UNIVERSITY OF EDUCATION, WINNEBA

EXPLORING THE CORRELATIONS BETWEEN LEARNING STYLES AND ACADEMIC PERFORMANCES OF SHS STUDENTS IN INTEGRATED SCIENCE IN GOMOA EAST DISTRICT

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DECLARATION

Student's declaration

I, Ebenezer Ato Baiden,, declare that this thesis, with the exception of quotations and references contained in published works which have all been identified and duly acknowledged, is entirely my own original work, and it has not been submitted, either in part or whole, for another degree elsewhere.

Signature ……..……..

Date: ……..……..……

Supervisor's declaration

I hereby declare that the preparation and presentation of this work was supervised in accordance with the guidelines for supervision of thesis as laid down by the University of Education, Winneba.

Name of Supervisor: Prof. (Mrs.) Ruby Hanson

Signature ……..……

Date: ……..……..……..

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LIST OF ABBREVIATIONS

SHS	Senior High School
VAK	Visual Auditory and Kinesthetic learning styles
VARK	Visual Auditory Read/Write Kinesthetic
ISAT	Integrated Science Achievement Test
WAEC	West African Examination Council
WASSCE	West Africa School Certificate Examination
IBM	International Business Machine
SPSS	Statistical Package for Social Science Research
LSI	Learning Style Instrument
TIMSS	Trends in International Mathematics and Science study

Abstract

The present study was an attempt to explore the correlation between learning styles of SHS students and their academic performances in science in the Gomoa East district of Ghana. The target population of the study was all the students in the Gomoa district. The accessible population was students in the two public senior high schools in the Gomoa East district. The study was conducted using a sample size of 280 students. The instruments used for the study were adapted „VAK Learning Styles Self-Assessment Questionnaire" developed by Chislett & Chapman (2005) as well as results from Integrated Science Achievement Test (ISAT). The validity of the adapted instrument was enhanced through assessment provided by a professor in science education and two Mphil students who were familiar with the purpose of the survey. Both the Learning style questionnaire and the ISAT were subjected to a reliability test which recorded a Cronbach"s alpha value of 0.80 and 0.85 respectively. Descriptive statistics were used to analyze the data, in terms of frequencies, means, and standard deviation. Pearson"s moment correlation and t-test were also employed to analyze the data. The findings of the study revealed that the most preferred learning style of secondary school students in the district was Visual (43.6%) followed by Kinesthetic (30%), and Auditory (26.4%). Moreover, the study revealed that there was a positive correlation between learning style of students and the academic performance in science. It was also found that a statistical difference existed between learning styles of first and second year students in the district. However, correlation between the learning style preferences of males and female students in the district was statistically insignificant. The findings of the study would enable curriculum planners to suggest more student-accepted curriculum. It would also suggest to school administrators to look into the development of facilities to enhance students of Integrated Science.

CHAPTER ONE

INTRODUCTION

1.0 Overview

This chapter deals with the: background to the study, statement of the problem, purpose of the study, objectives of the study, research questions, hypothesis, assumptions of the study, significance of the study, limitation and delimitation of the study.

1.1 Background to the Study

There are a number of learning-related concepts, such as perception of academic control and achievement motivation which have been the focus of attention when attempting to identify factors that affected learning-related performance (Cassidy & Eachus, 2000). One concept in particular which has provided some valuable insights into learning in both academic and other settings is learning style. Learning styles have been defined in various ways. Zhou (2011) defined learning styles as the manner and the conditions under which learners most efficiently and effectively perceive process, store and recall what they are attempting to learn. Learning preference refers to a person‟s natural, habitual and preferred way of assimilating new information (Reid, 1995).

Learning is a major component of student life. When one learns there is always a relative change in behaviour. Individuals who converge in a school as students come from different environments and hence have different backgrounds. Such differences make them exhibit different personality traits including ways of assimilating learning materials. The approaches students use to learn are highly individualistic hence a wide variation of techniques exists. For instance one student may prefer the quiet and

serene atmosphere of the library, another on the student lounge, one may underline a passage in a text, another may take notes, one may study intensively for several hours, and yet others may take many breaks. Some can work under pressure whiles others cannot. Some may need much direction, others require very little direction. Effective learning can only be achieved through the choice and use of a good learning style. In the classroom, exposure of students to basic learning styles by teachers can help in the achievement of good academic results.

Scholars, who promote the learning style preference approach agree that effective instruction can only be undertaken if the learner‟s learning preferences are diagnosed and the instruction is tailored accordingly (Pashler, McDaniel, Rohrer, & Bjork, 2008). A quotation that states "I hear and I forget. I see and I remember. I do and I understand by Confucius (551-479 BC)" provides evidence that, even in early times, there was recognition of the existence of different learning preferences among people. The idea of individualized learning styles originated in the 1970s, and has gained popularity in recent years (Sprenger, 2003). From the above, learning style clearly indicates the way a leaner takes in and integrates information which seems more comfortable than any other way.

Previous studies have indicated that, gender, and cultural heritage affects learners‟ learning style (Charlesworth, 2008). Charlesworth (2008) examined the relationship between learning style and culture and found out that statistically significant differences existed between learning styles of learners which he classified as activist, reflectors, and pragmatist. Thus, cultural backgrounds affect students‟ learning styles and need to be considered while designing and delivering instruction. According to Coffield (2004), the logic of lifelong learning suggests that students will become more

motivated to learn by knowing more about their own strengths and weaknesses as learners. In turn, if teachers can respond to individuals‟ strengths and weaknesses, then retention and achievement rates in formal programmes are likely to rise and „learning to learn‟ skills may provide a foundation for lifelong learning.

Omrod (2008) reports that, some students seem to learn better when information is presented through words (verbal learners), whereas others seem to learn better when it is presented in the form of pictures (Visual learners). Clearly in a class where only one instructional method is employed, there is a strong possibility that a number of students will find the learning environment less optimal and this could affect their academic performance (Mlambo, 2011). Brown (2003) asserts that, students‟ learning styles and achievement usually improved when their learning styles matched a teacher‟s teaching style. This implies that, students‟ learning in Science may be affected positively or negatively depending on how well a teacher is able to integrate teaching styles that commensurate with an individual‟s learning style. Research by Murphy, Gray, Straja, and Bogert (2004) posits that learning based on the Visual Auditory and Kinesthetic (VAK) learning style model provides a medium for self-knowledge and exploratory opportunities in the classrooms, thus, making a more productive learning experience and enjoyment among students. From the above, it convincingly suggests that learning is more effective if education is delivered and oriented in a way that matches an individuals‟ learning style.

The knowledge of student preferred learning styles is vital if teachers or educators are to provide tailored strategies for individual students (Fleming, 1995). Scholars, who promote the learning preferences approach agree that effective instruction can only be undertaken if a learner‟s learning preferences are diagnosed and the instruction is

tailored accordingly (Pashler, McDaniel, Rohrer, & Bjork, 2008). Learning style preference is not simply a concept discussed by researchers and psychologists. It is the key to improving school climate and students achievement by recognizing that all people are not the same, and that all students do not learn in the same way (Dunn & Griggs, 2000). Consequently, it is imperative to bring to the attention of teachers the need to incorporate students‟ individual or major learning styles into their teaching processes.

Though extensive literature and research exist on learning styles in some countries, especially European and Asian countries, there have been only a comparatively small number of studies that have assessed learning styles and academic performance in Ghana. A study by Tachie (2010) on the influence of learning styles on performance in science in selected Basic Schools in the Greater Accra region showed that, grouping students according to their learning style provide a kind of scaffolding, which helps students achieve much in their academic performances. Tachie‟s study did not extend to the Senior High School level and hence this study. This study will therefore explore the correlation between learning style and academic achievement among secondary school students in the Gomoa East district.

1.2 Statement of the Problem

The poor learning of integrated science in Ghanaian schools has been reflected in the poor performance of Ghanaian SHS students in West African Senior School Certificate Examination (WASSCE) that disqualified them from gaining admission into tertiary institutions for further studies (Entsuah-Mensah, 2004).

A report by Fletcher (2016) at the WAEC‟s 21st Endowment Fund Lecture revealed that performances of Senior High School (SHS) students in science and mathematics

have seen a downward trend from 2007 to 2015. He blamed the appalling performance on the application of wrong teaching methods by teachers, poor learning skills and bad policy initiatives, among many others. These subjects served as the basis that tertiary institutions consider for admission. Performing woefully in these subjects is a clear indication that one will not be able to progress to the next stage of their academic ladder without having to rewrite their examination. The statistics as released by WAEC (2015) indicated that only 25.29 % of candidates passed in mathematics; that is students getting A1 to C6. About 23.63% passed in integrated science. The reason for their failure was mainly due to wrong learning styles (Montgomery & Groat, 2000).

Reports from internal examinations, informal reports from teachers in the Gomoa East district as well as the researcher‟s observations indicate that, most students‟ record low performance in the Integrated Science. Again, from interactions with students, it appears teachers mostly use the traditional approach to deliver science lessons. According to VAK learning style model, learners use at least Visual, Auditory or the Kinesthetic modalities to learn new information. Using traditional approach most often may be addressing only Auditory learners to the neglect of students of other learning styles. This may be the cause of low performance in science in the district. Performance of students in Integrated Science in both internal and external examinations in the district over the years leaves much to be desired. The assessment of WASSCE results from 2012 to date indicated that, there has been a downward trend in performance of students in Integrated Science. For instance, from Potsin T. I. Ahmadiyya Senior High School (P-AMASS), the school considered to be the best in the district in terms of infrastructure, academics, population and so on, the school‟s statistics indicates that in 2012 the proportion of students who passed Integrated

science (A1-C6) was 68.4%; 53.2% in 2013; 24.3% in 2014; 33.0% in 2015 and 22.2% in 2016. This trend showed that, there was a decline in students‟ performance in Integrated Science except for the 2013 which saw a marginal improvement over the previous year. Tracing the causes of students‟ poor performances has been a headache for stakeholders in the educational sector. Perhaps this low performance in science could be attributed to the fact that students learning styles have not been considered. The problem therefore is whether there is a correlation between learning styles of students and their performance in science.

1.3 Purpose of the study

Senior High School students in the Gomoa East District do not perform well in Integrated Science. One cannot discern yet if the contributory factor would be the learning style of the students. Thus the purpose of this study was to explore the correlation between learning style and academic achievement among senior high school students.

1.4 Objectives of the study

The objectives for the study were to determine:

1. The dominant learning style preference of students in the district.
2. The relationship between learning style preferences of first and second year students.
3. The relationship between learning style preferences of male and female students.
4. The correlation between learning style and academic achievement among students in the district.

1. 5 Research Questions

1. What is the dominant learning style preference of students in the Gomoa East district?
2. What is the relationship between learning style preference of first and second year students?
3. What is the difference in learning style of male and female students?
4. What is the correlation between students‟ learning styles and their academic achievement?

1.6 Null Hypothesis (Ho)

Ho 1. There will be no relationship between preferred learning styles of first and second year students.

Ho 2. There will be no difference in learning styles of male and female students.

Ho 3. There will be no correlation between students learning styles and their academic performance in Science.

1.7 Assumptions of the study

The following assumptions will guide the study:

Students in the Gomoa East district record low performances in Integrated Science. The students gain knowledge in Integrated Science through various instructional methods of which the lecture method is predominant. As such, Auditory learners are mostly advantaged over other students with different learning styles.

Another assumption is that students have different learning styles. Therefore if the teaching style does not match the students‟ learning style, effective learning would not occur and lead to poor performance of students.

1.8 Significance of the study

To enhance meaningful reforms in Ghana, findings of the study could be very paramount to the following stakeholders in education:

- **Students:** The study would help students to understand and become aware of how they themselves learn and study best. Moreover, learning styles will be personal qualities that influence the way students interact with their learning environment, peers, and teachers.
- **Teachers:** The study will help instructors to select and design teaching strategies, lessons, and activities that maximize student learning and understanding. Having an understanding on students‟ learning styles may help to develop teaching strategies and this may enhance performance of students. Again, a better understanding of learning styles helps teachers especially those in training to reduce frustration for themselves and their students (Reiff, 1992).

Being aware of our students‟ learning style differences would help educators to regulate lessons appropriately (Coffield et al., 2004).

1.9 Delimitations and Limitations

1.9.1 Delimitations

The study was delimited to students in the two public SHS in the Gomoa East District. This was due to the time frame for the study and financial constraints. The study was also delimited to the first and second year students. This is because, the final year students were writing their West African School Certificate Examinations (WASSCE) at the time of the data collection.

1.9.2 Limitations

Ideally, the study should have been conducted over a wider population of Senior High Schools in the central region of Ghana. However, this study only targeted SHS students in the Gomoa East district due to the resources and time frame for the study. This will make generalization of the findings difficult due to the sampling size.

Also, the use of the VAK learning style inventory to gather quantitative data may not have been sufficient. The use of a triangulation approach, which includes interview and classroom observation to assess learning styles, should have also been considered.

1.10 Operational definition of terms

Academic performance

Academic performance means how much knowledge the individual has acquired from the school (Bashir & Mattoo, 2012). Performance is the students‟ ability to use his knowledge and skills learnt in school to solve problems. Students‟ performance in Integrated Science measured through the scores obtained in the Integrated Science Achievement Test (ISAT)

A particular learning style may naturally suit one student in his construction of knowledge, while another style may be best suited to another. Some people have a very strong preference for a particular learning style, while; other people have a mixture of two or three learning styles, which is not so common, though.

Visual learning style

Someone with a Visual learning style has a preference for seen or observed things, including pictures, diagrams, demonstrations, displays, handouts, films, flip-chart, etc. These people will use phrases such as „show me", „let"s have a look at that" and will be best able to perform a new task after reading the instructions or watching someone else do it first. These are the people who will work from lists and written directions and instructions.

Auditory learning style

Someone with an Auditory learning style has a preference for the transfer of information through listening: to the spoken word, of self or others, of sounds and noises. These people will use phrases such as „tell me", „let"s talk it over" and will be best able to perform a new task after listening to instructions from an expert. These are the people who are happy being given spoken instructions over the telephone, and can remember all the words to songs that they hear!

Kinesthetic learning style

Someone with a Kinesthetic learning style has a preference for physical experience - touching, feeling, holding, doing, and practical hands-on experiences. These people will use phrases such as „let me try", „how do you feel?" and will be best able to perform a new task by going ahead and trying it out, learning as they go. These are the people who like to experiment, hands-on, and never look at the instructions first!

1.11 Organisation of the Dissertation

The study is organized in five chapters. The first chapter one is the introduction, which covers background to the study, the statement of the problem, purpose of the study, objectives, research questions, significance of the study, delimitations and

limitations of the study, definitions of concepts used in the study and organisation of the study. Chapter two consists of literature review, while chapter three contains methodology. The research findings are presented and discussed in chapter four. Chapter five covers the summary of findings, conclusions and recommendations.

1.12 Chapter summary

This chapter has covered the introduction to the study. It began with the background to this study and the research problem under investigation. In addition, the chapter covered the purpose, objectives and research questions as well as the hypothesis. The chapter also presented the significance of the study, study limitations and delimitations. The chapter further presented the operational definitions of terms used, and the organisation of the study.

