1964). Novak (2009) suggest that conative preferences and the implications that come from the dominance of single style in society reach far beyond simple schooling and fairness in academia. Cognitive preferences was first investigated by Heath (1964) and validated by Tamir (1988). However, in recent years cognitive preference was investigated by different researchers such as Wasagu (1999); Bachi and Udi (1990); Abah and Jegede (1990); Lim (2008); Muhammad and Hano (2011) Novak (2009); Muhammad (2010); Reuven and Anton ;(2010); Caesar and Reuven (2010); Muhammad and Mckay (2011); Mckay and Alwi (2011) and Zhidong (2013) among others. Cognitive preference is one of the aspects of cognitive styles that has been investigated over 50 years and considered as one of the significant aspects on science teaching and learning. Cognitive preference was known in science education research since 1960 because of the logical connection between the designing and development of science and curriculum projects. Cognitive Preference was studied mainly in relation to the learning science where they refers to the modes used by dealing with scientific information (Tamir 1981),



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the available literature justified this as all the reviewed literatures were on sciences, research on cognitive preferences has been investigated over decades; cognitive preference in individual has been a topic of interest for researchers when explaining the complexity of effective human computer interaction (Alwi 2011). Bachi (nd) noted that there is an ardent need to revamp the existing educational programmes and suitably modify conditions which are known to alter or influence cognitive preferences to certain leaning styles. Evidences show that every individual differs substantially in their styles of thinking and experience (Heath, 1964; Messick, 1976; Bajah, 1981). It has been noted that studies in cognitive styles area are today making considerable impact on science teaching, by revealing how pupils learn science (Busari, 1991; Igwebuike, 1991). Ogunsola (1980) traced out that at the start of the experiment subjects, cognitive preferences were comparable to another pre-degrees students in Ahmadu Bello University, Zaria Nigeria and the order of preferences are as follows:

R \Rightarrow P \Rightarrow Q \Rightarrow A in the ratio: 1.57:1, 37:1, 2:1.

When all sub-groups were set aside Eⁱⁱ and Cⁱⁱ groups without the pre-test were compared significant. Mann Whitney U-values were obtained at P<0.05. There was a statistically significant gain on Q suggesting that the treatment had the desired effect for this sub-group and that the pre-test may be counterproductive in this case. The study also shows a statistically significant gain in questioning, which was the experimental target. But there was a statistically significant drop in application. It is noteworthy that there was a gain in R and a loss in P although these gains were not statistically significant. This result confirms indirectly the orthogonal relationships between R-Q and P-A which was proposed by Tamir and Kempa (1978) and suggests the possibility of shifting student's cognitive styles from predominantly Recall (R) to Questioning (Q), using an appropriate instructional strategy. In another hand, Wasagu (1991) revealed that: generally, there was no significant difference between boys and girls when a cultural belief was correlated with gender and cognitive preference versus gender; there were about the same number of males and females in terms of proportion who were found to be high achievers; and a significant difference was established between age of students and cognitive preferences. These findings do not support the works of Abah and Jegede (1990) because they had noted a significant difference between ages of students and their cognitive preference; consequently, Tamir and Lunetta (1978) conducted a study titled "cognitive preference in Biology of a group of talented high school students". They found that there were high preferences for 'Q' and low preferences for 'R'. This preference pattern represents a very high level of intellectual curiosity and a desire to learn science more. And there was a lack of distinct relationship between cognitive preference and some of the background variables (i.e. gender, religion and hobby) which was attributed to the homogeneity of the sample. Most of the earlier researches concentrated on identifying cognitive preference or cognitive styles of students in Biology, Chemistry, Physics computer science and Agriculture. The cognitive preferences and problem solving in Chemistry, an attempt to shift students' cognitive styles through teaching and cognitive preferences and creativity on the other hand have been similarly investigated. But little has been reported about cognitive preference in relation to science in general and cognitive preferences and scientific achievement and only few researchers relate their findings with curriculum development. Hunt etal (1989) demonstrated that individuals learn more effectively from teaching methods which are consistent with their modes of thinking. However, in the typical classroom situation, where the didactic approach is commonly used, it will be impracticable to teach individual students according to their cognitive styles. There is nothing to suggest but, in a mass education supported system, an individual cognitive style is the most desirable. If the students can be assisted through teaching to shift their cognitive style in the desired directions they will learn more effectively (Okebukola 1988; Ogunsola, 1980). Okebukola (1985) in particular reported significant differences in cognitive styles between successful and less successful science students in Nigeria.

These efforts of classification however, have limited educational value unless and until they can be integrated with the teacher education programmed and curriculum development to improve the teaching learning processes, and effective learning to be achieved the junior secondary school curriculum is expected to reflect the four modes of cognitive preferences (Recall, Application, Principle and Questioning) because a student who is said to have one mode of cognitive preference does not mean that he does not possess the other modes (Tamir, 1982). The educational concern is how the teacher might shift students' cognitive styles from one mode to another, in this case from Recall (R) -----> Questioning The potency of the defining issue-discussion approach has been well demonstrated, Rest (1974) pioneered on approach to changing the moral judgment of individuals in a desired direction using the Defining Issue Approach (DIA) students were presented with dilemma stories involving moral issues. The issues were discussed in the open among colleagues. Individual



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opinions and judgments were sought through discussion. It was hoped that the individual's judgment may be improved along the development stages proposed by Kohlberg (1963). The criterion test was a Defining Issue Test (DIT). The original DIT consisted of six hypothetical stories involving crucial moral issues. The test was a recognition task which enabled the subjects to rank four issue statements from a set of 12; each which was written to exemplify the characteristics of one of Kohlberg's stages of moral development, the approach has been widely used in several countries with a remarkable amount of results (Rest, 1974 and Okatahi 1984). The theories of Piaget, Bruner and Gagne have had a major impact on primary science and e integrated science and senior secondary school curriculum development. The theories have implications for what is to be taught, how it should be taught and the consequence in which it should be taught. According to Piaget (1930) children develop their intellect in a sequence of stages from neonatal to infancy to post adolescence. All children may have the same sequence of stages but, the rate at which a particular child passes through these stages is greatly influenced by nature and nurture. Piaget (1929) revealed four (4) stages of intellectual development are:

1. Sensorimotor stage (0-2 yrs.) the key features of this stage are: object permanence
2. Pre operational stage (2-7 yrs.), with Egocentrism feature
3. Concrete Operational stage (7-11 yrs.) the key feature is Conservation
4. Formal Operational stage (11/12 yrs. +) Manipulate ideas in head, (e.g. Abstract and Reasoning).

According to Eboy and Mulner (2014) Each stage of development has approximate age, the sensorimotor stage is between 0 to two years of age, Preoperational stage from two to seven years of age; Concrete operational seven to eleven years while, Formal Operational stage is eleven years to Adult, this study titled Cognitive preferences and scientific achievement among science secondary school students of form six students will used Formal Operational stage because the students may fall at the age ranges of 18-21. According to Piaget a child's cognitive development is about a child developing or constructing a mental model of the world. This indicated that His interest is on children and concern in what they learn and how they thought in a different ways. Zimbardo (1985) mentioned that Jean Piaget devoted much of his life to studying children's cognitive development- the way mental process such as thinking, reasoning and perceiving the word. Despite all his effort, Piaget was criticized that he ignored cognitive development after adolescence and failed to consider the developmental stages beyond formal operational stage, one of the critics is Koplowiz (1990) who said there should have been another stage after Formal Operational stage; this stage called it a stage of unitary operation.