CHAPTER TWO

REVIEW OF LITERATURE

2.0 Overview

This section reviews some of the contributions, ideas and studies that have been undertaken by some earlier researchers and authors. The literature related to this study is reviewed under the following sub headings:

- Definition of learning style
- Theoretical framework of the study
- The VAK learning style model
- Learning styles versus grade level
- Learning style versus gender/sex
- Learning style preference versus academic performance
- learning style versus teaching styles
- Implications of learning styles
- The Senior High School Integrated Science Curriculum
- Issue of Learning Style Instruments
- Other learning style models

2.1 Definition of learning style

With the introduction of idea of "style" to psychology by Allport (1937), the term has been used to refer to patterns of behaviour that are consistent over long periods of time and across many areas of activity (Grigorenko & Sternberg, 1995). The concept has always been associated with individuality, relative stability and consistency (Rayner & Riding, 1997). In educational psychology, learning style generally refers to consistent individual differences in the way individuals set about learning something

(Adey, Fairbrother, Wiliam, Johnson, & Jones, 1999). Since the end of the seventies, the concept has gained growing popularity among educators (Rayner & Riding, 1997; Wilson, 1998). Today, it is a common conception in many educators‟ vocabulary to talk and think about individuality in learning. Literature on learning styles abounds and there is wide acceptance among educational Psychologists and researchers of the concept of learning styles.

Numerous definitions for learning styles have emerged over the years resulting in broad conceptualizations. Dunn and Dunn (1992) defined „style‟ as the way in which individuals begin to concentrate on, process, internalize and retain new and difficult academic information. The American Association of School Administrators (1991, p.2) stated that "learning styles refer to the ways individual students learn best". In a similar vein, Stewart and Felicetti (1992, p.15) defined learning styles "as those educational conditions under which a student is most likely to learn". In another way, Mills (1999) identified learning style as our perceptions of our natural learning strengths. According to Reid (1995), learning style can also be referred to as an individual‟s natural, habitual and preferred way of absorbing, processing and retaining new information and skills. Learning style involves learners‟ preferred ways to receive, process, and recall information during instruction which is related to learners‟ motivation and information-processing habits (Aragon, Johnson, & Shaik, 2002). In a more detailed description, Lucas and Corpuz (2007) describe learning styles as the preferred way of how an individual processes information and also describe a person‟s typical mode of thinking, remembering or problem solving. Once we are introduced to the main learning style concepts we may, as educators, be approached with the question "why should we incorporate learning style theory into teaching practice?" Learning style is sometimes defined as the characteristic cognitive,

affective, social, and physiological behaviours that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment (MacKeracher, 2004). From the above definitions, learning style can be seen as the way individual best take in information. A focus on style can result in the learner feeling more involved in the process of learning.

2.2 Theoretical framework

Learning theories concern studies of human mind and behaviour. The theoretical framework of the study is hinged on the theories of cognitivism, behaviourism and constructivism. These theories considered in this study seek to explain the underpinning variations in student learning styles and performances. Each of these theories makes different assumptions about how people learn and remember. Each of them provides general explanations based on observations over time. They explain processes of knowledge acquisition and predict behaviour. The descriptions of each of the theories are presented.

2.2.1 Cognitivism as learning theory

Cognitive-centered approaches focus on the identification of styles based on individual difference in cognitive and perceptual functioning. Cognitive theorist view learning as involving the acquisition or reorganisation of cognitive structures which humans process and store information (Rivard, 1996). Cognitive theory provides educators with an understanding of how students learn and how to design instruction around those methods of learning. Learning according to cognitive theorist is change within the individual‟s mental structure that provides them with the ability to change their outward behaviour (Rivard, 1996). The way individuals process learning cues is referred to as cognitive learning style. The emphasis is on how a learner selects,

perceives, processes, encodes and retrieves information from memory (Di Vesta, 1987). Cognitive theories teach teachers the importance of considering students‟ past experiences and mental constructs before they come into the classroom. It would therefore suggest that such experiences are likely to influence students‟ Auditory, Visual, kinesthetic learning style preference. Brunner (1966) cited by Tachie (2010) described cognitive learning as processes of conceptualization and categorization. He contended that intellectual development includes awareness of one‟s own thinking, the ability to recognize and deal with several alternatives and sequences, and the ability to prioritize. Brunner also saw the benefit of discovery learning to bring about insight.

2.2.2 Behaviourism as learning theory

The theory of behaviourism concentrates on the study of overt behaviours that can be observed and measured (Good & Brophy, 1990). Behaviourism is founded on the strength of stimulus–response (S-R) association (Gropper, 1983) cited by Tachie, (2010). Operationally, the stimulus can be defined as either the material to be learned or instructional event that leads to elicit a response. Gardner (1995) stated that people are all so different largely because they all have different combination of intelligences. If educators recognize these differences, as diverse ways of learning, comprehending and knowing (learning styles) there is at least a better chance of enhancing performance (Tachie, 2010).

2.2.3 Constructivism as a learning theory

Within the constructivist view of learning, two views dominate. The first is a cognitive view championed by Gagne (1985). In this perspective, leaning is a result of an individual cognitive effort to construct his or her personal knowledge. The other view of social constructivism was well articulated by Vygotsky and Bandura. In their views, learning is considered a result of the collaboration of a group of learners in an effort to construct a common core of knowledge. Vygotsky (1978) believed that students learned best when interacting with others, especially if the others were more competent in the area being explored. The support of others allows the students to progress further than the students would have alone. Vygotsky is famous for his portrayal of the gap between what a student might learn alone, and what the students might learn with support, a gap that he called Zone of Proximal Development (ZPD). Vygotsky also encouraged the use of models and demonstration in instruction. This helps kinesthetic learners. Another is the use of themes to complete projects. This allows students to take advantage of each other's strength and to learn and develop together.

Scott (1987) defined constructivist in science as one who perceives students as active learners who come to science lessons already holding ideas about natural phenomenon, which they use to make sense of everyday experiences. In an explanation of the implications of constructivism for practicing science teachers Lorsbach and Topin (1992) said that the constructivist epistemology asserts that the only tool available to a knower are his senses. It is only through seeing, hearing, touching, smelling and tasting that an individual interacts with the environment. With these massages from the senses, the individual builds a picture of the world. Therefore, constructivism asserts that knowledge resides in individuals. In addition,

constructivists believe that learners construct their own reality or at least interpret it based upon their perceptions of experiences.

2.3 The VAK learning style model

Learning style is an umbrella concept bringing together various schools of thought which share the belief that students learn best when they are given the opportunity to do so, deal with information, and communicate in a manner that they feel most comfortable with (Pallof & Pratt, 2003). As a result, diverse models have been developed to explain these individual differences in learning. The present study is embedded on the Visual (V), Auditory (A) or Kinesthetic (K) learning style model (VAK) identified by (Chislett & Chapman, 2005). The original VAK concepts were first introduced by psychologists such as Fernald, Keller, Orton, Stillman and Montessori, starting in the 1920´s (Chislett & Chapman, 2005), but recently, the interest has further gained ground; especially in education (Brian, 2011). Based on this theory, several scholars have developed learning style inventories. One family of learning style models that has gained popularity recently has been those which have emphasized sensory modalities as a means of providing stimuli to the learner, known as VAK (Coffield, Moseley, Hall, & Ecclestone, 2004).

According to Clark (2011) cited by Tayo and Oluwakemi, (2015, p. 31), "VAK is derived from the accelerated learning world and seems to be about the most popular model due to its simplicity". VAK learners use all three modalities to receive and learn new information and experiences. However, according to the VAK modality theory, one or two of these receiving styles is normally dominant. VAK theory is now a favourite of the accelerated learning community because its principles and benefits extend to all types of learning and development, far beyond its early applications.

Gardner's theory is one way of looking at learning styles; Kolb and VAK are still other ways. A similar theory Visual, Auditory, Read/Write and Kinesthetic (VARK or VAKT) and different models has been adapted from VAK (Fleming, 2001), but they often amount to pretty much the same thing which is probably why VAK has proven so enduring (Chapman & Chislett, 2005).

An important principle of this model is the idea that students‟ potential and achievement are heavily influenced by relatively fixed traits and characteristics (Dunn, 2001). This raises a fundamental educational question, namely, how far individuals can remedy their low preferences or change their preferences altogether. The recent overview of the model contains the claim that the learning styles of students changed substantially as they matured from adolescence into adulthood (Coffield et al., 2004).

The VAK learning style model guides teachers in carrying out suitable activities that can help students achieve more (Coffield, et al., 2004). One family of learning style models that has gained popularity recently has been those which have emphasized sensory modalities as a means of providing stimuli to the learner, known as VAK (Coffield, et al., 2004). As Clark (2000) explains, all learners use all three styles to receive information. However, one or more of these receiving styles is normally dominant. This dominant style defines the best way for a person to learn new information. Thus one learner may prefer one style of learning for one task, and a combination of others for another task. All learners can use all of these sensory modes in learning, but one mode is often dominant and preferred. Although there are some overlaps between them they are described as follows:

2.3.1 Visual learners

According to Montenayor and Aplaten (2009), Visual learners are the kind of learners who learn best through seeing the teacher‟s body language, facial expression and even the Visual content of eh course material used by the teacher.

Visual learners need to see a teacher‟s body language and facial expression to fully understand the content of a lesson. They prefer to sit at the front seats in the classroom to avoid Visual obstructions (such as people‟s heads). They may think in pictures and learn best from Visual displays including diagrams, illustrated text box, overhead transparencies, videos, and many more (Shaw, 2012). During a lecture or classroom discussions, Visual learners often prefer to take detailed notes to absorb the information. They remember best if they learn from a written text. Sometimes, they may not be able to recall the information but they will know exactly where to look for it. They seldom get lost in new surroundings. Visual learners have been identified as students who are typically proficient in pattern recognition (Banner & Rayner, 2000). Constantinidou & Baker (2002) found that Visual presentation through the use of pictures was advantageous for all adults, irrespective of a high or low learning-style preference for Visual images. Indeed, it was especially advantageous for those with a strong preference for verbal processing.

2.3.2 Auditory learners

Auditory learners interpret the underlying meanings of speech through listening to tone of voice, pitch speech and other nuances. Written information may have little meaning until it is heard. Auditory learners need to hear whilst learning. They tend to enjoy activities which emphasize discussion, storytelling or some speaking activity. Class-based research conducted by Banner and Rayner (2000) has also suggested that

students who are verbalizers often achieve good pronunciation. On the other hand they may have difficulties with writing and reading tasks. Auditory learners are very good listeners. They tend to absorb information in a more efficient manner through sounds, music, discussions, and teachings (Shaw, 2002). These individuals will be more likely to record lectures so that they can replay them at a later time for study purposes. Auditory learners appreciate books on tape and may find that reading aloud will help them to retain information. Rather than written reports, Auditory learners tend to do better on oral presentations and reports. Auditory learners enjoy the oral-aural learning channel. Thus, they want to engage in discussions, conversations, and group work. These students typically require only oral directions (Oxford, 1995).

2.3.3 Kinesthetic learners

Kinesthetic learners actually belong to the category of learners who grasp, learn, and understand things by touching, doing, and moving. They are very hands on and experiential type of learner who learn via exploration of the physical world around them (Montemayor & Aplaten, 2009). Kinesthetic learners learn best if they can move, touch or manipulate objects. They find it extremely difficult to concentrate if no movement is involved and they are asked to sit still throughout the whole lesson. The kinesthetic style has also two sub channels – kinesthetic which refers to movement and tactile which is linked with touch (Clark, 2000). Learners with kinesthetic preference often take notes during the lecture, play with a pen or draw some pictures. They need to be physically involved. They learn best by manipulating objects. The Kinesthetic learners are tactile learners. This means that they learn best through moving, doing, acting out and touching. Projects that are hands-on in nature are best for kinesthetic learners. Kinesthetic learners tend to become frustrated when they must sit for long periods of time (Shaw, 2002). They enjoy conducting

experiments, exploring and performing tasks. Kinesthetic learners are those who "imply total physical involvement with a learning environment such as taking a field trip, dramatizing, pantomiming, or interviewing"(Kinsella, 1995).

The Visual, Auditory and kinesthetic modalities are means that an individual can perceive effectively. Primary school material is presented predominantly through a Visual channel. However, the best way to present new information is by using all sensory styles to correspond with the general distribution of VAK preferences among the students.

2.3.4 Review of past studies

Historically, a wealth of learning styles has been described in the literature. A number of studies using the VAK or VARK found significant difference in learning styles among students. On cultural backgrounds, Park (1997) conducted a comparative study of Chinese, Filipino, Korean, Vietnamese, and Anglo students in secondary schools and concluded that Korean, Chinese, and Filipino students were more Visual than Anglos and that Korean, Chinese, and Anglo students showed negative preferences for group learning while Vietnamese showed a major preference and Filipino students showed a minor preference. Also, Joy and Kolb (2007) concluded that culture has an impact on the learning style scales that is comparable to that of some of the demographic variables. Culture has a significant effect in deciding a person‟s preference for Abstract Conceptualization versus Concrete Experience. This means that, since students come from different background, they will possess their individual style of assimilating information.

In identifying prevailing learning style of students in the UK, Clark (2000) states that about 65% of every population falls into the category of Visual type, 30% has a strong

preference for Auditory type and only about 5% prefer the Kinesthetic style. Another study conducted by the Socony Vacuum Oil Company revealed that students retain about 10 % of what they read, 26% of what they hear, 30% of what they see, 50 % of what they see and hear, 70% of what they say, and 90% of what they say as they do something (Felder & Silverman, 1988).

In the United States, a study carried out by Kopsovich (2001) on the relationship between learning styles of students and their Mathematics scores on the Texas assessment of academic skills test established that the learning style preferences of all students in the area of persistence significantly impacted their math achievement scores. Mulalic, Mohd, & Ahmad (2009) attempted to determine the learning styles of the students, and the differences in learning styles of the students according to their gender and ethnicity. Results revealed that the students‟ preferred learning style was Kinesthetic. They expressed minor preference for Visual, and Auditory.

In a comparative study of undergraduate students in Japan and Australia, Sugahara, Susuki and Boland (2010) found that the Japanese like to learn by watching due to their relatively collective approach to learning. In contrast, Australian students, who tended to be more individualistic in their learning, were more willing to learn by doing. O‟Gorman (2010) investigated young adolescents‟ learning style and reported that students aged 11-15 had essentially the same preferences, in the same rank order, for each learning style: social, aural, physical, Visual, verbal, logical, and then solitary. According to a study in Philippines University, Batangas, the first year General Engineering students is mostly composed of Visual learners (64.44%). Also, the second year General Engineering students 2A were mostly composed of Visual learners (82.76%). Again, Park (1997) conducted a comparative study of Chinese,

Filipino, Korean, Vietnamese, and Anglo students in secondary schools and concluded that Korean, Chinese, and Filipino students were more Visual than Anglos. Lu and Chiou (2010) also conducted a study to determine if gender can affect the quality of learning through E-learning by making sure that the learning style preferences of students were satisfied. The sample of 353 male and 169 female students from Northern Taiwan University were enrolled in online courses, and responded to a Kolb learning style inventory. The study showed that there is a direct and positive relationship between gender and learning styles. Mammen et al. (2007) examined general surgery residents at the University of Cincinnati during the period of 1994 to 2006. The sample was comprised of 56% females and 44% males. Chi-square analysis was conducted to explore the differences between genders. The result reported significant differences in learning styles between male and female general surgery residents based on the Kolb learning styles theory.

In Kenya, a study by Nzesei on a correlation study between learning styles and academic achievement among Secondary School Students in Kenya found out that, no significant difference existed in learning style preference among male and female students. Also, there is strong positive and statistically significant relationship between learning styles and academic achievement (Nzesei, 2015). A study by Tachie (2010) on influence of learning style on performance of Science in Junior High School in Accra revealed that, the dominant preference was Auditory (65%) followed by Kinesthetic (25%) and Visual (10%).

Instructors should be aware of the application of proper teaching methods in order to increase their students‟ success. Once instructors determine the most accurate teaching method, depending on the level of the students, it becomes simple to select

the proper strategy to apply to students (Arsian & Aksu, 2005). The simplicity and intuitive usefulness of the VAK model has contributed to its popularity, but it is important to remember that students will have a different mix of strengths and preferences. So, science teachers should ensure the inclusion of mixture of aids and methods that will engage students, whatever their preferred learning style.

2.4 The Concept of Academic Achievement

Determinants of students‟ performance have been the subject of on-going debate among educators, academics and policy makers. The extent of student‟s learning in academics may be determined by the grades that a student earns for a period of learning that has been done.

Academic achievement refers to a successful accomplishment or performance in a particular subject area and is indicated by grades, marks and scores of descriptive commentaries. Cary, Roseth, David and Roger (2008) define academic achievement as performance on task with measures including comprehension, quality and accuracy of answers of tests, quality and accuracy of problem solving, frequency and quantity of desired outcome, time or rate to solution, time on task, level reasoning and critical thinking, creativity, recall and retention, and transfer of tasks. Academic performance also refers to how students deal with their studies and how they cope with or accomplish different tasks given to them by their teachers in a fixed time or academic year (Dimbisso, 2009).

Kobaland and Musek (2001) stated that there are two broad groups of definitions of academic achievement. The first one could be considered more objective, because it refers to numerical scores of a pupil‟s knowledge, which measure the degree of a pupil‟s adaptation to school work and to the educational system. The second group is

a more subjective one, as its determination of academic success is reliant upon the student‟s attitudes towards his academic achievement and himself, as well as by the attitudes of significant others towards his/her success and him/herself.

2.4.1 Poor academic performance

The concept of low academic performance varies in its definition. Diaz (2003) considers low academic performance or academic failure as the situation in which the subject does not attain the expected achievement according to his or her abilities, resulting in an altered personality which affects all other aspects of life. Similarly, Tapia (2002) as cited in Diaz (2003) notes that while the current educational system perceives that the student fails if he or she does not pass, more appropriate for determining academic failure is whether the student performs below his or her potential. Aremu (2000) defines poor academic performance as performance that is adjudged by the examinee/testee and some other significant as falling below an expected standard. Poor academic performance according to Aremu and Sokan (2003) is a performance that is adjudged by the examinee/testee and some other significant that shows as falling below an expected standard. Also, Asikhia (2010) described poor academic performance as any performance that falls below a desired standard. A candidate who scores below the standard is regarded as showing poor academic performance in school. Aremu (2000) stresses that academic failure is not only frustrating to the students and the parents, its effect are equally grave on the society in terms of dearth of manpower in all spheres of the economy and politics.

Not a single factor can be definitely pointed out as predicting performance. It is interplay of so many factors – gender, learning styles, age, parents‟ educational attainment, and many more. In fact, almost all of the existing environmental and

personal factors are a variable of academic performance (Amandeep & Raj, 2015). Research that has investigated the effects of age on student performance has generally found that mature-age students receive higher grades in education settings (Newstead, Ellis, Ellis & Dennis, 1997). There have been some reported exceptions, such as finding of no significant difference in performance between older and younger students. Newstead et al (1997) attribute the better performance of mature- age students to better study habits.

A study in Moshi district, Tanzania by Cyril, Lucas and Jonathan (2010) revealed that some of the challenges that limit their performance include: limited number of teachers per subject compared to the number of students, lack of conducive teaching and learning environment and shortage of teaching and learning materials. Poor performance of students in science subjects in secondary schools is an issue that has been well known and discussed by many people for so long in Ghana. Many research findings have been carried out but performance seems to be dropping in our secondary schools. There have been complaints by the public that the students are performing badly in science and worse in mathematics. The interest in raising levels of achievement in math and science has led to a focus on investigating the factors that shape achievement in these subjects (Lamb & Fullarton, 2002). Education of secondary school level is supposed to be the base and the foundation towards higher knowledge in tertiary institutions. Studies by Miller-Grandvaur and Yoder (2002) on secondary schools education found out that secondary schools are an important part of the educational interventions in sub-Saharan Africa. However, the main challenges in secondary school education seem to be academic performance of students.

2.5 Learning style versus form/grade level

Other factors such as age, educational level, and motivation as well as situational factors, such as the type of the class or the subject being studied, ought to be taken into consideration (Spoon & Shell, 1998). All these factors influence students´ learning. Utilizing learning style theory in the classroom is extremely beneficial at all educational levels for a variety of reasons. As we progress through educational experiences, the level of specialization increases, resulting in additional influence of our orientation toward learning (Roger & Nancy, 2006). On the role of learning styles in the teaching/learning process, a statistically significant difference existed in learning style type for each grade level (Roger & Nancy, 2006). There was an increase in the percentage of students, whose predominant learning style type is Auditory as grade level increases, peaking at 63.79 percent in grade 9 from a starting point of 29.49 percent in grade 4. However, a study by Asiry (2014) on learning styles of dental students at King Saud University concluded that, the learning preference of students remain unchanged from first to final years at College of Dentistry, King Saud University.

Age plays a role in how individuals learn and receive information. Several studies have shown that learning style preferences have a direct relationship with the age of the learner. Jensen (2009) indicated that learning preference of the learner relied on his or her age. Thus, it can be implied that learners at different ages may use and vary in their learning styles preferences.

2.6 Learning style versus gender/sex

There are various factors that affect learning styles. Several studies have indicated that learning styles are affected by gender, age, cultural heritage or ethnic

background. Several studies have also determined that learning styles are affected by other factors. Dunn and Griggs (2000) determined some factors that affected learning style and such as gender, age, and culture. Numerous learning style preference studies have found a link between gender and preferred learning styles. The National Assessment of Education Progress (NAEP) of the United States of America documents that among nine year olds, males performs better than females in Mathematics and Science. The gap widens (and becomes statistically significant) by age thirteen and persist through secondary schooling (Dee, 2007). Radon (2007) argues that gender is one among many variables considered in learning style studies. Wehrwein, Lujan, and DiCarlo (2007) investigated gender differences in learning style preferences among undergraduate physiology students. The VARK questionnaire was administered to identify undergraduate physiology major learning styles. The students were enrolled in a capstone physiology laboratory at Michigan State University. About 86 students participated in the study; however, only 8 students who returned the questionnaire volunteered their gender information (55.8%). The study found out that, 54.2% of female and 12.5% of male students preferred a single mode of information presentation. Among the female students, 4.2% preferred Visual learning style, 0% preferred audial, 16.7% preferred to read (printed words) while 33% preferred hands-on activity to take in and give out information (kinesthetic).

A study was conducted by Kia, Aliapour and Ghaderi (2009) to determine the relationship between learning style preferences and the academic achievement of Iranian students at Payame Noor University (PNU). The study categorised students into seven groups; according to their learning style. These categories were: visual, verbal, aural, physical, logical, social and solitary. The study showed that most male

students preferred a verbal learning style, followed by solitary. The majority of female students, however, preferred aural learning followed by verbal, visual and logical learning style. In another study, Johnson (1997) examined the learning style preferences of physical education majors an analyzed difference in learning styles. A total of 64 male and 18 female physical education majors participated in the study. The study was conducted at a university in the south east of the United States. The Canfield learning style inventory was used to identify students learning style preferences. The result indicated that both male and female students vary from the norm in learning style.

Also, a dissertation on a correlation study between learning styles and academic achievement among secondary school students in Kenya show that there is a positive relationship between learning styles and academic achievement and in all the male and female students (Nzesei, 2015). Tachie (2010) conducted an exploratory survey on leaning style preference of students in the Junior High Schools in Ghana. A sample of 1334 JHS students were drawn from three districts in the Greater Accra region of Ghana. The VARK learning style instrument was used and the result indicated that, the mean performance of male students was better than that of the female students. Wehrwein, Lujan, & DiCarlo (2007) carried out a research on gender differences in learning style preferences among undergraduate physiology students. Their findings showed that male and female students have significantly different learning styles.

However, some studies investigating the link between learning style and gender showed no relationship between the two variables. Al-Saud (2013) examined learning style preference of first year dental students at King Saud University in Riyadh, Saudi Arabia. A total of 113 students participated in the study, of which 42 were female and

71 were males. The VARK questionnaire was used to identify students learning styles. The researcher found out that gender difference was not statistically significant. In conclusion, educators need to be aware of the findings on the research on gender and learning styles. This will help them to design and deliver information to students during instruction in a manner that is compactible to their learning style preference. It is paramount for students and teachers to know learning style preferences in order to improve teaching learning.

2.7 Learning style versus academic performance

According to Uzoeshi (2005), academic performance is a measure of the ability of a learner to recall appropriate learned information at a particular time. The degree of recall of learned experiences seem to depend on the influence of some psychological factors. These psychological factors that affect the academic performance of students in Junior Secondary Schools, include, phobia, stress, depression, delinquency and inferiority complex (Uzoeshi, 2005). Learning styles are personal qualities that influence the way students interact with their learning environment, peers, and teachers (Alkhasawe, Mrayyan, Docherty, Alashram, & Yousef, 2008).

There is general acceptance that the manner in which individuals choose to or are inclined to approach a learning situation has an impact on performance and achievement of learning outcomes. The influence of learning styles on achievement is dependent upon subject areas (Jones et al., 2003), instructional methods (Tulbure, 2011) and assessment methods (Gurpinar, Alimoglu, Mamakli & Aktekin, (2010). Researchers have utilized learning styles in explaining students‟ achievement in large-scale nationwide tests (Jilardi-Damavandi, Mahyuddin, Elias, Daud, & Shabani, 2011).

In separate studies, Purdie, Hattie, and Douglas (1996), Zhang (2004), and Dawson-Brew, Sey, and Nyarko (2010) reported that students who used two or more learning styles have a higher academic performance than those who used a single learning style. Other studies had shown that when instructional strategies were congruent with students‟ learning styles, achievement scores were higher (Boulmetis & Sabula, 1996). Other studies reported that when students were taught by an approach compatible with their learning, they achieved better in academic performance (Dunn, Honigsfeld & Doolan, 2009) and were more positive towards learning (Griggs & Dunn, 1995; Penger & Takavcic, 2009). Drysdale, Ross and Schulz (2001) on students‟ performance on university courses reported that students from 11 of the 19 courses showed significant differences between academic performance and learning styles, no significant differences were found on courses in the liberal arts and social sciences.

Sarvghad and Dianat (2009) conducted a study aimed at investigating the learning and problem solving styles of university students. The results of the study showed that there was a significant relationship between students' learning styles and their problem solving styles. It was also indicated that there was a significant relationship between students' major and the patterns of use of both learning styles and problem solving styles. Further, it was revealed that there was a statistically significant difference between the pattern of use of problem solving styles of male and female students. Significant differences exist between learning style preference and academic performance in science irrespective of the instrument used. Also investigation conducted by Tachie (2010) revealed that, the higher the Auditory preferences of the

students, the less they performed, though Visual and Kinesthetic preferences did not significantly contribute to the variance in performance. This indicates that more of Auditory stimulation does not increase performance but rather decreases it.

Again, in a study on college students, O"Brien and Thompson (1994) found that students achieved higher grades when they were taught by teachers who matched their learning styles. In contrast, in studies related to the effects of learning styles on achievement in a World Wide Web course, results showed that learning styles had no effect on students" achievement or attitude in Web-based instruction (Day, Raven & Newman, 1997; Shih & Gamon, 2002). Results obtained by Drysdale, Ross, and Schulz (2001) on students" performance on university courses were rather mixed. While they reported that students from 11 of the 19 courses showed significant differences between academic performance and learning styles, no significant differences were found on courses in the liberal arts and social sciences.

Collinson (2000) conducted a study among elementary students to investigate the influence of learning style on academic achievement. The sample of 110 students was selected randomly from grade three, four and five public school students. The researcher used a learning style inventory developed by Dunn and Dunn to assess students" learning styles. Academic achievement of students was based on Stanford Achievement Test (SAT) composite scores obtained from student cumulative folders. A one-way ANOVA was used to measure the relationship between learning style and academic achievement. The results showed significant differences between academic achievement with three out of twenty-two learning style elements. According to Reiff (1992) cited by Wilson (2012), a lack of self-confidence and resentment toward school characterize students who experience repeated failure because educators

consistently prohibit them from utilizing their preferred learning modalities. Understanding how different learning styles might influence science achievement may guide educators in their efforts to raise achievement.

2.8 Research gap identified

Poor performance of students in science subjects in secondary schools is an issue that has been well known and discussed by many people for so long in Ghana. Many research findings have been carried out but performance seems to be dropping in our secondary schools. A number of studies exist on the factors associated with learning. These factors include age, motivation, socio-economic background and many more. One other factor which researchers have not focused much on in Ghana is the correlation between learning styles and academic performance of students in SHS‟s. There have been complaints by the public that the SHS students are performing badly in science and worse in mathematics. This was confirmed by a report by the education minister, Dr. Mathew Opoku-Prempeh in a capacity-building workshop for heads of SHS in Kumasi. He expressed upset with low grade that continue to be scored in SHS Mathematics and Integrated Science by candidates presented for WASSCE (Opoku-Prempeh, 2017). There need be research findings to identify the major reason contributing to this problem and come up with permanent solutions to resolve the matter.

2.9 Learning styles versus teaching styles

The use of the Learning style inventories and similar instruments are commonly used to match students‟ learning styles with learning methods (Hayes & Allinson, 1996). Teaching style consists of patterns of beliefs, needs and behaviours that the teacher expresses towards students (Grasha, 1996). It also reflects a teacher‟s personal

qualities which all together influences the selection of instructional process. Understanding learning styles and the role of learning styles in the teaching/learning process is a key component in effective teaching. Although Guild (2001) asserted that educators are cognizant of the diversity of the learners who populate their classrooms, he acknowledged that, regrettably, they typically maintain a singular approach to teaching. This uniformity in practice negates any benefits of the stated awareness (Guild, 2001). Moreover, educators who maintain a limited understanding of the differences among individual learners are likely to seek one paramount approach as the answer to all teaching and learning (Guild, 2001). Likewise, Evans and Waring (2006) discovered a majority of teachers involved in their study typically utilized an approach based upon transmitting information rather than one specifically geared toward the development of students‟ understanding. According to Sarasin (1999), teaching cannot be successful without knowledge of learning styles and a commitment to matching them with teaching styles and strategies. Utilizing learning style theory in the classroom is extremely beneficial at all educational levels for a variety of reasons.