Burner's theory noted that any subject or topic can be taught effectively in some forms to any child at any stage of development, when teaching science, which contradicted Piaget's view, it is necessary to help the child to pass progressively from one stage of intellectual development to the next by probing the child with challenges and opportunities which can help the child forge ahead into the next stages of development. According to Burner, science programmes or curriculum needs to be built around major conceptual schemes, skills and values of societal importance. It is recommended by Burner that a child in the elementary school should be encouraged to learn through discovery. On the other hand, Gagne is concerned with successful teaching and learning of inquiry which is a vital goal of science education. Gagne noted that science instructions to a child should be in a certain kind of skills which include number computation, spatial and manipulative skills. The skills of observing, describing, classifying, measuring, inferring and model conceptualising are also expected to be included. Task analysis is aimed at analysing complex into relatively simple ones. It is through task analysis that a number of intellectual processes like memory storage, search, retrieval, transforming, control of variables and others can be achieved. The self-regulation theory involved an active internal mental process of forming new reasoning pattern which teaches on how to compare new ideas being compared with old ones. It encourages students to get involved in analysing a problem situation considering tentative solutions to problems evaluating effectiveness of such solution proffered and introducing new approaches when such first possible trial solutions fail. One can bring a science instructional technique that embodies much of Piaget's equilibration theory (Renner and Lawson 1973). There are three phases learning cycle was developed and refined by the Science Curriculum Improvement Study (SCIS) of the University of California. The three phase learning cycle is said to have the advantage of:

1. Developing the questioning attitude of the learner of his studies while discouraging
2. The unquestioning acceptance to vaguely understood principles and procedure.
3. Leading a learner from physical action domain to abstract mental operations and hence conceptualisations which are



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formal thought.

In a related development, Wasagu (1991) conducted a study concerned with the relationship between cognitive preference and attitude towards science, among secondary science students. The study revealed that, there was a significant relationship between cognitive preference orientation and attitudes toward science among student in secondary school in Sokoto State. It was indicated in Kalgo (1993) that sex is a more dominant factor than cognitive style or personality differences in the academic achievement of boys and girls, also shown that it is the sex of an individual rather than his or her cognitive style or personality type that determines his or her academic achievement in the subjects used in that study. In recent years, an important characteristic of the new science curricula has seen an increased emphasis placed on concept formation, scientific principles, inquiry processes and critical thinking. The implicit in this approach is the assumption that the teacher and the way he deals with the curriculum may influence the students' cognitive styles unrelated to intelligence, and there is the need for the science teachers to note all the four cognitive preferences of the students and relate them to their teaching strategy in order to improve learning efficiency. There is the need to have knowledge of the relationship between the cognitive demand of a subject matter and a learner's level of development. A teaching strategy can be frustrating, interesting, challenging or meaningless to a child depending on the cognitive competences of the child.

From research findings, most secondary school students operate at the concrete operational stage Akanbi (1988). Piaget explains this stage as children develop the ability to use logic and stop relying so heavily on simple sensory information to understand the nature of things. In other words, they acquire the capacity to perform mental operation silently in their heads. Piaget called these skills concrete operations. As children depend on reason to solve problems, their resourcefulness in categorising and classifying objects expands appearance differs from reality; one is temporary, while the other is permanent. In the identification of knowledge by Piaget, physical knowledge refers to knowledge of object specific properties that can be observed and gained directly from internal reality, that is to say recall and application cognitive preferences. The logical-arithmetical knowledge, that is to say principle involves relationships introduced among objects, social knowledge are facts and truths which are firmly noted in the norms and values of the people among whom is even a child. The socio culturalist perspective recognises emphasis on the socially and culturally situated nature of their science, technology or mathematical activity. The process of learning is primarily one of the social constructions, Drive (1994). In other words, the socio culturalist concern lies in helping students to view the scientific disciplines as social disciplines in groups of people functioning together by virtue of sacred cultural practices (Wasagu, 1998). A child from primary school entering into a junior secondary school is assumed to have acquired a personal initiative through elementary understanding of what science is. Primary science is one of the subjects being taught at the primary education level. A primary school leaver may be familiar with a few principles of primary science which have been arrived through personal experiences. Students learn through their own actions in a new situation. Students can explore new materials and new ideas with minimum guidance or exception of specific accomplishment which can also be effectively done in a laboratory set up, Karpus, (1977). Learner's questions arising before a teacher, due to new experiences acquired by such learners. Learners' exploration and invention of knowledge acquisition can be applied to new reasoning patterns to additional examples, new situations and greater challenges leading learners to a discovery stage in integrated science. Mark (1967) was the first to join Heath who modelled his study as "cognitive preference test in high school chemistry". It was based upon Heath test, and using the same approach as Heath compared the scores of students in the Chemical Bond Approach (CBA) chemistry courses. He also demonstrated similar differences on the CPT scales between CBA and control a group of students as Heath did between the two physics groups. Mark (1967) showed that cognitive preferences were unrelated to ability.

In a related development, Kempa and Dube (1973) carried out study in Norwich in order to determine science based cognitive preference orientation in students, subsequent to the study of chemistry at the general certificate in education (ordinary level). In their study 40 items chemistry based cognitive preference test was developed and administered to the 284 undergraduate students. The subject content of the instrument corresponded closely to that of current 'O'-level chemistry curricular. Result from the study showed that the cognitive styles of different ability groups contrast markedly. They reported that higher achievers tended to exhibit a high degree of scientific information learned distinctively towards the pure science scale. Low achievers lacked scientific curiosity and accepted science primarily because of the uses that may be derived from it rather than because of its intrinsic values as a field of intellectual enquiry. Tamir and Lunetta (1978)



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conducted a study titled “cognitive preference in Biology of a group of talented high school students”. In their study, they examined the effects of secondary science curricular and other variables on the cognitive preference of talented students. 40-items biology cognitive preference test, designed and validated by Tamir (1978) was administered to 177 science oriented high school students throughout the United States. However, the responses of extension statement for each item were all correct. Tamir and Lunetta (1978) found that there were high preferences for ‘Q’ and low preferences for ‘R’, this preference pattern represents a very high level of intellectual curiosity and a desire to learn more, and there was a lack of distinct relationship between cognitive preference and some of the background variable (i.e. gender, religion and hobby) which was attributed to the homogeneity of the sample, they also found that both readers and frequent readers of scientific literature differed from a middle group of readers but were not significantly different from each other in cognitive preference; no statistical significant differences were observed in cognitive preference among groups of the sample divided according to gender, hobby and religion; they also showed that there were no statistically significant differences between ipsative and normative sub tests. Tamir and Lunetta (1978) concluded that both ipsative and normative procedures gave the same ranks orderly mean-score. Because, the interrelations between (R, A, P and Q) were all positive with the exception of one (Application) which was moderate and statistically significant. In a related development,

Naught (1982) conducted a study to find out the relationship between cognitive preference and pattern of achievement in chemistry for grade 12 students in Australia. Naught (1982) used the four different cognitive preferences postulated by Heath (1964). His data were analysed by using both modified R-technique factor analysis and the multidimensional unfolding technique. The results of his study were consistent with the following two general propositions: Students who develop the cognitive preference consistent with those implied or stressed by the high school certificate chemistry course tend to perform better in an end-of-course achievement examination than the students whose cognitive preference are not consistent with those implied preference. Higher cognitive preference for a particular preference is positively correlated with performance on the shorts of cognitive tasks implied in that preference. In a related development, Tamir and Kempa (1978) carried out a study “cognitive preference styles across Three Science Disciplines”. The four cognitive preference originally suggested by Heath (1964) were used in their study. Three cognitive tests, in physics, chemistry and biology which has been designed and validated in the University of East Anglia under the supervision of Kempa were translated into Hebrew with some modifications. Each of the three tests comprised of 20 items. The tests were administered to length grade students. Tamir and Kempa (1978) found that the length grade students possess a general cognitive preference style in science which cuts across the three major disciplines namely; physics, chemistry and biology; yet this general style does not account for all of the variance, and the specific cognitive preference patterns, which differ from each other, exist to each of the three-science discipline. This difference however, is similar between the physical science disciplines: physics and chemistry, relative to the difference between each of them and biology, The results revealed that all subjects showed higher preferences for recall and principles, than application and questioning; there was a tendency to prefer more ‘R’ than other styles in chemistry and tendency to prefer more “P” than other styles in biology; CESAC students pattern of cognitive style did not differ significantly from the pattern of non CESAC students; and the effect of the curriculum material on the pattern of students’ cognitive styles appeared to be minimal.