The idea of linking students‟ learning styles with teaching styles is a widely proposed strategy for teaching. This is the so-called “matching” hypothesis. It suggests that we focus not only on the content of what is to be learnt but on individual learning style characteristics, which should dictate the process of learning (Dunn & Griggs, 2000). Svinicki (1999) states that the more the learner participates in his or her education, the better learning he or she gains. He adds that the theories of learning have developed, from the behaviourist model, in which the learners once were viewed as passive participants in the whole process to the recent cognitive model, in which the learners drive actively the process of learning. In their article, „Using Learning Style

Instruments to Enhance Student Learning", Hawk and Shah (2007, p. 2) confirmed that "one single approach to teaching does not work for every student in the same classroom. Therefore, identifying students" learning styles and matching them with appropriate teaching strategies is significant in language learning". If we do not attend to students´ individual learning style needs. Felder (1996) claims that serious mismatch may occur with unfortunate potential consequences. Such a mismatch between teaching and learning styles causes learning failure, frustration, and demotivation (Peacock, 2001). Studies by Mahlios (2001) and Lovelace (2005) have shown that a match or a mismatch of a teacher"s teaching styles and students" learning styles can influence performance.

An influential school of thought in the literature and practice proposes the notion that an increase in teaching efficiency is associated with matching instructors" teaching style with learning styles. Many researches have shown that when individuals have materials presented to them which match their own style they consistently achieve better results (Banner, 2000). The idea of matching is seen by these proponents as a universal panacea for learning problems (Dunn & Griggs, 2000). Thus, students whose learning styles are not being matched may become confused and fall behind academically and simultaneously lack the confidence and interest to put forth the necessary effort to continue to attempt the learning process (Fine, 2003). Likewise, Felder (1996) noted that, if students are never exposed to instructional approaches that maximize their preferred learning style but are consistently required to utilize a less desirable style, their learning is likely to be compromised due to a significantly raised level of discomfort.

There are many studies that show that success and performance increase when the correct teaching style matches with the right learning style (Holvikivi, 2007). There is strong empirical evidence from various disciplines that learners‟ performance increased when teaching was arranged according to their learning preferences (Dyer & Schumann, 1993; McGlinn, 2003; Sandmire & Boyce, 2004). Therefore, teachers need to take into account the diversity of learning styles in their classrooms in order to benefit all students. Kolb and Kolb (2005) stated that knowing individuals‟ learning styles helps instructors to select the most appropriate learning approaches in different learning contexts.

To provide open access to science learning and encourage a broader spectrum of students to pursue studies in the sciences, teachers, instructors, and faculty must begin to address the diversity of learning styles among students in our classrooms. The success of teachers in bringing about a meaningful learning experience is greatly dependent upon how much they know about how their students learn as well as selecting appropriate teaching strategies according to their needs. For teachers, this would entail an understanding of their own learning styles so they will be more sensitive to the diverse learning styles of students whom they teach (Dawson-Brew & Sey, 2010). Students with different learning styles may process information differently. Teachers need to apply teaching strategies that “speak to” multiple learning styles, so all students have a chance to benefit. The knowledge of student preferred learning styles is vital if teachers or educators are to provide tailored strategies for individual students (Fleming, 1995). Knowing students‟ preferred learning style also helps to overcome the predisposition of many teachers to treat all students in a similar way (Fleming, 1995) as well as motivate teachers to move from

their preferred mode(s) to using others. In so doing, they can reach more students because of the better match between teacher and learner styles (Mlambo, 2011).

When we try to assess teaching style we realize that the instructor possesses a combination of styles that are characteristic for his interaction in the classroom. Consequently, teaching styles can be put into four different clusters. The order of the cluster reflects the perceived importance of the style. Each of the styles also interacts in a predictable way with the learning styles of students and is associated with a set of characteristic behaviour and teaching techniques. According to (Grasha, 1996) several factors influence the teaching style of the instructor. Teaching style, similar to learning style can be modified over time and for different purposes in different classroom context. Among these is the size of the class, subject matter, time pressure (Grasha, 1996).

To sum up, research has shown that both teaching and learning styles are unique and can be identified by specific characteristics associated with each style. Finally, we should be aware of the fact that a student´s learning style can change through time so that what was once preferred may no longer be the student‟s current preferred learning style (Brown, 2003). Thus the emphasis should be put primarily on the manner in which a teacher presents new information.

According to Bastable (2008), information that is delivered in a style that matches a students' learning style promotes understanding that leads to the retention of new information at a conceptual level, while unmatched style may result in surface learning that only leads to memorization (Wittmann-Price & Godshall, 2009). Discounting learning styles can lead to bored, unresponsive class participants, which in turn affect grades and attendance rates, therefore, leading to a loss in satisfaction

(Alkhasaweh, Mrayyan, Docherty, Alashram, & Yosef, 2008). It has also been proved by Drago and Wagner (2004) that students possess diversity in learning styles, which has become their priority, and teachers should effectively deliver the course according to the students‟ needs.

2.10 Educational implications of learning styles

One of the most significant issues in learning to learn is an individual‟s taking the responsibility for his/her own learning. With the shift from an instructional to a learning paradigm, there is growing acceptance that understanding the way students learn is the key to educational improvement. To achieve a desired learning outcome, one should provide teaching interventions that are compatible with the students‟ learning styles. Thus, learning style is a concept that is important not only in shaping teaching practices, but also in highlighting issues that help school administrators think more deeply about their roles in facilitating student learning (Nzesei, 2015). Evidence-based research convincingly suggests that learning is more effective if education is delivered and oriented in a way that matches individuals‟ learning style (Guraya, Guraya, Habib, & Khoshhal, 2013). The individuals should know what their own learning styles are and what characteristics this style has and they should thereby behave according to this style. In this way, the individual can acquire the constantly changing and increasing amount of information without need for the assistance of others. When the learner takes the responsibility of their own learning, they attribute meaning to the process of learning. They develop an understanding of their own form of learning style and become much more satisfied with the environment s/he interacts with. Every opportunity for learning is a chance for him/her. It is in the learner‟s hand to use different ways and develop the learning styles to some extent (Coffield, 2004).

Learning style has an important place in the lives of individuals. When the individual knows their learning style, they will integrate it in the process of learning, and learning will be more easily, fast and be successful. Another advantage of the identification of the own learning style by the student is that it will help the student to become an effective problem solver. The more successful the individual is at solving the problems s/he faces, the more control s/he will take over his/her own life (Biggs, 2001). It is important that individuals receive education in areas suitable for their learning styles. A person educated in an area having no relationship to their learning style may lack confidence and may be unsuccessful and may as a result become frustrated.

The trends of education have changed from a teacher-centered to the student-centered learning in recent years. Therefore, it is essential to identify different learning styles in instruction that match up with students‟ preference. Accepting diversity in learning styles is accepting the belief that all students can learn (Guild, 2001). The purpose of teaching is to facilitate learning and to encourage the learners to learn more effectively. Thomas et al. (2002) show that learning style is important in increasing the understanding and achievement of each subject. Anderson (1993) reported that students‟ performances improved when they were encouraged to use a learning style of their choice. Other studies reported that when students were taught by an approach compatible with their learning, they achieved better in academic performance (Dunn, Honigsfeld & Doolan, 2009) and were more positive towards learning (Penger & Takavcic, 2009).

When the learner takes the responsibility of his/her own learning, s/he attributes meaning to the process of learning. S/he develops an understanding of his/her own

form of learning style and becomes much more satisfied with the environment s/he interacts with. Every opportunity for learning is a chance for him/her. It is in the learner‟s hand to use different ways and develop the learning styles to some extent (Coffield, 2004). Learning style is a common strand, found throughout recent science educational reform recommendations worldwide (Bellone & Czernak, 2001).

Knowledge of learning style also provides information to the student as to why s/he has learnt in a different way than others. It helps to control the process of learning. It is vital because one of the most important signals in learning is to learn to be autonomous, that is, for the individual to take responsibility for his/her own learning. Because of this, s/he should know what learning style is. This has to be part of the learning process to enable the individual to obtain knowledge, which constantly shifts and changes, without any help from others. Briefly, confidence in learning will consistently rise when learners know how to learn. Learning to learn and grasping knowledge in a suitable manner will lessen the need for an overbearing control by teachers. At this point, teachers guide the students.

2.11 The Integrated Science Curriculum

Integrated science is the teaching of science in a way to present scientific ideas as a unified whole (Ajao, 1996). It is a subject that comprises biology, chemistry, physics and partly any other science related subject. Integrated science is a course designed to show the unity, and interrelationship of the distinct areas/fields that make up science. Integrated science syllabus is simply a collection of topic from single science (Abba, 2000).

2.11.1 Rationale for teaching Integrated Science

The senior high school system in the Ghana falls within the second tier of education in the educational process. At this stage in the educational process, a solid scientific foundation should be laid to prepare the students for their chosen career in Tertiary Institutions. The goals of Integrated Science Education as stipulated by the Curriculum Research and Development Division (CRDD), (2010) is that, every citizen of the country needs training in science to be able to develop a scientific mind and a scientific culture. This is the only way by which the country can create a scientific culture toward achieving the country‟s strategic programme of scientific and technological literacy in the shortest possible time. Every citizen of the country needs training in science to be able to develop a scientific mind and a scientific culture. The integrated science syllabus is a conscious effort to raise the level of scientific literacy of all students and equip them with the relevant basic scientific knowledge needed for their own living and secondly, needed for making valuable contributions to production in the country (CRDD, 2010).

2.11.2 Scope of content

The content of the senior high school integrated Science syllabus covers the basic sciences and includes topics in Health, Agriculture and Industry (CRDD, 2010). The course has been designed to offer a body of knowledge and skills to meet the requirements of everyday living and also provide adequate foundation for the study of other subjects and for those who wish to pursue further education and training in science related vocations. The approach in the syllabus is based on themes that students can relate to in their everyday experiences, and to commonly observed phenomena in nature. The basic aim is to enable students to appreciate the links

between seemingly different scientific topics and hence help them to be able to integrate ideas from various scientific sources.

The five themes chosen for this subject were: Diversity of matter, Cycles, Systems, Energy and Interactions These themes encompass a core body of concepts in both the life and physical sciences. This body of concepts has been chosen because it provides a broad based understanding of the environment, and will help build a foundation upon which students can rely for further study. In particular, the relationships between science and technology and the environment are explored under the theme of Interactions. Although the content of the syllabus is organized into five themes, the topics under each theme should not be viewed as separate blocks of knowledge. In general, there are no clear boundaries between these themes. Another feature of the syllabus is the spiral approach. This is characterized by revisiting concepts and skills at different levels with increasing degrees of depth. The spiral approach allows the learning of scientific concepts and skills to be matched to students‟ cognitive development to facilitate gradual mastery of skills.

2.11.3 Organization of the syllabus

The syllabus covers three-year period of Senior High School Education. Each year‟s work embraces the five themes which are: Diversity of Matter, Cycles, Systems, Energy and Interaction of Matter. The five themes form the five sections of the syllabus for each of the three years‟ work. Details of the coverage of the themes are as follows:

Section 1 - Diversity of Matter

Our world has great biological, physical and geological diversity. The study of diversity enables students to appreciate that there is a great variety of living and non-

living things around us and in the world in which we live. They will also recognize that there are common threads that connect all living things and there are unifying factors in the diversity of non-living things that help to classify them. The study of diversity will allow students to appreciate importance of diversity and the necessity of maintaining it.

Section 2 – Cycles

The study of cycles enables students to recognize that there are repeated patterns of change in nature and understand how these patterns arise. Examples of these cycles include the day and night cycle, life cycles of living things and the recycling of resources. Studying these cycles helps humans to predict events and processes and to understand the Earth as a self-sustaining system.

Section 3 - Systems

The study of systems enables students to recognize that a system is a whole consisting of parts that work together to perform a function. There are natural and artificial systems. Examples of systems in nature are the digestive and respiratory systems. Examples of artificial systems are electrical systems. A study of these systems allows humans to understand how they operate and how different parts influence and interact with one another to perform a function vital for life.

Section 4 – Energy

The study of energy enables students to appreciate that energy affects both living and non-living things. It makes change and movement possible in everyday life. There are many forms of energy and one form can be converted to another. Humans use energy in many ways and for many different purposes. Humans are not the only living things that use energy.

Section 5 – Interactions of Matter

The study of interactions enables students to appreciate that the interactions between and within systems helps humans to better understand the environment and their role in it. There are many types of interactions. There are interactions between the living world and the environment at various levels. There are also interactions between forces and objects. At the societal level, the interaction of humans with the environment drives the development of Science and Technology. At the same time, Science and Technology influences the way humans interact with their environment.

2.11.4 Grading procedure

To improve assessment and grading and also introduce uniformity in schools, it is recommended that schools adopt the following WASSCE grade structure for assigning grades on students" test results.

Grade A1: 80 - 100% - Excellent Grade

B2: 70 - 79% - Very Good Grade

B3: 60 - 69% - Good Grade

C4: 55 - 59% - Credit Grade

C5: 50 - 54% - Credit Grade

C6: 45 - 49% - Credit Grade

D7: 40 - 44% - Pass Grade

E8: 35 - 39% - Pass Grade

F9: 34% and below - Fail

2.12 Issue of Learning Style Instruments

Many researchers have critiqued learning style measurements and raised questions about the scientific foundation of these models. Curry (1990) reported that the efficacy of learning style measures was limited by the lack of a convincing theoretical

basis. Although it is widely accepted that individuals have distinct preferences for particular learning styles (Bozionelos, 1997), there has been no clear research evidence showing that a person could be categorised as a particular type of learner on the basis of subjective assessment. This is because learning preferences change depending upon the learner‟s past experience (Cuthbert, 2005). Stahl (1999) questions the usefulness of these measures and asserts that the learning style models on which the instruments are based have very little or nothing to do with creating a positive impact on the person whose learning style is being evaluated and matched to the instructional methods of the model. Many scholars have raised questions about the consistency of learning style preferences and how they could be put under just one category of a learning style and linked to a certain model. According to Coffield et al. (2004), the most frequently used learning style instrument presented by Dunn and Dunn is problematic because the lack of independent research limits psychometric evidence. They suggested further investigation to evaluate the reliability and validity of the measure carried out by external, independent researchers. Coffield et al., (2004) suggested that the Index of Learning Style can be used to encourage oneself to adopt a learning style but cannot be used as a measuring tool. They also believed that the Index of Learning Style is being used inaccurately to label students and recommend learning strategies to them.

One of the more popular instruments used to assess students‟ learning style is the VARK learning style questionnaire. Some of the usability features of the VARK model were investigated by Wehrwein et al., (2007). They concluded that the VARK model encourages teachers to be aware to students‟ differences before making decisions about them, supports the idea of matching teaching methods and students‟ preferences, encourages educators to use a variety of teaching and assessment

techniques, encourages educators to redesign resources and educational environments, and provides an opportunity for students to talk about their learning style with their teachers. The validity and reliability of VARK, however, are yet to be fully verified. Boatman, Courtney and Lee (2008) noted that few studies evaluated the quality of VARK. The limitation associated with the VARK‟s validity and reliability were discussed by Breckler, Joun and Ngo (2009) who proposed that the VARK questionnaire is not a complete inventory as it supplies the users with a simple profile of their sensory learning preferences. It is fair to say that if one is looking for a perfect learning style measurement then there is going to be disappointment. However, there is some evidence from various settings that the use of learning styles can have positive practical applications. While the effectiveness of learning styles is under scrutiny, there is no disputing the fact that students do have learning preferences. For instance, Massa and Mayer (2006) carried out a study which examined this through setting up various measures to assess individuals‟ preferences for receiving instructions one of two ways; either verbally or visually. Results from these measures found significant correlation to the participants‟ self reported preferences, showing that tests can be effective at least in demonstrating personal. Preferences, although it may be just as effective to ask the individual which way they think would work best for them. Furthermore, this study also on to find no significant results that tailoring instructions to the individuals‟ preferences had any effect on how well they carried out they completed the task. Thus, it is clear that while individuals can have a definite preference for learning styles, learning through the preferred style may not result in any increase in learning effectiveness; so buying a test solely for the purpose of identifying preferences may not be in the students‟ or teachers‟ best interests.

2.13 Some other models of learning styles

Learning styles, however, is an umbrella concept bringing together various schools of thought (Butler, 1986) which share the belief that students learn best when they are given the opportunity to learn, deal with information, and communicate in a manner that they feel most comfortable with (Pallof & Pratt, 2003). As a result, diverse models have been developed to explain these individual differences in learning. There are at present 71 models of learning styles (Hall & Moseley, 2005) and many of them have been used effectively in educational research to determine students‟ learning preferences. Below are some other learning style models:

2.13.1 Meyers-Briggs Type Indicator

Perhaps the best known learning style is the Meyers-Briggs Type Indicator (Meyer & McCaulley, (1986) which measures personality traits. The model classifies students along four dimensions which are orientation to life (Extraverted/Introverted), perception (Sensing/Intuitive), decision making (Thinking/Feeling) and attitude to the outside world (Judging/Perception).

The Myers-Briggs Type Indicator (MBTI) is perhaps the most well-known instrument for identifying personality types. The model was created by Isabel Briggs Myers and her mother, Katherine C. Briggs in the 1940's and it was based on the ideas and theories of psychologist Carl Jung, a contemporary of Sigmund Freud and a leading exponent of Gestalt personality theory (Clark, 2000). Their aim was to transfer the model into a form that would be comprehensible and of use to an ordinary person. An instrument for measuring a person‟s preferences uses four basic scales with opposite poles which refer to an individual‟s orientation to life (1) extraversion/introversion,

perception (2) sensing/intuitive, decision making (3) thinking/feeling, and attitude to the outside world. (4) judging/perceiving (Montgomery & Groat, 1998).

2.13.2 Extroversion versus Introversion

These two preferences point to the sources where the individual draws his energy from. Extroverts tend to enjoy social interaction with other students; they like to share their ideas and like to work by trial and error. They might be sometimes too quick to react and their response might not be always right. They enjoy activities where they can get involved. They get discouraged and bored with slow jobs. On the other hand introverts draw their energy from their inner world of ideas or concepts. Introvert students often choose to work alone or in a pair. They need some time for reflection to make sure they understand the concept before they start working on a task. They like to work only on one task at a time and at their own pace. They perform better in written assignments than in oral presentations.

Sensing versus Intuition

The second category describes a way person receives and analyses data from the environment. A sensing person receives data primarily from five senses (sight, hearing, taste, smell, touch). Such students are usually detail oriented, seek facts and are interested in their practical implementation. Sensing people choose traditional ways of solving a task. They seldom use imagination. In class setting sensing students prefer organized, linear, and structured instruction (Clark, 2000). These students learn best by discovery learning where they are asked to uncover general principles. In contrast to sensing students, they become restless with routines, are more imaginative than observant and dislike precise work with many details.

Thinking versus Feeling

Thinking students make impersonal decision based on an analysis of the situation, logic and principle. They are thinking in terms of „true or false". People with such preferences try to be fair, impersonal and impartial. However, sometimes they may hurt other people"s feelings even without knowing it. Facts and theories are important for them. Feeling students take into account human values when making a decision. Their decisions tend to be based on how they might affect other people. Feeling students like working in groups where they feel comfortable. They try to avoid conflicts and seek harmony.

Judging versus Perceptive

The last scale shows how people relate to the world around them. A judging person likes order and structure. He likes to follow a plan and feels uncomfortable in unpredictable environment. He is organized, systematic and self-regimented (Clark, 2000). Judging students always submit their work on time. They may start many tasks but have difficulty in completing them.

Although (MBTI) is primarily a personality model it is believed that our personality plays a crucial part in determining our learning style thus it is important to discuss its impact on the language learning process in general, as different teaching approaches would appeal to different personality profiles.

2.13.3 Kolb's Learning Style Model

Kolb"s learning style model measures how students process information. Students were identified as having a preference for concrete experience (CE) or abstract conceptualization (AC) (how they take information in), and reflective observation (RO) (how they internalize information). According to Kolb"s learning styles, learners

can thus be classified into one of four learning styles, namely, converger, diverger, assimilator, and accommodator, mapped in one of the four quadrants (Kolb, 1986).

- Convergers combine AC and AE. Convergers are best at finding practical use to theories and ideas and are good at solving problems and making decisions. Kolb suggests they prefer dealing with technical tasks than with social and interpersonal issues.
- Divergers combine CE and RO. Divergers are best at viewing concrete situations from different points of view, they prefer brainstorming situations to taking action.
- Assimilators are learners who combine AC and RO. Assimilators are best at understanding a wide range of information and organizing them into concise logical form. They are more interested in abstract ideas and concepts rather than people. They value more of the logical soundness of a theory than its practical value.
- Accommodators are learners who combine the learning steps of CE and AE. Accommodators learn primarily from „hands-on" experience. They prefer to act on feelings rather than on logical analysis. In solving problems, they rely more heavily on people for information than on their own technical analysis.

The principle of Kolb"s learning system is that we all follow four stages of learning as we acquire knowledge, experience and skills. Learning is presented as a cycle. Kolb argues that the learning cycle can begin at any one of the four points and that it should be understood as a continuous spiral. The cycle, however, typically begins with a concrete experience.

2.13.4 The Herman Brain Dominance Instrument

In another model called the Herman Brain Dominance Instrument (Herman, 1990), students were classified into four different modes or quadrants based on the task-specialised functioning of the brain: Quadrant A thinking (left brain, cerebral, that is associated with logical, analytical, quantitative, factual and critical reasoning); Quadrant B thinking (left brain, limbic, that is associated with sequential, organised, planned, detailed and structured reasoning); Quadrant C thinking (right brain, limbic, that is associated with emotional, interpersonal, sensory, kinesthetic and symbolic reasoning); and Quadrant D thinking (right brain, cerebral, that is associated with visual, holistic and innovative reasoning).

Chapter Summary

This chapter presented a review of the available literature that was considered to be of direct relevance to the present study in order to enrich it as well as providing justification for it. The literature review covered the definition of learning style, the theoretical framework of the study, The VAK learning style model, factors that affect academic performance, learning styles versus grade level, learning style versus gender/sex, learning style preference versus academic performance. The chapter also identified the research gap as well as the implications of learning styles in education. The Senior High School Integrated Science curriculum, issues regarding learning style instruments and other learning style models were also reviewed.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Overview

This chapter discusses the study area and the procedures that were followed in conducting the study. The procedures involve the description of the research design, the population, sample and sampling technique, research instruments for data collection and their validity and reliability aspects.

3.1 The study area

The Gomoa East District is one of the seventeen (17) districts in the Central Region of Ghana. Its capital is Gomoa Afransi. The district was carved out of the the Gomoa West District, which has it capital as Apam in 2008 under the Legislative Instrument 1883. It occupies an area of 539.69 square kilometres with a total population of 207,071, comprising 47.5 percent males and 52.7 percent females (Ghana Statistical service PHC, 2010). The district is situated between latitudes 5°14‟ north and 5°35‟ north and longitude 00°22‟ west, and 00°54‟ west. It is located in the south-eastern part of the Central Region. It is bordered by a number of districts, to the north-east by Agona East, south-west by Gomoa West, east by Awutu Senya and Ga south in the Greater Accra Region and to the south by Effutu. The Atlantic Ocean borders the south-eastern part of the district. The proportion of Ghanaians by birth in the District is 89.4 percent. Those who have naturalised constitute one percent and non-Ghanaians 9.8 percent.

3.1.1 Literacy and education

Out of the total district population of 142,877 persons aged 11 years and older, 18.5 percent are non-literates while 81.5 are literates. A little over one-half, (55.4%) are

literate in English and a Ghanaian language while 37 percent are literate in English language only. A little more than six percent (6.3%) are literate in a Ghanaian language only. There are two Public Senior High Schools in the district. These are Potsin T. I. Ahmadiyya SHS (P-AMASS) and Fetehman S.H.S. Majorities of students in these High Schools are indigenes of the district. However, a lot more are also from other urban and rural communities.

3.1.2 Occupation

As high as 33.7 percent of households in the District are engaged in agriculture while 66.3 percent representing are households not engaged in any agricultural activity. In the rural localities, 57.5 percent households are agricultural households while in the urban localities, 12.5 percent of households are into agriculture. Most households in the District (891%) are involved in crop farming. In animal farming, poultry (chicken) is the dominant animal reared in the District

3.1.3 Climate

The district has two main rainfall patterns with the major one occurring between April and July and the minor one between September and November. It also experiences the dry season from December to March but now this pattern of rainfall is changing in duration. Currently, the mean annual rainfall ranges between 70mm and 90mm in the southern coastal belt and between 90mm and 110mm in the north-western semi-deciduous forest areas. The district‟s mean annual maximum and minimum temperatures ranges between 29^{o}C and 26^{o}C which occurs in February to March and August respectively. Its relative humidity is influenced by the presence of large water bodies like the ocean, rivers, lagoons and streams. The relative humidity ranges between 70 percent and 80 percent for the northern and southern sectors of the district

respectively. There are two wind systems namely: the south-western monsoon winds whose direction influences the rainfall pattern and the north-eastern trade winds (dry hamattan winds) which are severe between January and February.

The district falls within the coastal plains. The relief is mostly rising and falling with a number of hills. Generally, it rises from the coastal south to the north with isolated hills and forest dissected plateau in the north. The coastal plains in the south has the Yenku hills which form a broad ridge with a maximum height of 215m; generally, the slope is moderate but becomes steep in a few places. A few rivers and a number of streams make up the drainage system of the district - Ayensu and Brushing Rivers which flow into the sea near the Oyibi lagoon near Winneba and the Apaa lagoon in Apam are some of the major ones. Some of the streams found in the district include Nyanya near Nyanyano and Pompom near Fetteh and Pretu.

3.1.4 Vegetation

There are two vegetation types in the district: the dry coastal savannah and the moist semi-deciduous forest. The coastal savannah consists of grassland with scattered patches of thickets which stretch from Fetteh in the south eastern part of the district to Langma (Dampase) at the eastern edge bordering the Ga South district. The most semi-deciduous forest is found in the northern part of the district - around Afransi, Amoanda and Lome. At the extreme northern and north-western parts near Gomoa Eshiem and Gomoa Takyiam, parts of the vegetation have the semblance of a tropical rain forest. In this part of the district are found most of the cocoa and coffee farms.

3.1.5 Religious affiliation

Eighty-two percent (82.4%) of the population are reported to be Christians (Catholic, Protestant, Pentecostal/Charismatic and other Christian) followed by Islam (10.7%) and Traditionalists (0.4%). About six percent (5.8%) indicated that they had no affiliation to any religion (Ghana Statistical Service, 2010).

3.2 Research Design

Research design is the blueprint for conducting the study that maxim (Barnner & Rayner, 2000). Research design refers to the way a study is planned and conducted, the procedures and techniques employed to answer the research problem or question (McMillan & Schumacher, 1984). Designing a study helps the researcher to plan and implement the study in a way that will help the researcher to obtain intended results, thus increasing the chances of obtaining information that could be associated with the real situation (Burns & Grove, 2001).

The study was carried out using the exploratory survey design. The study was also designed along the lines of a correlation research. Gay (1996) described correlation research as that involving the collection of data in order to determine whether and what degree a relationship exists between two or more quantifiable variables. In correlational studies information is collected without manipulating the environment. Correlational studies are also conducted to demonstrate associations between variables, causality cannot be inferred (Creswell, 2008).

3.3 Study Population

Polit and Hungler (1999) refer to the population as an aggregate or totality of all the objects, subjects or members that conform to a set of specifications. In this study the target population was all Senior High students in the Central Region of Ghana. The

accessible population comprised SHS students of first and second year in the Gomoa East district. The two (2) Senior High schools in the district are Potsin T.I. Ahmadiyyah SHS and Fetehman SHS. Table 1 below shows the population of students in the two public Senior High Schools as at May, 2017.

Table 1: Population of students in the two public Senior High Schools

Name of School	Number of Girls	Number of Boys	Total
Potsin T. I. AMASS	1018	925	1943
Fettehman SHS	413	436	849
Total	1431	1361	2792

Source: Schools‟ statistics (2017)

3.4 Sampling procedure

3.4.1 Sampling for the district

The process of selecting a portion of the population to represent the entire population is known as sampling (Polit & Hungler, 1999). Purposive sampling method was used to select the Gomoa East district. One basic assumption for selection of the district was that, SHS students in the district exhibit more of the observed characteristics of low performance in Integrated Science. Sample drawn from the district could therefore be considered as having similar characteristics, hence the reason for selecting the district.

3.4.2 Sampling for the students

Kothari (1990) defines sampling as the selection of part of an aggregate or totality on the basis on which a judgment of inference about the aggregate or totality is made. It is the process of drawing samples that would be a representative of the population of the study. To secure a sample which subject to limitations of size will produce the

characteristics of the population as closely as possible, stratified random sampling techniques were used to select the subjects into two strata, thus first and second year students. After that lottery method was used to select the subject for the study. The stratified sampling techniques as observed by Gray (2007), allows the researcher to select respondents who will be appropriate for the study. According to Polit and Hungler (1999), sampling helps because it is more economical to choose part of the entire population instead of studying the entire population.