In a related development, Ogunsola (1981) examined all school of basic studies, Ahamadu Bello University Zaria, fresh students in chemistry department admitted in the 1981/82 session responses to stimuli in the forms of chemistry questions collected from SBS entrance examination over the year. He found that: More male students showed greater preferences for principle than female students who showed greater preferences for recall, application and questioning. Most students who schooled in the South showed greater preferences for principles than those who schooled in the North, who showed greater preferences for recall, application and questioning. Joe (1983) carried an exploratory study of some Nigerian students’ cognitive preference in biology. The study was done in River State Nigeria, with 180 form five students drawn from six schools. The result showed that on the average, the students had a high linking for principles preference followed by recall, application and questioning. It also showed that the least preferred mode among the researched was questioning. Equally, sex and anticipated career did not significantly correlate with all four cognitive preferences. There is no much difference from the above study with that of Ogunsola (1981). It can be also noted that while Recall (R) is the most preferred mode, Principle (P) is the most preferred in Joe (1983) otherwise, everything is the same. Abah and Jegede (1990)



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carried out a study on a comparison of the cognitive preferences of science students at three hundred level of education in Zaria. Their instruments which were used to measure the subjects are cognitive preference test in physics (CPTP), cognitive preferences test in chemistry (CPTC) and cognitive preference test in biology, (CPTB) respectively, the instrument consist of 20 items each. Abah and Jegede (1990), revealed the following results: Secondary school students showed the highest preference for questioning followed by undergraduate students, with school of basic studies students showing the lowest preference for questioning; school of basic studies students showed the highest preference for principles, followed by undergraduate students with secondary school students showing the lowest preference for principles; of the three samples undergraduate students showed the highest preference for Recall in two tests (Biology and Chemistry); the school of Basic studies students showed the highest preference for Recall in one test (the chemistry test); secondary school students did not show the highest preference for Recall in any test instead exhibited the lowest preference for Recall in two tests (the Biology and Chemistry tests). The above findings showed that Recall mode is still the most dominant preferred mode among the Nigerian students at almost all levels of education (i.e. primary, secondary and tertiary institutions). The poor achievement in the science among youth presently in Nigeria might have been caused by the Nigerian students mode of preferences at all levels of education. The curriculum progress will very much depend on the extent to which it will succeed in steering the work of different perspectives so that they can contribute in a co-coordinated and co-operative way to the development of new physics curricula and new ways of teaching. According to Lijne, (2007) The curricula that focused on physics as a discipline demands, to be more geared to the less able, and less scientifically interested.

Recently there is growing interest in pursuing research on cognitive preferences as demonstrated by the number of new studies that involve web-mediated instructional environment (Mckay 2011), but the interest should not only be in one subject area because the study of cognitive preference often term as learning styles or thinking styles has become widespread within the field of psychology (Novak 2009). Heath (19664) stressed that cognitive preference and cognitive styles are two different terms, but, may be used interchangeably, hence the differences between them said to be artificial (Tamir 1977). The pedagogical activities are organised around survey and practical work from which observations are made and questions are drawn. More so, from pedagogical aspect, it implied active participation by the pupil in the learning process; use of the experimental method practice of formulating and solving problems. However, through teaching a teacher can make an attempt to shift student's cognitive preference from predominantly Recall (Recall) to Questioning (Q) using Rests Defining Issues Discussion Approach as Ogunshola did. Ogunsola (1994) conducted an exploratory study on how to shift student's cognitive preference. A total of 69 pre-degree students from a college of Agriculture participated in the experimental study. Subjects were assigned randomly to one of the groups in the Solomon 4-way design models, so that $E^i=23$, $E^{ii}=16$, $C^i=19$, $C^{ii}=11$. Treatment consisted of three weeks of specially packaged instruction in A-level chemistry, Tamir and Kempa's cognitive preference test was adapted as the criterion measure. Ogunsola (1994) traced that at the start of the experiment subjects, cognitive styles were comparable to another pre-degrees students in Ahmadu Bello University, Zaria Nigeria and the order of preferences are as follows: R-----> P -----> Q -----> A in the ratio: 1.57:1, 37:1, 2:1. When all sub-groups were set aside E^{ii} and C^{ii} groups without the pre-test were compared significant. Mann Whitney U-values were obtained at $P<0.05$. There was a statistically significant gain on Q suggesting, that the treatment had the desired effect for this sub-group and that the pre-test may be counterproductive in this case, the study also shows a statistically significant gain in questioning, which was the experimental target. But there was a statistically significant drop in application. It is noteworthy that there was a gain in R and a loss in P although these gains were not statistically significant, this result confirms indirectly the orthogonal relationships between R-Q and P-A which was proposed by Tamir and Kempa (1978) and suggests the possibility of shifting students cognitive styles from predominantly recall to questioning, using an appropriate instructional strategy.

It was revealed by Wasagu (1988) that there was no significance difference between boys and girls when cultural belief was correlated with gender and cognitive preference, but, gender was found to be important for recall and critical questioning this was also indicated by Bachi (nd), Muhammad (2009) in contrast Hyde (2005) found that female and female were found similar in their cognitive skills. Naught (1982) conducted a research on cognitive preferences using Heath model, the statistical method used was R-technique factor analysis. His study shows that students who develop cognitive preference with those implied stressed by the higher school certificate chemistry course tends to perform better in an end



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course achievement examination than the students whose cognitive preferences are not consistent with those implied preference. These differences in cognitive preferences exist not only among students but within the teachers because, a study was conducted by Bachi and Uddin (1990) compared how cognitive preference differs in groups of secondary school teachers identified by type of curriculum taught, gender and length, the combined cognitive preference inventory compiled by Pincha Tamir was applied to 1003 teachers, their study revealed that with few exceptions, the overall pattern of cognitive preference that emerged for all groups is recall-principle, application-questioning. But, they did not link the implications of their findings to teaching and learning, therefore a research that will find the cognitive preference and scientific achievement with its implication to curriculum development is needed. Recently, Hau et al (2013) found that; Quick Response (QR) code was mainly used as a speed and ready access to multimedia contents such as a speedy and ready access to multimedia content such as web site, data bases, audio and video files, questions and answer text and so forth; and most of the research topics covered in the previous studies involving the adequacy of QR code as an enable in various types of instructional approaches, instructional approaches covered included, experimental learning, collaborative learning, discovery learning, Science Technology Society approach and so forth.

It was reported by Mackar and Alwi (2011) that cognitive preference in individuals has been a topic of interest for researcher when explaining the complexities of effective human-computer interaction, they also found that there are interactive effectiveness and exhibits display format on quality of the resulting human computer interactions (HCL), this was supported by Smith (2008) who stressed that over the past 30 years, a body of scholarly research has accumulated within the learning literature, involving computer-mediated instructions (CMI) that address several cognitive psychological characteristics which are linked to broader concept either an individualistic or a social/cooperative learning styles: thus by examining what students were learning about scientific investigations, the research found that the students experienced curriculum appeared to be focused on narrow view of scientific inquiry as far testing and acquiring assessment technique (Hume and Coll 2009). Novak (2009) seek to found the cognitive preference and ethnic identity among Angola and Native Americans high school students. The findings of their study indicated that Angola and Native Americans have statistically different cognitive preferences and those preferences were correlated with their ethnic identity. It was indicated that in Nigeria almost all levels of education exhibit Recall (R) mode as their dominant mode (Muhammad 2009). In relation to this another study was conducted by Palaniappan (1998) investigated the cognitive preference and figural creativity among Malaysian undergraduate students, 130 female with age range 23-27 year old enrolled, in the education department of the university of Malaya where the sample, two different instruments were used Tolerance Test and creative thinking (TTCT) and combine cognitive preferences inventory (CCTI). The results revealed that the correlation between recall (R) and Questioning (Q) modes was negative and statistically significant, indicating that the student ranked Recall (R) items highly and gave low rank to Questioning (Q) and vice versa. Also found in the study that student who used the Recall (R) mode of thinking had a low preference for Application modes and vice versa, in most cases, every successful learner learns in different ways on the whole, every student has certain degree of preferences in each type of learning style and majority of the sample have dominance in one or more styles of learning (Zaionol Abidin et al., 2011).

Most of the literature reviewed on cognitive preferences reported that Nigerian students most dominant preferences is (R) recall mode Wasagu (1988) this findings was supported by Bachi (1990), Muhammad (2008), Abah and Jegede (1990), Ogunshola (1994) But, did not support the results of Joe (1983) and Reuven and Caesar (2010) who their results analysis of biology cognitive instrument shows that (p) principle was the most preferred mode by students and teachers followed by q questioning mode while, recall (R) and application (A) were the lowest preferred modes, in the same vein, Tamir and Lunetta (1978) found that there were high preferences for Q questioning and low preference for recall (R). The study of cognitive preference often termed learning styles or thinking styles has become widespread within the field of psychology (Novak 2009). The implications of these insights are particularly important for educational institutions (Moore 2002). In line with this, Tamir (1975) traced three major elements of cognitive styles, first a general characteristics of the individuals; second a broad discipline-related element, which was up to now reflected mostly in the natural sciences and the last is a specific subject matter area Bachi and Uddin (1990) did in their study titled: A study on cognitive preference of science secondary school teachers in India, where they compared how cognitive preference differs in groups of secondary school teachers identified by different curriculum taught, gender, length of teaching experience and educational qualifications, the



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results show that with few exceptions the overall pattern of cognitive preferences that emerged for all the groups is Recall-Principles, Application-Questioning. While, Inbar (1995) conducted his own in School Principal. His study is titled Cognitive Preferences of secondary school principals. The results of the study indicated that Relating and recalling information without considering its implications; relating to its practical application: posing critical questions about the information's validity; and relating to information according to the fundamental principles, he also found that school administrators were found to be different in their cognitive preferences as function of individual differences and different roles of school administration. Gibbs (2009) is of the view that thousands of studies have exploited gender difference in cognitive skills, male and female are similar on most and gender gap in math-related skills fluctuate based on the type of skills assessed and period observed, but, not all in psychological variables including cognitive skills (Hyde 2005), a study was conducted by Zhangy etal (2011) on identifying cognitive preferences for attractive female faces: an event related potential experiment using a study-test paradigm. 14 hetro sexual participant (age range 18-24 years, means average 21.67 years) were used to judge 84 attractive and 84 unattractive face images as either "attractive" or "unattractive". They were then asked to whether they had previously viewed each face in a recognition test in which 50% of the images were novel. The results of the findings revealed that, attractive female faces arouse more intense positive emotions in participants than do unattractive face, and they also represent reproductive fitness and mating value from the evolutionary perspectives.

It is obvious that cognitive preference make an impact on the students overall achievement, as mentioned by Novak (2009) that understanding cognitive preference aids the individual in better understanding history as well as the forces that help to shape the constellation of each culture, however there is the need to evaluate the learners performance which could serve as an important criterion for determining the success of curriculum (Muhammad 2009). Must of the researchers concentrated on cognitive preference were on one subject area (Biology, Chemistry, Physics Computer Science and Agriculture), of students and cognitive preference very few investigated cognitive preference science secondary schools, effects of ones age on cognitive preference, implication of the findings to curriculum development or teaching and learning, and they concentrated on either form four or five students, therefore, this study will fill this gap.

The summary the chronological areas researched based on the available literature on cognitive preference can be seen in the table below:

Name and Year	Area of Research
Heath, R.W., (1964)	"Curriculum cognition and educational measurement"
Marks L.H., (1967)	"CBS higher school chemistry and concept formation"
Dube, G.E., (1971)	"Cognitive Preference and interest of Chemistry Student in Secondary school"
Kempa, R.F and Dube, G.E (1973)	"Cognitive Preference Orientation in Students Chemistry"
Rogel, M., (1974)	"Achievement and Cognitive Preference Studies of Chemistry Students"
Tamir, P., (1974)	"Cognitive Preference and Achievement"
Tamir, P., (1975)	"A note on Cognitive Preference in schools"
Brown, S.A., (1975)	"Cognitive Preference in Science their nature and analysis"
Tamir, P, and Lunetta, V.F. (1978)	"Cognitive Preference in Biology of group talented high school students"
Tamir, P, and Lunetta, V.F. (1978)	"Cognitive Preference. Across Discipline"
Tamir, P.,(1979)	"The Relationship Among Cognitive Preference School Environment, teachers Curriculum via and Submitters"
Jungwirth, E. (1980)	"Alternative Interpretation of Findings Cognitive Preference"
Messeng, L.Y (1980)	"Cognitive Preference of Malaysia Pre University Students in Chemistry"
Naught, M.C. (1982)	"Relation between Cognitive Preference and Achievement in Chemistry"
Joe, A.J. (1983)	"An exploratory study of Nigerian Students Cognitive Preferences in Biology"
Okebukola, P.A. (1986)	"A study of Relationship between Cognitive Preference and learning mode as determinant of meaningful learning through concept mapping"



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Tamir, P., (1988)	“The Relationship between Cognitive Preference Students background and Achievement in Science”
Akanbi, T. (1988)	“Cognitive Preference Instructional modes and Cognitive Development level and Achievement in Chemistry”
Abah, C.O.& Jegede, O.J. (1990)	“A Comparison of Cognitive Preference of science students at 3 levels of Education”
Wasagu, M.A. (1990)	“Attitude toward science schools as correlated with cognitive preference orientation”
Bachi, J.P. and Uddin, H. (1990)	“Cognitive Preference of Science Secondary School Teachers in India”
Wasagu, M.A. (1991)	“A study of Relationship between Cognitive Preference and attitudes towards Science”
In bar, D.E. (1995)	“The Cognitive Preference of school Principals”
Wasagu, M.A. (1998)	“Cultural belief Cognitive Preference and Achievement in Science”
Lim, K.C. (2008)	“The Cognitive Preference and ethnic Identity among Angola and native American high school students”
Novak, C.M. (2009)	Cognitive Preference and Ethnic Identity among Angola and Native American in high school students”
Muhammad, T. (2009)	“Integrated Science Cognitive Preference of Junior secondary school students”
Palaniappan, A.K. (2010)	“Figural Creativity and Cognitive Preference among Malaysian Undergraduate Students”
Caesar, A, and Reuven, L.B. (2010)	“Cognitive Preference and Critical Thinking skill of 11 Grade Biology Students”
Zhang, Y. etal. (2011)	“Identifying Cognitive Preference for Attractive Faces”
Muhammad, T.& Hano, J.L. (2011)	“Comparison of science and Non-science junior secondary school cognitive preference”
Mohammad, M. & Mckay, E. (2011)	“The effect of Cognitive Preferences and Prior knowledge on web mediated instruction”
Zhidong, D.Z (2013)	“Human gender and differences in Cognitive Preference towards attractive Faces”
Alwi, (nd)	“Attractive effects Between Cognitive Preference and Instructional strategies in Museum learning”