3.5 Sample composition

According to Bulmer (1979), a sample is a subset of subjects that is representative of the entire population and which must have sufficient size to warrant statistical analysis. Brink (1996) asserts that a sample is a subset of a population selected to participate in the study, it is a fraction of the whole, selected to participate in the research project (Brink, 1996). For this study, the study sample comprised of 280 students from the two public SHS in the Gomoa East district. According to Van-Dalen (1979) a survey research should involve at least 10-15% of the accessible population. The 280 sample size selected constituted 10.02% of the accessible population and is in conformity with Van-Dalen (1979). The utilization of the survey design was meant to enable the researcher gather data from a wide variety of respondents than would have been possible with a single case study. Table 2 below shows the breakdown of the sample size for the study.

Table 2: Breakdown of sample size for the study

Name of school	SHS 1		SHS 2		Total
	Male	Female	Male	Female	
Potsin T. I. Ahmass	33	36	45	41	155
Fetehman SHS	30	30	35	30	125
Total	63	66	80	71	280

From Table 2, 155 students were selected from Potsin T. I. Ahmadiyya SHS (P-AMASS) whiles 125 were selected from Fetehman SHS. Out of the 155 from P-AMASS, 77 of them were female students whiles the remaining 78 were male students. Also, out of the total of 125 students who were selected from Fetehman SHS 60 of them were female students whiles 65 were male students. Again, 69 first year students availed themselves at P- AMASS and the remaining 86 were second year students. At Fetehman SHS, the first and second year students selected for the study were 60 and 65 respectively. Stratified random sampling method was employed for the sampling. The researcher believes that, the sample size of 280 would be a good representation of the population.

3.6 Instrumentation

Polit and Hungler (1999, p. 267) define data as „information obtained in a course of a study". According to Hunter and Leahey (2008), the objective of quantitative method in research is to develop and employ mathematical models, theories and hypotheses on the phenomena. In this study, data was collected by using an adapted VAK„s Learning Style Self-assessment questionnaire developed by Chislett and Chapman (2005) and results from Integrated Science Achievement Test (ISAT). Questionnaire is one of the most widely used instruments for collecting data in survey research. Bryman (2004) suggested that the appeal of the questionnaire partly stems from its

cheapness and quickness in terms of administration, the absence of the interviewer effect and its convenience for correspondence. Apart from these advantages, the survey questionnaire also enables one to collect standardized information in respect of the same variables for everyone in the sample selected (Zahari, 2007). This makes the questionnaire an indispensable tool in gathering primary data about people, their behaviour, attitudes, opinions and awareness of specific issues. The VAK questionnaire is practical self-assessment instruments that can help the students assess their unique learning styles (Chislett & Chapman, 2005). The model was developed to evaluate each individual‟s preferred learning style through different sensory channels namely Auditory, Visual, Tactile and Kinesthetic. In the present study the researchers have adapted the model to fit well the ways of learning in traditional classroom settings in the Gomoa East district of Ghana.

In adapting the instrument, changes made included addition of certain questions to suit the research questions of the study, reconstruction of the sentence, rewording, and introduction of content that were relevant to the study and easy to be understood by the students at setting. The questionnaire contained a total of thirty-three (33) questions but divided into two sections. Section A was made up of eight (8) items and Section B, contained twenty-five (25) test items, which dwelt on questions that aided in identifying each student as Visual, Auditory or Kinesthetic learning styles. Also, Integrated Science Achievement Test (ISAT) was administered to students to assess their performance. The ISAT was made up of twenty-five (25) multiple choice questions in areas such as Energy, diversity of matter.

3.6.1 Scoring of the instrument

The questions were structured under two sections. Section A formed the basics of the respondents, which included gender, age, grade level or form, school, and programme. Section B dwelt on the leaning style preference of respondents. The first eight questions were structured for the respondent‟s basics. The remaining 25 items (section B) were based on the respondents‟ learning style preference. The instrument was scored on a three (3) multiple choices which indicate each of the Visual, Auditory and Kinesthetic learning style. The questions were structured in such a way that, all option A‟s indicates Visual, option B‟s indicates Auditory and option C‟s indicates Kinesthetic. Therefore, the number of A‟s, B‟s and C‟s shows the student‟s learning style preference. This made the scoring very easy to statistically identify the preferred learning styles. Each circled answer was awarded 1 point. For instance,

I remember things best by:

a) writing notes or keeping printed details

b) saying them aloud or repeating words and key points in my head

c) doing and practising the activity or imagining it being done

The answer to the above item would merit one mark only. Descriptive statistics was used to analyze the students‟ preferences of the various VAK components, as well as their grade level and gender. Pearson correlation and Chi square test were utilized to explore the correlations between the VAK scores and academic achievement of students.

3.6.2 Description of Integrated Science Achievement Test (ISAT)

Integrated Science Achievement Test (ISAT) was constructed based on topics that students have learnt. Based on the current teaching syllabus for integrated science for senior high school, Diversity of matter is one of the major sections. This section

covers measurement (p.2-3), Diversity of living and non-living things (p. 3-4), Matter (p. 4-5) and Rocks (p.6). From the Integrated Science teachers and also from the pilot test conducted, students have been taught all those topics. The ISAT is a well-structured multiple choice questions made up of twenty (20) questions intended to measure the level of achievements on the lessons treated. Inferential statistics was used to find the correlation between learning styles and the performance in the ISAT.

3.6.3 Pilot testing of the instrument

Before the actual study was done, pilot test was conducted using the LSI and ISAT at Senya Senior High School. Prior to that, permission was sought from the School authorities. The Learning Style Instrument (LSI) was used to categorize students into their various learning styles. The scores of the LSI and that of the ISAT were analyzed using the Pearson‟s Moment Correlation. The results were discussed with a senior lecturer at the Integrated Science Department of the University of Education, Winneba (UEW) for the validity. Also, the coefficient of reliability was done using the Cronbach‟s alpha.

3.7 Data collection procedure

3.7.1 Phase 1

The researcher visited the two schools and made his intentions known to the headmasters of the two schools in the district using the introductory letter by the University (attached in appendix Q). This was to bring about cordial relationship between the researcher and the officials of the schools and discussion on the best way of conducting the research and getting results that will help improve students‟ performance in science.

3.7.2 Phase II

The researcher, with the help of the research assistants employed the stratified sampling technique to put the students into to strata. The first year students formed one stratum and the second year students also formed another stratum. Students in each stratum were then asked to pick cards with inscriptions „yes" or „no". Those who picked cards with inscription „yes" were grouped and the purpose of the inventory was explained to them. The LSI was then giving to the participants for responses. Thereafter, researcher administered the ISAT also to the students for their responses. The students took about twenty-five (25) minutes complete the LSI whereas the completion of the ISAT took about thirty-five (35) minutes.

3.7.3 Phase III

The data collected from the learning style inventory (LSI) were first coded and entered into SPSS where the descriptive statistics was run in accordance with the study objectives. The ISAT was later marked and scores recorded. The purpose of the ISAT was to identify the students" level of achievement, and was compared with the various learning styles scores of the students using the again the Pearson"s moment correlation analysis in the SPSS version 20.0.

3.8 Validity and Reliability of the Instruments

3.8.1 Validity

Validity is defined as the accuracy and meaningfulness of inferences, which are based on the research results (Mugenda & Mugenda, 2003). In other words, it is the degree to which a study tool measures what it purports to measure. Validity is also defined as a measure of truth or falsity of the data obtained through using the research instrument. It is classified as internal and external validity of the measuring

instrument (Burns & Grove, 2001). In this study validity refers to the measure of truth or falsity of whether or not there is a correlation between learning styles of students and their academic performance. The instrument‟s validity can be regarded as the extent to which "the instrument actually reflects the abstract construct being examined" (Burns & Grove 2001, p. 814). A research instrument is valid if its content is relevant and appropriate to research objectives (Eshiwani, 2004).

To ascertain content validity of the instruments, the instruments were given to the academic supervisor at the department of Science Education, UEW, to determine its workability. This consultation was aimed at examining the contents and the structure of the instruments, and judged their adequacy for use in the study. Also, the instrument was given to two Mphil students who were aware of the purpose of the study. The resultant suggestions and recommendations were used to make appropriate amendments to the instruments.

3.8.2 Reliability

Reliability is the degree of consistency with which the instrument measures an attribute (Polit & Hungler 1999). It further refers to the extent to which independent administration of the same instrument yields the same results under comparable conditions (De-Vos, 1998). Reliability is a measure of the degree to which a research instrument yields consistent results or data the same way each time it is used under the same condition with the same subjects (Mugenda & Mugenda, 2003).

The less variation the instrument produces in repeated measurements of an attribute the higher the reliability. In ensuring reliability of the instrument, data obtained from the LSI was subjected a reliability test which recorded a Cronbach‟s alpha value of

0.80. The ISAT also recorded a Cronbach"s alpha value of 0.85. This means that, data obtained using the instruments were all reliable.

3.9 Data analysis and presentation

The purpose of data analysis is to organize, provide structure to, and elicit meaning from research data (Eshiwani, 2004). The collected data was entered, cleaned and analyzed using IBM SPSS version 20.0.

Descriptive statistics was run to get the frequencies to present the number of students with a particular learning style, learning style of boys and girls as well as the form or the grade level of the students. Pearson Product Moment Correlation and Chi square tests were used to find the correlation between learning style and academic performance to show whether a relationship exists and how strong or weak it is by gender and grade level. The difference in the relationships between male and female students was represented statistically using tables.

Chapter summary

This chapter presented the methodology of the study. It described the study area, the research design, population and sample composition. It also provided the instrumentation of the study as well as the validity and reliability of the study. The study used a descriptive research design. The purposive sampling procedures were used to select the sample. The sample consisted of eighty eight (280) respondents. SPSS computer programme was used to analyse data. Questionnaires and achievement test were used to collect data from a sample of 280 SHS students in the district.

CHAPTER FOUR

DISCUSSIONS OF FINDINGS

4.0 Overview

This chapter presents both the descriptive statistics and the inferential statistics (correlation analysis) on respondents learning style and their academic performance. It attempts to answer the research questions raised as guided by the objectives of the study. The analysis was done with the responses of data collected from 280 respondents using variables such as the scores, grade level (form), learning style preference and gender of respondents.

4.1 Gender distribution of respondents

The total respondents for the study were 280 students drawn from the two public SHS"s in the district. The distribution of gender within the study is presented in Table 3.

Table 3: Gender Distribution of Respondents

Gender	Frequency (%)
Male	143(51%)
Female	137(49%)
Total	280 (100%)

Source: SPSS version 20 output, 2017

From Table 3, a total of 143 out of the 280 respondents were males while 137 were females. This means that 51.1 % of total respondents were males and 48.9 % females suggesting an almost 1:1 gender ratio. The collation indicated that a slight majority of respondents were males. However, the result of study is not affected in anyway due to the objectivity of the method used for the analysis. Nevertheless, the males still

outstrip the females in numerical proportions. This observation agrees with that of a similar study conducted in Kenya (Nzesei, 2015).

4.2 Distribution of grade level and gender of the respondents

At the time of collection of data, the SHS 3 students were busily writing their final year WASSCE Examinations. In view of that, data was collected from the first and second year students. The distribution of grade level of respondents is shown in Table 4 below.

Table 4: Crosstab of Grade Level /Forms and Gender

		Gender		Total (%)
		Male	**Female**	
Grade Level	Form 1	63	66	129(46%)
	Form 2	80	71	151(54%)
Total		143(51%)	137(49%)	280(100%)

Source: SPSS version 20 output, 2017

Table 4 shows the form of respondents with respect to their gender distribution. From table 4, the majority of respondents from form one who participated in the study were females. On the contrary, majority of respondents in form two were males. Out of the 151(53.9%) male respondents, 80 representing (53.0%) were males and the remaining 71(47.0%) were females.

4.3 Research question 1

What is the dominant learning style of SHS students in the district?

The emergence of numerous learning style models over the past 25 years has brought increasing attention to the idea that students learn in diverse ways and that one approach to teaching does not work for every student or even most students (Hawk &

Shah, 2007). It is therefore important that determination of the dominant learning style preference of students be conducted. This is to inform how best an instructor or teacher should approach the teaching method. This research question sought to determine the prevailing learning style among the SHS students in the district.

To answer research question 1, statistics on the dominant learning style of students is summarized in Table 5.

Table 5: Summary Statistics of Learning Style Preferences among SHS Students in Gomoa East District

Statistics	Visual	Auditory	Kinesthetic
Mean	12.17213	10.71622	11.22619
Standard Deviation	2.146273	0.899319	1.101491
Kurtosis	-1.30267	-0.6842	0.203724
Skewness	0.13984	-0.21379	-0.51999
Count	122	74	84

According to Tabachnik and Fidell (1996), the normality of data is attained when kurtosis and skewness are between -2 and +2. The computed scores for the learning style preferences fell within the ranges for skewness and kurtosis. Hence, all the observations on learning style preferences were normally distributed signifying the absence of extreme values that has the potential of upsetting the results of the study.

From the findings, the Visual learning style was observed to have recorded the highest standard deviation (2.15), followed by Auditory (1.10) and Kinesthetic (0.899) (Table 5). The lower the standard deviation, the greater the level of unanimity amongst responses of study participants on questionnaire items pertaining to a particular learning style. Based on the foregoing, it stands to reason that that the level of

unanimity of responses amongst study participants was strongest for kinesthetic, followed by Auditory and then Visual learning styles.

Also, the results in Table 5 above show that Visual Learning style recorded the highest mean score of 12.17 ± 2.15 (SD). This was followed by Kinesthetic and Auditory learning styles which respectively recorded means of 11.226 ± 0.899 (SD) and 10.716 ± 1.10 (SD). The foregoing result therefore indicates that Visual learning style was the most dominant learning style amongst the study participants surveyed. This is because the Visual learning style recorded the highest count of 122 and a mean score of 12.17 The second dominant learning style by virtue of registering the second highest count of 84 and a mean score (11.226) was Kinesthetic. Auditory learning was found to be the least preferred learning style among the surveyed participants with a count of 74. In percentages, more students showed dominant preference for the Visual learning style 12(43.6%), followed by the Kinesthetic learning style 84(30.0%) with Auditory learning style registering the lowest proportion 74(26.4 %). These findings agree with assertions by Fleming (1995) who argues that most people possess a dominant or preferred learning style.

The findings of the study are in consonance with a dissertation on a correlation study between learning styles and academic achievement among secondary school students in Kenya which showed that, majority of the students had strong Visual than Auditory and Kinesthetic modalities **(**Nzesei, 2015). Also, Dobson (2009) in assessing relationships between learning style preferences found out that out of the 64 students who participated in the study, respondents disproportionally choose Visual modality (36%), followed by Read/write (28%), Kinesthetic (18%) with Auditory (17%). However, this finding is against the findings by Tachie (2010) on learning style

preference of Junior High School (JHS) students in some selected schools in the greater Accra region of Ghana. His findings rather showed that, majority of the students showed preference for the Auditory leaning style (65%), followed by the Kinesthetic style (25%) and then the Visual learning style (10%). Also, results from Mulalic, Mohd, and Ahmad‟s (2009) study revealed that the students‟ preferred learning style was Kinesthetic. They expressed minor preference for Visual, and Auditory.