Discussion of Findings

A review of Cognitive Preference, cognitive styles, scientific achievement and their implications for curriculum development were conducted and reported from the available literatures, cognitive style and Cognitive Preference are considered as important factors in students’ achievement. It was reported that Cognitive Preference aids individual in better understanding of scientific concepts, history as well as the forces that help to shape the constellation of each culture. It was indicated from the literature that Cognitive Preference and Cognitive styles were originated from two terms “cognition” and “style” (Gibbs 2009, and Sternberg etal 2014). These learning and thinking styles (Cognitive Preference and Cognitive Styles) differences exist among male and female as investigated by (Tamir 1988, Wasagu 1998, Ogunshola 1984, Abah and Jegede 1999, Muhammad 2009, Moore 2002, McCabe 2014, Zhidong 2013, Shojoe and Leila 2013, Hyde 2005) among others. The concept of learning styles describes individual differences in learning based on the learner’s preference for employing differences of the learning cycle (McCabe 2014). From the literature Cognitive styles was described as an individual differences in approaches to tasks that can make a difference in the way which potentially in the efficiency with which a person perceive, learns or think (Andrew Bock 2001). While on the other hand it shows that Cognitive styles is refers to preferences for information processing or how knowledge is received and organised (Witkin 1977, Reissman 1966, Ogunshola 1988, Ahmad zade and Shojoe 2013).



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It was pointed out by Tamir (1981) that Cognitive Preference constitute a kind of Cognitive style which deal with attributes of special relevance to learning, is an internal unseen mode of individual that leads to exhibiting the cognitive styles which can be seen externally (Hath 1964). Cognitive Preference was in existing since 1960s, and from the literature it was indicated that Cognitive Preference was originally constructed by Heath 1964, who stated that, as we study Cognitive Preference our interest is not on whether student can identify correct or in correct information, but rather what he or she is likely to do with information intellectually, Heath (1964) Modes are: Recall (R), Application (A), Principle (P) and Questioning (Q). Cognitive Preference was studied mainly in relation to the learning science where they refers to the modes used by dealing with scientific information (Tamir 1981), evidences from the reviewed literature supported this because all the researches on Cognitive Preference were in in science disciplines (Biology, Physics, Chemistry, Computer science and Agriculture). However, from the literature it shows that different psychological theories point out that individual differs in their development, Piaget for example pinpoints four stages of development which are: Sensorimotor 0-2, Preoperational stage 2-7 years, Concrete operational stage 7-11 years and Formal operational stage 11/12+ years. From this it shows that this study would use Formal operational stage since it will investigate Form six students who are at the age ranges between 18-21 years old. Finally, evidences from the literature indicated that cognitive styles/learning styles, cognitive preferences and scientific achievement has been investigated from different parts of the world among which are: United States (e.g., Rudolph 200, Novak 2009 & McCabe 2014), Saudi Arabia (e.g., Nuzhat etal 2013), Jordan (e.g. Alhajiya and Khreshheh 2012), Australia (e.g. Pithers 2002 & McKay and Alwi 2011), Iran (Zade and Shojoe 2013), Israel (e.g. Tamir 1976, Tamir 1988, Inbar 1995, & Caesar and Reuven 2010), Malaysia (e.g. Palaniappan 1998, Zainol Abidin 2011, Messeng 1980, Mohammad and McKay 2011, Lim Kc 002, & Damavandi etal 2011), Ireland (e.g. Moore 2002), India (e.g. Bachi nd & Bachi 1990)), Taiwan (e.g. Chiou 2008), China (e.g. Sternberg 2014 & Shi 2011) and Nigeria (e.g. Okebukola nd Jegede 1988, Wasagu 1990, Wasagu 1991, Muhammad and Hano 2011 and Abah and Jegede 1990) among others.

Conclusion

From the reviewed literature it is clear that both cognitive preference and cognitive styles and Academic achievement were investigate from different countries, but despite all this efforts the research should have focus on the following areas: Most of researchers should have investigated the relationship between of cognitive preferences and scientific achievement, whether cognitive preferences can determines the scientific achievement of students, they should have indicated the implications of their findings to curriculum development and teaching and learning, which this research will try to do; It is obvious that cognitive preference make can make an impact on the students' overall achievement but, most of the researches concentrated on one subject area like Biology, chemistry Agriculture and Computer science, very few investigated cognitive preference and scientific achievement, this is a problem that need investigation frequently; there should have been a study from the literature on cognitive preferences and scientific achievement of form six science students and its implication to curriculum development in Zamfara State, Nigeria; The effects of ones age on cognitive styles were much investigated in cognitive style, but, few on cognitive preference, which this research would investigate; in contrast to the abundance of research on relationship between cognitive preference and Achievement, very few researchers have directly show the relationship between cognitive preference and science scientific achievement, which this study will investigate; many researchers have argue that cognitive preference is an important yard stick which show individual papered way of learning which can be a variable of studying new science curriculum but only few researchers shows the implications of their findings to curriculum development; age as an important determinant of student's achievement, most of the reviewed literature should have use age as one of the variables investigated in the areas cognitive preference and scientific achievement; research on conative styles and cognitive preference mostly carried out on either form four, five, undergraduate, teachers or principals but, there is no researchers conducted on cognitive preference and scientific achievement on Form six (SSIII) student, and from the reviewed literature most of the recent researches investigated cognitive styles/learning styles very few recent research carried out on cognitive preference, though, not in science and senior secondary school level (Form Six students). This study hope to bridge this gap, thus, Government should have created more Girls science secondary school in Zamfara state to close the gap of gender imbalance, as reported from the literature related to the cognitive preferences.

References

- Abah, C. O. & Jegede, O. J. (1990). A Comparison of Cognitive Preference of Science students at 3 levels of Education in Zaria. *Journal of Studies in Education* 1 (1), 33-140.



Qualitative Study on Correlation Between Cognitive Preference Style and ... Tukur, M., Et. al. (2026)

- Akanbi, T. (1988). *Cognitive Preferences, Instructional Modes, Cognitive Development Levels and Achievement in Chemistry*, Unpublished Ph.D. Thesis University of Ilorin, Ilorin.
- Ahmadzaide, L. & Shojoe, M. (2013) Investigating the Relationship between Cognitive Style (Field dependence/Independence and Academic Achievement in Male and Female Students of Behbahn Islamic Azad University. *Journal of life Science*. Biomed, 3 (3), 245
- Alwi, A. (2011). Interactive Effects between Cognitive Preferences and Instructional Strategies in Museum learning Experiences. School of Multimedia Communication and Technology, University of Utara Malaysia, *Sinktok Malaysia*.
- Alhajiya, N, & Al-Khresheh, T. (2012). The effect of Conative, Learning Style-Based Reading Programme on the Achievement of Jordanian Freshmen English Major, *International Education Studies*, 5, (3).
- Adikwu, M.V. (2008). “Curriculum Development in Science Technology and Maths (STM), Education” A key Note Address presented at the 49th Annual Conference of Teachers Association of Nigeria, Yenegoa, Nigeria.
- Akudolu, L.R. (2012). “Emerging Trends in Curriculum Development in Nigeria”. Education in Nigeria: From the Beginning to the Future, Chapter 9. 1-25.
- Nuzhat, A., Sleem, R.O., Alhamdan, N. & Ashor, N. (2013). Gender differences in cognitive styles and Academic performance of medical students in Saudi Arabia, *Medical Teacher*, 35, 78-82
- Asuzu, C.U., (1984). *Problem Solving in Science and Cognitive Categorisation Styles*. Unpublished M.Ed. Dissertation, University of Ibadan, Nigeria
- Bajah, S. T. (1981). Dichotomy of Science and Superstitions Beliefs. Recognition in Science Education for Africa. *Journal of Science Teachers Association of Nigeria*. 21(1) pp.22-37.
- Busari, O. O. (1991). Sustaining Students Interest in Science Cognitive Style and Teacher Variables. *Journal of Science Teacher Association of Nigeria*, 27, (1), pp.7-14.
- Bassy, S.W, Umoren, G & Udida, L.A, (nd). “Cognitive Styles Secondary School Students Attitude and Academic Performance in Chemistry in Akwa Ibom State”, Nigeria. Cross Rivers University of Technology, Nigeria, p 12 & 23.
- Bachi, J.P. (nd). An Investigation into Factors Affecting Cognitive preference styles in Biology Department of Teacher Education Regional Institute of Education Ajmer, India. *Journal of Science and Mathematics Education in S.E. Asia*, xxv (1). 41-55.
- Bachi, J.P, & Uddin, H., (1990). Cognitive Preferences of Secondary School Teachers in India. The example of Uttar Pradesh, *International Review of Education*, 36 (4). 453-467, Kluwer Academic Publishers.
- Bieri, J., (1955). Cognitive Complexity-Simplicity and Predictive behaviour, *Journal of Abnormal and Social Psychology*, 51, 263-268.
- Burrows, T.A., (2008). “A Comparison Study of Cognitive Differences of Attention Deficit/Hyperactivity Disorder subtype to a Clinic Control on the Standard Binet Fifth Edition”. PhD. Thesis, University of Alberta Published Heritage Branch.
- Bock, M.A. (2001). “Dimension of Cognitive Style: Integrating Definition and improving Measurement”. PhD. Thesis, University of Connecticut, p. 13, 14 & 24.
- B/Tudu, S.Y. (1998). *Participation of Muslim women of N/Nigeria in public life with particular reference to Sokoto, Kebbi and Zamfara state from 1960 to date*. Thesis, Department of Islamic studies, Usman Danfodio University, Sokoto, Nigeria.
- Caesar, A, & Reuven, L.B., (2010). “Cognitive Preferences and Critical Thinking Skill of 11th Grade Biology Students”. Paper presented at EAPRIL International Conference on Challenges in Professional Learning Across the Disciplines Libon, Portugal, 24-26.
- Chiou, W. (2008). *College Students’ Role Models, Learning Styles Preferences and Academic Achievement in Collaborative Teaching, Absolute versus Relativistic Thinking. Adolescence*. 143 (169). 137 & 139. Liberal Publishers.
- Driver, R. et al (1994). Constructing Scientific Knowledge in the Classroom Educational Researcher. 23(7) pp.5-12.
- Dube, G. E. (1971). *Cognitive Preferences and Interest of Chemistry Students in Secondary Schools*. Master’s Thesis, University of East Anglia.



- Qualitative Study on Correlation Between Cognitive Preference Style and ...* Tukur, M., Et. al. (2026)
- Dalhatu, S. (2013). Girl Child Education: The Challenges and a Road Map to the Attainment of a Qualitative Education in Nigeria. *Kabai Journal of Multidisciplinary Studies*. 1(1). 25-32.
- Dragon, K. (2009). "Field Dependence and Field Independent Student Achievement in Technology based Learning: A Meta-Analysis". A Thesis Submitted to the Faculty of Graduate Studies and Research in Partial Fulfilment of the Requirements for the Degree of Masters of Education, Heritage Branch, P 2-6.
- Davis, L.W.. (2012). "A Comparison of Learning Styles and Academic Performance of Students Enrolled in Introductory Poultry Science in Bachelors of Science and Association of Applied Science Programme". A Thesis Submitted to the Graduate Faculty of North Carolina State University. In partial Fulfilment of the Requirements for the degree of Masters of Science. P 25-33.
- Damavandi, A.J, Muhyuddin, R, Habibah, E.O, Muhammad, D, S, & Shabani, J. (2011). Academic Achievement of Students with Different Learning Styles, *International Journal of Psychological Studies*, 3, (2), 186.
- Dunn, R, Dunn, K, & Price, G.E., (1989). Learning Styles Inventory, Lawrence, KS: Price Systems.
- Easke, B., & Black, K.N. (1971). Conceptual Tempo in Young grade School Children. *Child Development*, 42, 505-516.
- Eboy, D.W. & Mulner, L.J. (2014), Marching Traffic Safety Strategies to Youth Characteristics: A Literature Review of Cognitive Development Transportation Research Institute. 78 & 79. Retrieved from www.nhtsa.gov/people/injury/research/jouthcharacteristics.November, 2014.
- Ehinderu, O. (1986). The School and Curriculum Evaluation in Nigeria, Ibadan, Text Flow Ltd. Federal Republic of Nigeria, (2004) National Policy on Education, Revised Edition. Lagos, NERDC.
- Fafunwa, B. (1974). History of Education in Nigeria, London: Geoge Allen and Union.
- Felder, R, M., & Sporlin, J.E. (2005). Application, Reliability and Validity of the index of Learning Styles. *Intl. J. Engr. Education*, 2, (1), 103-112.
- Gowers, A. (2007). "Gender differences in Children and Adults in Cognitive Styles, Academic Visual Motor, Emotional and Behavioural Functioning in Clinic Referred Population". A Thesis Submitted to the Faculty of Graduate Studies and Research in Partial Fulfilment of the Requirements for the Degree of Masters of Education in Counselling Psychology, P 26.
- Gould, T.E. & Caswell, S.V. (2006). Stylistic Learning Differences Between Underground Athletic Training Students and Education, Gregore Mind Styles, *Journal of Athletic Training*, 41 (1), 109-106.
- Gusau, A.M., Etal (2013). Public Perception on Muslim Female Education in Zamfara State, Nigeria. *Kabai Journal of Multidisciplinary Studies*. (1) 189-203.
- Gardner, R. (1965). Cognitive Styles in Categorising Behaviour, *Journal of Personality*. 22 (2) 214-233.
- Gibbs, B.G., (2009). "Gender and Cognitive Skills throughout childhood" PhD Dissertation Ohio State University. 9 & 100.
- Heath, R. W. (1964). Curriculum Cognition and Educational Measurement. *Educational and psychological Measurement*. Vol.21, 235-253.
- Hau, G.B., Siraj, S., Alias, N., Abdu Rauf, R.A., Zakari, A.R., & Darusalam, G. (2013). Research and trends in the Field of Technology-Enhanced Learning from 2006-2011. Content Analysis of Quick Response Code (QR code) and its Application in Selected Studies, *The Malaysian online Journal of Educational Technology (MOJET)*, 1 (1) 54-72.
- Hume, A, & Coll, R.K. (2009) Consideration for Cognitive preferences to Enhance Effective HCL in online Exhibits. *International Journal of Computer Information System and Industrial Management Applications* 3, MIR Labs, Dynamic Publishers, inc.USA, <http://www.mirlabs.net?ijcisim/index.html>. November, 2014.
- Hyde, J.S. (2005). The Gender Similarities Hypothesis. *American Psychologist*, 581- 592.
- Hunt, R., Krzystofiak, F., Meindl, J., & Yoosry, A. (1989). Cognitive Style and Decision Making. *Organisational behaviour and Human Decision Process*. 144, 436-453.
- Joe, A. J. (1983). An Exploratory Study of Nigerian Students Cognitive Preferences in Biology. *Journal of Science Teachers Association of Nigeria*. Vol. 22(1)104-112.
- Jungwirth, E. (1980). Alternative Interpretation of Findings in Cognitive Preference Research in Science Education. *Science Education*, Vol. 58(2) pp.85-91.
- Jung, C.G. (1923). Psychological types. New York: Harc out, Brace and Co. Ltd.