From the findings, the poor performance of students in the Gomoa East district (in Integrated Science) may be due to the fact that, most of them are Visual learners but their teachers are mostly known to be using more of the lecture method in teaching (which satisfy the Auditory learner). Therefore, the teaching method does not match majority of the students learning style hence, the low performance in Integrated Science. As Mahlios (2001) and Lovelace (2005) shown that match or a mismatch of a teacher‟s teaching styles and students‟ learning styles can influence performance. Also, researchers indicate that when individuals are aware of how they learn and if teachers respond to individuals‟ strengths and weaknesses, achievement and retention rates tend to improve (Coffield, Moseley, Hall, & Ecclestone, 2004). Therefore, Science teachers should be using more Visual aids and organize more practical lessons to satisfy Visual learners. Besides, the use of Auditory-Visuals materials in science lessons will be helpful. Again, in service training on learning styles should be organized for the science teachers so as to know how their students learn in order to tailor their teachings to the best way students learn.

4.4 Research Question 2

What is the relationship between learning style preference of first and second year students?

The objective for this question was to determine the relationship between learning style preferences of first and second year students. Before answering the research question 2, the distribution of students learning style and the grade level was determined. From the adapted VAK questionnaire administered to the students (n=280), Table 6 below presents the cross tabulation of learning styles of respondents and their grade level distribution.

Table 6: Cross tabulation of Forms and learning style

		Learning styles			**Total**
		Visual	Kinesthetic	Auditory	
Form	SHS 1	60(47%)	31(24%)	38(30%)	129(51.6%)
	SHS 2	62(41%)	53(35%)	36(24%)	151(48.4%)
	Total	122(44%)	84(30%)	74(26%)	280(100%)

Source: SPSS version 20 output, 2017

Table 6 shows that out of 129 respondents from the first year, who participated in the study, 60(46.5%) respondents were used to the Visual learning style, 38(29.5%) were used to Audio learning style and 31(24.0%) were used to the Kinesthetic style. For the second year students, though majority of them were visual 62(41.0%) from the total (n=151), but rather followed by kinesthetic 53(35.0%) and then Auditory 36(24.0%).

The summary of the findings on statistics of academic score of respondents is shown in Table 7

Table 7: Summary statistics of academic scores of first and second year students in the Gomoa East District

Descriptive Statistics	First Year	Second Year
Mean	51.2713	51.6291
Range	64	67
Minimum	23	20
Maximum	87	87

From the results in Table 7, it can be observed that mean academic score of the second year students was almost at par with that of the first year students. This observation seems to suggest that either the first year students were so strong academically or the second year students were not academically stronger than the first year students. This notion is further buttressed by an almost identical range (First year = 64; Second year = 67), minimum (First year = 23; Second year = 20) and maximum scores (First year = 87; Second year = 87).

To determine the relationship between learning style preferences of first year students and second year students, a Pearson product moment correlation test was conducted. Before conducting the analysis, the number of observation for the learning style preferences for the second year students (n = 151) was brought at par with that of the first year students (n = 129). This is because the observations for the second year students exceeded that of the first year students by twenty two (22) observations. This move was necessary to ensure that each observation under one variable (i.e. second year students learning style preferences) can be paired with observations under the other variable (i.e. first year students learning style preferences) under investigation.

Summary of the Pearson moment correlation analysis on learning style preferences of first and second year students are summarized in Table 8 below.

Table 8: Pearson moment correlation analysis on learning style preferences of first and second year students

Statistics	Computed Values	Critical values
Pearson Moment Correlation, r	0.1209	0.117*
N	129	

From table 8, the *r* critical value was found to be 0.117 at a 0.05 significant level. The computed *r*-value was observed to be 0.1209, suggesting a positive correlation between learning style preferences between first year and second year students. Furthermore, since the computed *r*-value (r = 0.1209) was observed to greater than the *r*-critical value ($r_{critical}$ = 0.117), it therefore means that the relationship or correlation between the learning style preferences of first year and second year students in Gomoa East District schools was statistically significant and cannot be due to chance. Perhaps, this finding explains why the two year groups appear to be at par academically as earlier discussed.

This finding is confirmed by the study by Nancy and Roger (2006) who found a statistically significant difference in learning style type for each grade level. The finding is however against a study by Asiry (2014) on learning styles of dental students at King Saud University which concluded that, the learning preference of students remain unchanged from first to final years at College of Dentistry, King Saud University. This means that, students would normally prefer to learn in a variety of ways, with each style of learning having its own strength and weaknesses (Cook, 2000). The above finding further suggests that first year and second year students in Gomoa East District may have similar learning style preferences, which has implications for teaching and learning methods used as far as form is concerned. The

finding therefore presupposes that a learning style that is effective for first year students may by extension be also effective for second year students. Cognitive theory provides educators with an understanding of how students learn and how to design instruction around those methods of learning. Learning according to cognitive theorist is change within the individual‟s mental structure that provides them with the ability to change their outward behaviour (Rivard, 1996). Science teachers should therefore vary their ways of teaching so as to satisfy each learner as they progress up in the educational ladder.

4.5 Research question 3

What is the relationship between learning style preference of male and female students?

This section answers the question on respondents‟ learning style in relation to their gender. This question seeks to determine whether there is any relationship between learning style preferences of males and females. Table 9 presents the summary of cross tabulation of learning styles of respondents and their gender distribution.

Table 9: Crosstab of Learning Style and Gender of Respondents

		Learning styles			Total
		Visual	**Kinesthetic**	**Auditory**	
Gender	Male	43(30%)	30(22%)	28(20%)	137(26.4%)
	Female	79(58%)	54(38%)	46(32%)	143(41.2%)
Total		122(44%)	84(30%)	74(26%)	280 (100%)

Source: SPSS version 20.0 output, 2017.

From Table 9, out of 143 male respondents who participated in the study, 54(38.0%) of them were used to the kinesthetic learning style, 46(32.0%) were used to audio learning style and 43(30.0%) were used to the visual learning style. However, the

female respondents showed more preference in the Visual style 79(58.0%), followed by Kinesthetic 30(22.0%) and then Auditory 28(20.4%).

The academic scores of male and female students in Gomoa East District is summarized in Table 10 below.

Table 10: Summary Statistics of Academic Scores of Male and Female Students in Gomoa East District

Descriptive Statistics	Males	Females
Mean	51.5524	51.0949
Standard Deviation	13.7997	14.2240
Count	143	137

From Table 10, it can be observed that male students registered a mean academic score of 51.55% ± 13.799 (SD), whilst the female students in the study recorded a mean academic score of 51.09 ± 14.224 (SD).

To determine the relationship between learning style preferences of males and females, a Pearson product moment correlation test was conducted. Before conducting the analysis, the number of observations for the learning style preferences for the male students were brought at par with that of the female students (n = 137), as the former exceeded the latter by six (6) observations. This move was necessary to ensure that each observation under one variable could be paired with another observation under the other variable under investigation.

Summary of the Pearson moment correlation analysis on learning style preferences of male and female students are summarized in Table 11 below

Table 11: Pearson Product Moment Correlation between Learning Style Preferences of Male and Female Students

Statistic	Computed values	Critical values
Pearson Product Moment Correlation, *r*	0.0526	0.117*
N	137	

Significant level = 0.05

From table 11, the *r* critical value was found to be 0.117 at 0.05 significant levels. The computed *r*-value was observed to be 0.0526, suggesting a positive correlation between learning style preferences between males and females. However, since the computed *r*-value (0.0526) was observed to be smaller than the *r*-critical value (0.117), it therefore means that the relationship or correlation between the learning style preferences of males and female students in Gomoa East District was statistically insignificant.

This finding parallels with a study that involved physiotherapy students in Faculty of allied Health Sciences, University of Peradeniya, Sri Lanka which showed that the most preferred teaching-learning method among all the students was lectures (61%), followed by practical (27%), self-study (6%) and tutorials (6%). there was no significant difference among male and female students on the preferred VARK mode.

This therefore suggests that males and female students in Gomoa East District may have different learning style preferences; this has implications for teaching and learning methods as far as gender is concerned. The finding therefore presupposes that a learning style that is effective for male students may not necessarily be effective for female students.

4.5.1 Testing the Differences between Learning Styles and Gender

To test the 2nd hypothesis, *"There is no significant difference between learning style preference of male and female students*, a paired *t*-test was conducted. The computed *t*-statistic was found to be 0.0177 ($p = 0.493$, df = 136), a value less than the *t* critical value of 1.656. This therefore means that there is no significant difference between learning style preference of male and female students. We fail to reject the null hypothesis that *there is no significant difference between learning style preference of male and female students*.

This is confirmed by a study in Saudi Arabia by Al-Saud (2013), who examined learning style preference of first year dental students at King Saud University in Riyadh, Saudi Arabia. A total of 113 students participated in the study, of which 42 were female and 71 were males. The researcher found out that gender difference was not statistically significant. On contrary to this, Johnson (1997) examined the learning style preferences of physical education majors an analyzed difference in learning styles. A total of 64 male and 18 female physical education majors participated in the study at a University in the South East of the United States. The Canfield learning style inventory was used to identify students learning style preferences. The result indicated that both male and female students vary from the norm in learning style. It can be concluded that, performance of male and female students may be influenced by a choice of a particular learning style but largely by other factors as well.

4.6 Research question 4

What is the correlation between the students' learning styles and their academic performance in science?

This section presents the correlational analysis between the academic achievement of respondents (scores) and their respective learning styles (Kinesthetic, Auditory and Visual). It further tests the significance of the correlations. This research question seeks to assess the correlation between learning style of students and their academic achievement in Integrated Science in the Gomoa East District. A number of studies have been carried out to determine the correlation between learning style and academic achievement among students (Gappi, 2013; Kopsovich, 2001; Vaishnav & Chirayu, 2013).

To achieve the objective of determining the correlation between learning style and academic achievement among students in the district, the variables needed for the correlation analysis were identified to be: (1) learning style (variable 1); and (2) academic achievement (variable 2). Because the data points (i.e. observations) representing both variables were measured with different scales, it was the considered opinion of the researcher that the fit between the two variables under investigation may be compromised. Consequently, the variables were subjected to data transformation using the logarithmic approach ($\log_{10}$ to be precise). Data transformation helped to narrow the wide variations between the two set of variables. Table 12 below provides a snapshot of a sample of the data points for the two correlation variables prior to data transformation and after data transformation.

Table 12: A snapshot of Observations Subjected to Data Transformation

Before Data Transformation		After Log $_{10}$ Data Transformation	
Learning style	**Academic Achievement**	**Learning style**	**Academic achievement**
16	70	1.20412	1.84510
14	66	1.14613	1.81954
10	76	1.00000	1.88081
9	67	0.95424	1.82607
14	54	1.14613	1.73239

Using the transformed data, a Pearson Product Moment Correlation analysis was conducted. The results are shown in Table 13 below.

Table 13: Pearson Product Moment Correlation between Learning Style and Academic Achievement in Science among students in Gomoa East District

Statistic	Computed values	Critical values
Pearson Product Moment Correlation, *r*	0.09948	0.095*
N	280	

Significant level = 0.05

The *r* critical value at 0.05 was found to be 0.095. The computed *r*-value was observed to be 0.09948, suggesting a positive correlation between learning style and academic achievement. Furthermore, since the computed *r*-value was observed to be greater than the *r*-critical value, it therefore means that the relationship or correlation between the learning style and academic achievement of students in Gomoa East District was statistically significant. In the light of the foregoing, the hypothesis, "*There is no correlation between students learning styles and their academic performance in Science*" is thus rejected.

This finding parallels the findings in the studies of Nzesei (2015), Tachie (2010) and Dobson (2009). Nzesei (2015) dissertation on a correlation study between learning styles and academic achievement among secondary school students in Kenya show that there is a positive relationship between learning styles and academic achievement in all the male and female students. Also, Tachie (2010) found a appositive correlation between learning style preference of Junior High School (JHS) students in some selected schools in the greater Accra region of Ghana and their academic achievement. Again, Dobson (2009) study revealed that, there was a significant different relationship between perceived sensory modality preference and academic performance ($p = 0.06$ by ANOVA). This implies that a respondent‟s score is affected by their choice of learning style.

In contrast, in studies related to the effects of learning styles on achievement in a World Wide Web course, results showed that learning styles had no effect on students‟ achievement or attitude in Web-based instruction (Day, Raven & Newman, 1997; Shih & Gamon, 2002). Results obtained by Drysdale, Ross, and Schulz (2001) on students‟ performance on university courses were rather mixed. While they reported that students from 11 of the 19 courses showed significant differences between academic performance and learning styles, no significant differences were found on courses in the liberal arts and social sciences.

Stake holders in SHS science education should therefore aim at providing enabling environments, as well as auditory-visual materials to increase performance of students in SHS Integrated Science. Also, science teachers should be encouraged to make their lessons as practical as possible to help students understanding. Besides, the Ghana

Education Service (GES) and Senior High School authorities should organize in-service training on learning styles for teachers. This will enlighten them to be able to varying their teaching methods. To add to that, the school authorities fix on the school times table a seminar/talk regarding the importance of the awareness of the learning style of a class at the beginning of every academic year. During the first few weeks of the academic year, a learning style questionnaire must be administered to students. The results of the said answered questionnaire must be disseminated to all teachers for them to be aware of students‟ learning preferences so that they review their teaching strategies to suit the learning styles of their students. When learning styles match a teacher‟s teaching style, effective instruction occurs leading to better understanding of instruction.

Chapter summary

This chapter presented the discussion the findings of the study. The finds the chapter presented showed that, the dominant learning style of students in the district was Visual style, followed by Kinesthetic and then Auditory styles. Also, there was correlation between the learning styles of first and second year students; but, the correlation between male and female students was not significant. Positive correlation also existed between learning style of students and their academic performance. The research findings were discussed based on the already existing findings as well as the research questions and the hypothesis made.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.0 Overview

This chapter presents the summary of findings, conclusions drawn from the study and recommendations made.

5.1 Summary of the key findings

The study was an exploratory survey design. It explored the learning style preference of Senior High School students in the Gomoa East district of the central region of Ghana. It also established the correlation between learning styles of students and their academic performance in Integrated Science as well as the learning style of male and female students. Data was collected using Integrated Science Achievement Test (ISAT) and Learning Style Self-Assessment Questionnaire from a sample of 280 students. The data collected was analyzed using descriptive statistics, Pearson moment correlation, and chi square test using the Statistical Package of Social Sciences (SPSS version 20).

5.1.1 Dominant learning style of students

The SHS students had different learning styles with the Visual learning modality being the dominant learning style. This was followed by the Kinesthetic style and then the Auditory modality. Generally, the learning style of students in the district was high on Visual and low on Auditory styles.

5.1.2 The relationship between learning style preference of first and second year students

Both the first and second year students showed more preference for Visual learning style. The next preference in order in the first year students was Auditory and lastly the kinesthetic style while the next style in order among the second year students was Kinesthetic and then Auditory. There was a positive correlation between learning style of first and second year students (0.1209>0.117).