- Qualitative Study on Correlation Between Cognitive Preference Style and ...* Tukur, M., Et. al. (2026)
- Igwebuike, T. B. (1991). Managing Cognitive Dissonance during Science Instruction. *Journal of Science Teachers Association of Nigeria*, Vol. 27(1), 89-94.
- Inbar, D.E. (1995). The Cognitive Preferences of School Principal. *Journal of Educational Administration*, 33, (2), 5-19, MCB UP Ltd.
- Ibrahim, K.M., Abubakar, Z., Surif, J, & Siewli, W., (2008). Relationship Between Cognitive Styles, Levels of Cognitive Thinking and Chemistry achievement among Form Four Science Student.
- Kalgo F. A. (1993). "Cognitive Style, Personality and Academic Achievement among Junior Secondary School Students of Sokoto State". Ph.D. Thesis, UDUS.
- Kempa, R.F. & Dube, G.E. (1973). Cognitive Preference Orientation in Students of Chemistry. *British Journal of psychology*. Vol. 43(3) pp. 279-288.
- Kozhevnikov, M. (2007). Cognitive Styles in the Context of Modern Psychology Toward an Interrelated Frame Work of Cognitive Styles, *Psychological Bulletins by the American Psychological Association*. Vol. 133, No. 3 464-481.
- Kargan, J. (1965). Impulsive and Reflective Children: Significance of Conceptual Tempo, Inj. Krum boltz (Ed), *Car Michael's Manual of Child Psychology*, 1273- 1365, New York: John Wiley and Son, Inc.
- Kirton, M. (1976). Adaptors and Innovators: A description and measure. *Journal of Applied Psychology*. 61. 622-629.
- Kolb, D.A. (1984). *Experimental Learning*. Engle Wood Cliffs. NT: Prentice Hall.
- Klein, G.S. (1951). A personal World through Perception. Inc. Blake and G.V. Ramsey (Ed), *Perception, An approach to Personality*
- Lijnse, P.L, (2007). Curriculum Development in Physics Education. *State Education*. Retrieved from <http://www.phyisca.ohiosossem/ICPE/E1.html>.
- Lehman, M.E., (2011). Relationship of Learning Styles. *Grades and Instructional Preferences. NACT Journal*, (3), 40-45.
- Lilia Halima, N.B. (2007). Development of Entrepreneurial science thinking Model from Science and Technology. *Seminar Pendedidikan Kejuruteraan da Alam Bina*.34-42
- Marks, L. H. (1967). CBA High School Chemistry and concept formation. *Journal of Chemical education*. Vol.44 pp.471-474.
- Messick, S. (1976). "Individuality in Learning San Francisco". Jersey and Buss Publishers.
- Mckay, E, & Alwi, A. (2011). Consideration for Cognitive Preferences to Enhance Effective HCL in online Exhibits. *International Journal of Computer Information System and Industrial Management Application*. 3 MIR Labs. Dynamic Publisher, Inc. USA. <http://www.mirlabs.netS/jjcisim/index.html>. 08 November, (2014).
- Muhammad, T. & Shinkafi, S.A, (2013). A Review of the Effort of STAN towards Teacher Education in Nigeria. *Kabai Journal of Multidisciplinary Studies*. 1 (1). PP 140-146,
- Messeng, L.Y. (1980). Cognitive Preferences of Malaysia Pre-University Students in Chemistry. A Thesis submitted in Partial Fulfilment for the award of Master of Education University Malaysia. 6 & 7.
- Muhyuddin, R, Elias, H, Mohammad D.S, & Shahabain, J. (2011). Academic Achievement of Students with Different Learning Styles. *International of Psychological Studies*. 3 (2). <http://www.ccsenet.org/ijps>. November, 2014.
- Muhammad, T.(2008). "Integrated Science Cognitive Preferences of Junior Secondary Schools Students in Zamfara State". (Implications for Curriculum Development), M.Ed. Thesis, UDUS, Nigeria.
- Muhammad, T. (2011). Vision and Mission of Science and Technology Education in Nigeria: The way forward. *Sardauna Journal of Education (SAJE)*. A Journal of Multi-Disciplinary Studies. A publication of Colleges of Education Academic Staff Union, (COEASU). 2 (1), PP, 135-140.
- Muhammad, T, & Hano, J.L. (2012). Comparison of Students' Cognitive Preferences in some selected Science and Non-science Secondary Schools in Zamfara State, *Bakalori Journal of General Studies*, 4, 2, 872-876
- Myers, B.E, & Dyer, J.E., (2006). The influences of Student Learning Style on Thinking Skill, *Journal of Agricultural Education*, 47 1, 43-52.
- McCabe, C. (2014). Preferred Learning Styles among College Students: Does Sex Matters. *North American Journal of Psychology*, 16 1, P 89-977.
- Muhammad, M and Mckay, E. (2011). The Effects of Cognitive Preferences and Prior Knowledge on web Mediated Instruction, *Proceedings of the International Engineering and Technology Conference*, Kuala Lumpur, Malaysia, PP 16-19.



- Qualitative Study on Correlation Between Cognitive Preference Style and ...* Tukur, M., Et. al. (2026)
- Moore, S. (2002). Cognitive Styles Among Computer Systems Students: Primary Findings, *Journal of Computing in Higher Education*, spring, 1, 42- 46.
- Naught, M.C. (1982). Relationship between Cognitive Preferences and Achievement in Chemistry. *Journal of Research in Science Teaching*, 19 (2) pp.177-186.
- NnaSunday, O. (2011). "The New Senior Secondary School Curricula. Prospect and Challenges for Achieving the Millennium Development Goals". A Paper Presented at the 8th Annual Conference on Educational Crisis and Millennium Development Goals in Nigeria.
- Novak, C.M. (2009)." Cognitive Preference and Ethnic Identity among Angola and Native American High School Students" A Dissertation Submitted in Partial Fulfilment of the Requirement for Degree of Doctor of Philosophy, Department of Psychology, Walden University, P 6, 7 & 117.
- Offorma, G.C. (2005). "Curriculum for Wealth Creation". Paper presented at the Seminar of the World Council for Curriculum and Instruction, Held at Federal College of Education, Kano, Nigeria.
- Ogunsola, F. (1980) "A study of Cognitive Style among S.B.S A.B.U. Chemistry Students" A Dissertation Submitted in Partial Fulfilment of the Requirement for Degree of In Science Education. ABU Zaria.
- Ogunsola, M. F. & Shuaibu, M.J. (1983). Cognitive Styles in Students of Chemistry SBS/ABU Zaria, Nigeria, *Research in Science and Technology Education*, 1(1) 101-107.
- Oluniy, O. & Olajamuke, A.C. (2013). Curriculum Development in Nigeria; Historical Perspective. *Journal of Educational and Social Research*, 3, (1) 2239-978.
- Omoifo, C.N. (1986). "The pattern of Cognitive Style among Chemistry CESAC Biology Studies of SBS/ABU, Zaria" M.Ed. Thesis, ABU Zaria Nigeria.
- Okenini, J.E. (2009). "Girls Child Education and Its Challenges the Universal Basic Education" Post Graduate Diploma in Education (PGDE). National Teachers Institute Kaduna, Gusau Branch, Zamfara State, Nigeria.
- Okebukola, P. A. (1986). Cognitive Preference and Learning Mode as determinants of Meaningful learning through concept mapping. *Science Education*, 72 (4) 489
- Orr, B., Park. O., Thomson, D. & Thomson, C.J., (1999). Learning Styles of Post- Secondary Students Enrolled in Vocational Technical Institute. *Journal of Industrial Teachers Education*, 36 (4), 17.
- Orji, N.S., (2010). "The New Senior Secondary School Curriculum Trade Entrepreneurship" Paper Presented at the Sensitization and advocacy Workshop for Adamawa State Teachers in the Years Basic Education and Senior Education Curriculum, Held at the N.U.T Hall Jalingo, Nigeria.
- Piaget, J. (1972). Intellectual evolution from adolescence to adulthood. *Human Development*, 15, 1-12.
- Parllet, M. (1970). The Syllabus-bound Students. In. Hudson (Ed.). *The Ecology of Human Intelligence*, Harmon ds Worth, Middle sex, England; Penguin Books.
- Palaniappan, A.K. (1998). Figural Creativity and Cognitive Preference among Malaysian Undergraduate Students. *Journal of Psychology Interdisciplinary and Applied*, 132 (4), 381-388. <http://www.tandfonline.com/loi/vjr/20>. Published Online, (2010).
- Pithers, R.T. (2002). Cognitive Learning Style: A Review of the Dependent-Field Independent approach. *Journal of Vocational Education and Training*. 54 (1), 120-125. Retrieved from <http://www.tadfonline.com/loi/rjue>. November (2014)
- Reissman F. (1966). Styles of learning *National Education Association Journal*, March 15-17.
- Rest, J., Cooper, R., Masanz, J., & Anderson, D. (1974). Judgement Issues in Moral Development an Objective Measure of Development. *Developmental Psychology*, 10, 491-501.
- Ryding, R. & Rayner S. (1998). "Cognitive styles and learning strategies". David Fulton publication.
- Rogel, M. (1974). Achievement and Cognitive Preference Studies of Chemistry Students, who studied different Curricula in Israel. Master's Thesis University of Jerusalem.
- Riding, R. & Cheema, T. (1991). Cognitive Style an Overview and Integration. *Educational Psychology*, 11 (1), 193-215.
- Sawyer, E. S. (1980). Cultural Conflicts in the Second School Students. The Sokoto Experience, *Nigeria Journal of Curriculum Studies* 2 (1), 22-27.
- Smith, D.R. (2008). "Learning Style Preference, Sense of Classroom Community, Gender, Age and Previous experience within Computer-Mediated Instruction (CMI)" PhD. Dissertation University of North Carolina at Greensboro.



- Qualitative Study on Correlation Between Cognitive Preference Style and ...* Tukur, M., Et. al. (2026)
- Sternberg, R.J., Grigorenko, E.L. & Zang, L. (2014). Styles of Learning and Thinking Matter in Institution and Assessment. *Perspectives on Psychological Science*. 3 (6) 486-504. Retrieved from <http://ippps.sagepub.com/content/3/B/586.November>, (2014).
- Stephen, U. (2002). "Cognitive Styles and Students' Problem solving Competence in Physics" Ph.D. Thesis University of Uyo, Nigeria.
- Smolak, L. (1986). *Infancy*. Prentice-Hall, Eagle wood Cliffs, N.J.
- Sivanessharajah, A. (2009). "Developing New Guidelines for Secondary Schools Curriculum in Seirilanka" A thesis submitted to the Faculty of Education, University of Malaya in
- Tamir, P. (1979). The Relationship among Cognitive Preference, School Environment, Teachers Curriculum Bias and Subject Matter, *American Educational Research Journal*, 12, 235-264.
- Tamir, P. (1974). Cognitive Preference and Achievement. *British Journal of Educational Psychology*, 46, (1)57-67.
- Tamir, P., (1975) .A Note on Cognitive Preference in Schools. *Studies in Science Education*. Vol.4. 111-124.
- Tamir, P. & Lunetta, V. (1978). Cognitive Preference in Biology of Group of Talented High School Students *Journal of Research in Science Teaching* 15, 10, 59- 64.
- Tamir, P. & Kempa R.F. (1978). Cognitive Styles across School Discipline. *Science Education*. Vol. 62.
- Tamir, P. (1957). The Relationship among Cognitive Preference, School Environment, Teachers Curriculum bias, Curriculum and Subject Matter. *American Educational Research Journal*. 12, (2). 35-64. Retrieved from <http://www.crossref/crossREF/isi/infotrieve>. 13 November, (2014).
- Tamir, P. (1981). Validation of Cognitive preferences. *British Educational Research*, 7 (1), 37-49.
- Wasagu, M. A. (1991). A Study of Relationship between Cognitive Preference and Attitude towards Science. *Sokoto Educational Review*, Vol. 2 (11) pp.11-22.
- Wasagu, M. A. (1998). Cultural Beliefs, Cognitive Preference and Achievement in Science, A of Science Secondary School Students in Sokoto State, Nigeria" Ph.D. Thesis. UDUS, Sokoto, Nigeria.
- Wasagu, M.A. (1990) "Attitude toward Science school as correlated of Cognitive Preferences Orientation among students in Science Secondary Schools in Sokoto State M.Ed. Thesis ABU, Zaria.
- Witkin, H. A. & Good Enough, D. R. (1977). *Field Dependence Revised*, (ETS RB 77- 16) Princeton: Educational Testing Service.
- Wolf, P. Hill, A. & Evers, F. (2006). *Hand Book for Curriculum Assessment*. ERDU. Educational Research and Development Unit 5 & 6.
- Watkins, D.T. (1976). "A Study of Cognitive Preference to interpret Student Learning in the Biological Science Curriculum Study-Green Version in Higher School of Pennsylvania" A Thesis of Academic Curriculum and Instructions Submitted in Partial Fulfilment of the Requirements for the Degree of Doctor of Education. 10-13.
- Zhidong, D.Z. (2013). "Human Gender Differences in Cognitive Preferences towards Attractive Faces in Visual Oddball Paradigm an ERP Study" Foundation and Practical Applications of Cognitive Systems and Information Processing Advances in intelligent System and Computing. Science Line Publication. 215- 248.
- Zainol Abidin, M.J. Alizae, A., Nor Abdullah, H. & Balbir Singh, K.K. (2011). Learning Styles and Overall Academic Achievement in a Specific Educational System. *International Journal of Humanities and Social Science*. Centre for Promoting Ideas, USA.1 (10).
- Zhangy, Y. Kong, F., Jackson, T. & Hassan, A.N. (2011). "Identifying cognitive Preference for Attractive Faces: An even-related Potential Experiment using a Study-test Paradigm" *J. Neuroscience Resource*, 89 (11). 1887-1893.
- Zohan, A., (2004). Higher order thinking in Science Classroom: *Students Learning And Teachers' Professional Development*. Nether Land. Klur Academic Publisher.