5.1.3 Difference between learning style of male and female students

The results further revealed that out of 143 male respondents who participated in the study, 54(38.0%) of them were used to the kinesthetic learning style, 46(32.0%) were used to audio learning style and 43(30.0%) were used to the visual learning style. However, the female respondents showed more preference in the Visual style 79(58.0%), followed by Kinesthetic 30(22.0%) and then Auditory 28(20.4%). It was concluded that, the difference between the learning styles of male and females is statistically insignificant (0.0526 < 0.117).

5.1.4 Correlation between learning style and academic performance of students

There was a significant difference between learning style of the students and their academic performance. There was a positive correlation between learning style and their academic performance of students in science (0.09948 > 0.095).

5.1.5 Implications of the findings

Science learning should be viewed as an active process of construction of knowledge as a meaningful whole. Several studies carried out in the recent past indicate that, for students to construct meaningful knowledge in the sciences, the teaching approach should match the learning style of students. The findings of this study imply that a lot

has to be done in our secondary schools in order to raise the performance standards of students in science. To begin with, the government and the society at large must ensure that schools are well equipped with the necessary materials that they require for effective implementation of the curriculum. Use of audio-visuals, designing of hands-on materials, use of charts and modification of teaching methods that satisfy students‟ learning styles will eventually increase performance in science. In-service training for teachers and students should also be carried out regularly throughout the country so as to equip them in learning style concepts. This will enable teachers to modify their methods of teaching.

5.2 Conclusion

This study showed that, the dominant learning style of the students in the district was the Visual style, followed by the Kinesthetic and the Auditory style was the least. Science teachers should incorporate more of pictures, diagrams, videos in their lessons. It was also found that there was a positive correlation between learning style of first and second year students and that teachers should know how to handle their lessons as students move from one level to another. However, there was no correlation between learning style of male and female students but, significant difference existed between learning styles of students and their academic performance in science. Teachers in the two schools should know that the ways in which their students learn vary greatly therefore, the methods of teaching should be varied as well to suit each individual‟s style.

Since most students in the district showed more preference for the Visual learning style, it could be concluded that, teachers‟ styles of teaching do not match these students‟ style of learning (Visual). This could be one of the causes of poor

performance of students in the area. Science teachers should minimize lecture methods in their lessons and focus more on valid methods such as the use of videos, animations, charts and more importantly practical lessons.

The two Senior High Schools in the district must look into the development of their facilities and equipment such as laboratories and projectors and encourage teachers to make use of them for more effective learning to take place. Individual students have particular strengths and weaknesses which can be built upon and enhanced through effective instruction. Project-based learning with audio-visual materials will be a powerful way to make students take hold of their learning and become more independent learners.

5.3 Recommendations

The following recommendations were provided:

The school authorities may provide a seminar/talk regarding the importance of the awareness of the learning style of a class. During the first few weeks of the academic year, students must be administered with a learning style questionnaire. The responses given by students must be disseminated to all the teachers to review their teaching strategies to suit the learning styles of the students.

Teachers should be aware of students‟ learning styles and vary their teaching strategies to be able to meet the needs of all students. Practical lessons should go on each week alongside the theoretical aspect, and this should continue from the first year till the students complete.

The schools should ensure that, their facilities such as libraries, science laboratories, ICT laboratories are well equipped with audio-visual equipment and encourage teachers and students to make use of them.

The Schools‟ Authorities should organize in - service training on learning styles for teachers. This will enlighten them on how their students learn. This will enable them to be able to vary their teaching methods to suit majority of the students.

Suggestions for future studies

It is recommended that, this study is replicated in other areas to cover the entire region to be able to determine the dominant learning style of SHS students in the region. Besides, further research need to be conducted to examine the relationship between teaching and learning styles and how both contribute to academic performances of students.

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APPENDICES

Appendix A

Table 1: Population of students in the two public Senior High Schools

Name of School	Number of Girls	Number of Boys	Total
Potsin T. I. AMASS	1018	925	1943
Fettehman SHS	413	436	849
Total	1431	1361	2792

Source: School‟s statics (2017)

Appendix B

Table 2: Breakdown of students sample size

Name of school	SHS 1		SHS 2		Total
	Male	Female	Male	Female	
Potsin T. I. Ahm.	33	36	45	41	155
Fetehman SHS	30	30	35	30	125
Total	63	66	80	71	280

Appendix C

Table 3: Gender Distribution of Respondents

Gender	Frequency (%)
Male	143(51%)
Female	137(49%)
Total	280 (100%)

Source: SPSS version 20 output, 2017

Appendix D

Table 4: Crosstab of Form and Gender

		Gender		Total (%)
		Male	Female	
Grade Level	Form 1	63	66	129(46%)
	Form 2	80	71	151(54%)
Total		143(51%)	137(49%)	280(100%)

Source: SPSS version 20 output, 2017

Appendix E

Table 5: Summary Statistics of Learning Style Preferences among SHS Students in Gomoa East District

Statistics	Visual	Auditory	Kinesthetic
Mean	12.17213	10.71622	11.22619
Standard Deviation	2.146273	0.899319	1.101491
Kurtosis	-1.30267	-0.6842	0.203724
Skewness	0.13984	-0.21379	-0.51999
Count	122	74	84

Source: SPSS version 20 output, 2017

Appendix F

Table 6: Cross tabulation of Forms and learning style

		Learning styles			Total
		Visual	Kinesthetic	Auditory	
Form	SHS 1	60(47)	31(24%)	38(30%)	129(51.6%)
	SHS 2	62(41%)	53(35%)	36(24%)	151(48.4)
	Total	122(44%)	84(30%)	74(26%)	280(100%)

Source: SPSS version 20 output, 2017

Appendix G

Table 7: Summary statistics of academic scores of first and second year students in Gomoa East District

Descriptive Statistics	First Year	Second Year
Mean	51.2713	51.6291
Range	64	67
Minimum	23	20
Maximum	87	87

Appendix H

Table 8: Pearson Product Moment Correlation between Learning Style Preferences of First and Second Year Students

Statistics	Computed Values	Critical values
Pearson Moment Correlation, r	0.1209	0.117*
N	129	

Significant level = 0.05

Appendix I

Table 9: Crosstab of Learning Style and Gender of Respondents

	Learning styles			Total
	Visual	Kinesthetic	Auditory	
Male	43(30%)	30(22%)	28(20%)	137(26.4%)
Female	79(58%)	54(38%)	46(32%)	143(41.2%)
Total	122(44%)	84(30%)	74(26%)	208(100%)

Source: SPSS version 20 output, 2017

Appendix J

Table 10: Summary Statistics of Academic Scores of Male and Female respondents

Descriptive Statistics	Males	Females
Mean	51.5524	51.0949
Standard Deviation	13.7997	14.2240
Count	143	137

Appendix K

Table 11: Pearson Product Moment Correlation between Learning Style Preferences of Male and Female Students

Statistic	Computed values	Critical values
Pearson Product Moment Correlation, *r*	0.0526	0.117*
N	137	

Significant level = 0.05

Appendix L

Table 12: A snapshot of Observations Subjected to Data Transformation

Before Data Transformation		After Log $_{10}$ Data Transformation	
Learning style	**Academic Achievement**	**Learning style**	**Academic achievement**
16	70	1.20412	1.84510
14	66	1.14613	1.81954
10	76	1.00000	1.88081
9	67	0.95424	1.82607
14	54	1.14613	1.73239

Appendix M

Table 13: Pearson Product Moment Correlation between Learning Style and Academic Achievement in Science among students in Gomoa East District, Ghana

Statistic	**Computed values**	**Critical values**
Pearson Product Moment Correlation, *r*	0.09948	0.095*
N	280	

Significant level = 0.05

Appendix N

THE ADAPTED VAK LEARNING STYLE QUESTIONNAIRE

UNIVERSITY OF EDUCATION, WINNEBA

SCIENCE DEPARTMENT OF SCIENCE

VAK LEARNING STYLES SELF-ASSESSMENT QUESTIONNAIRE

This is an adapted VAK questionnaire. It was originally developed by Chislett & Chapman, (2005). It is designed to help identify students‟ leaning styles. There is no right or wrong style. The point is that there are types of learning styles that suit the way you learn well. You are therefore kindly required to answer the questions below. The information provided is purely for academic purposes and your responses will be confidential. Thank you.

There are two sections, section A and Section B.

Please Tick (√) For Answers in Section A, and Circle The Right Option that Best Describes you.

Section A

Basics

1. Sex [ ] male [ ] female
2. Age (please tick one)
   [ ] 16, [ ] 17, [ ] 18, [ ] 19, [ ] 20,
3. School
   [ ] P - AMASS [ ] Fetehman SHS
4. Level / Form [ ] first year [ ] Second year
5. Program
   [ ] Business [ ] Science, [ ] General Art, [ ] Technical, [ ] Visual Art

6. Which of these core subjects do you like best?

   English [ ], Maths [ ], Integrated Science [ ], Social studies [ ]

7. When was your last test in integrated science?

   [ ] 1-2 weeks ago [ ] 3-4 weeks ago [ ] 4-6 weeks ago

8. What was your performance in your last test in Integrated Science?

   [ ] Very good [ ] Somehow good [ ] Poor

Section B

Circle the answer that best describe your actions

(It‟s best to complete the questionnaire before reading the accompanying explanation)

1. When I operate new equipment I generally:
   d) read the instructions first
   e) listen to an explanation from someone who has used it before
   f) go ahead and have a go
2. When I need directions for travelling I usually:
   a) look at a map
   b) ask for spoken directions
   c) follow my nose and find my way out
3. When I cook a new dish, I like to:
   a) follow a written recipe
   b) call a friend for an explanation
   c) follow my instincts, testing as I cook
4. If I am learning for exams, I tend to:
   a) Write learned points in my jotter before it sticks in my mind
   b) Say learned item aloud or have a discussion before it sticks
   c) I move around, chew gum whiles memorise before it sticks
   d) demonstrate first, move around before it sticks
5. I tend to say:
   a) watch how I do it

b) listen to me explain

c) you have a go

6. During my free time I most enjoy:

a) watching galleries

b) listening to music and talking to my friends

c) playing game, or moving around

7. When I go shopping for clothes, I tend to:

a) imagine what they would look like on

b) discuss them with the shop staff

c) try them on and test them out

8. When I am choosing a holiday I usually:

a) read lots of brochures

b) listen to recommendations from friends

c) imagine what it would be like to be there

9. When I am learning a new skill, I am most comfortable:

a) watching what the teacher is doing

b) talking through with the teacher exactly what I‟m supposed to do

c) giving it a try myself and work it out as I go

10. If I am choosing food off a menu, I tend to:

a) imagine what the food will look like

b) talk through the options in my head or with my partner

c) imagine what the food will taste like

11. When I listen to a band, I can‟t help:

a) watching the band members and other people in the audience

b) listening to the lyrics and the beats

c) moving in time with the music

12. When I concentrate, I most often:

a) focus on the words or the pictures in front of me

b) discuss the problem and the possible solutions in my head

c) move around a lot, fiddle with pens and pencils and touch things

13. I choose household furnishings because I like:

a) their colours and how they look

b) the descriptions the sales-people give me

c) their textures and what it feels like to touch them

14. My first memory is of:
    a) looking at something
    b) being spoken to
    c) doing something
15. When I am anxious, I:
    a) Visualise the worst-case scenarios
    b) talk over in my head what worries me most
    c) can't sit still, fiddle and move around constantly
16. I feel especially connected to other people because of:
    a) how they look
    b) what they say to me
    c) how they make me feel
17. When I have to revise for an exam, I generally:
    a) write lots of revision notes and diagrams
    b) talk over my notes, alone or with other people
    c) imagine making the movement or creating the formula
18. If I am explaining to someone I tend to:
    a) show them what I mean
    b) explain to them in different ways until they understand
    c) encourage them to try and talk them through my idea as they do it
19. I really love:
    a) watching films, photography, looking at art
    b) listening to music, the radio or talking to friends
    c) taking part in sporting activities, eating fine foods and wines or dancing
20. Most of my free time is spent:
    a) watching television
    b) talking to friends
    c) doing physical activity or making things
21. I find it easiest to remember:
    a) faces
    b) names
    c) things I have done

22. When I meet an old friend:
    a) I say “it‟s great to see you!”
    b) I say “it‟s great to hear from you!”
    c) I give them a hug or a handshake
23. I remember things best by:
    a) writing notes or keeping printed details
    b) saying them aloud or repeating words and key points in my head
    c) doing and practising the activity or imagining it being done
24. I tend to say:
    a) I see what you mean
    b) I hear what you are saying
    c) I know how you feel
25. I understand science lessons well
    a) When the teacher uses videos or chats
    b) When I discuss with my mates
    c) When I perform experiments

Thank you.

Now add up how many A‟s, B‟s and C‟s you selected.

A‟s = B‟s = C‟s =

If you chose mostly A‟s you have a **VISUAL** learning style.

If you chose mostly B‟s you have an **AUDITORY** learning style.

If you chose mostly C‟s you have a **KINAESTHETIC** learning style.

Some people have a very strong preference; other people have a more even mixture of two or less commonly, three styles.

Appendix O

INTEGRATED SCIENCE ACHIEVEMENT TEST (ISAT)

FOR

SHS 1 AND SHS 2 STUDENTS

NAME… …….. SCHOOL…….

Answer all questions

(Circle the Correct Option)

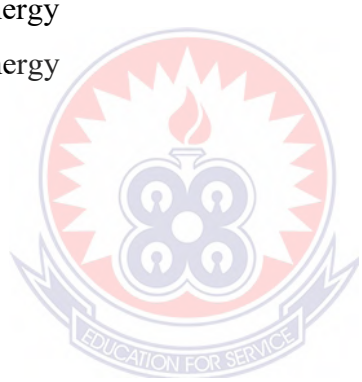
1. The study of micro-organisms is called
    a. Microbiology
    b. Cytology
    c. Zoology
2. Which of the following is not a property of non living things?
    a. They do not have cells
    b. They undergo respiration
    c. They feed
3. the ability of living things to detect changes in the condition inside and around them and hence respond to stimuli accordingly is known as
    a. movement
    b. excretion
    c. irritability
4. Classification of living things was started by
    a. John Dalton
    b. Gregor Mendel
    c. Aristotle
5. An example of a prokaryotes is
    a. Bacteria
    b. Virus
    c. Protozoa
6. The sum of the number of protons and neutrons in the nucleus of an atom is called……
    a. Atomic number
    b. Proton number

c. Mass number

7. Atoms of the same number of protons but different mass number are called ….
   a. Allotropes
   b. Isotopes
   c. Cellotapes
8. The mass of one mole of every substance is known as …..
   a. Mole
   b. Mass number
   c. Molar mass
9. How many moles are there in 5.85g of NaCl?
   a. 0.1 mol
   b. O.2mol
   c. 1.0mol
10. What is the mass of 0.5M NaOH in 500cm^3 NaOH solultion
    a. 20g
    b. 10g
    c. 0.1g
11. Which of the following is not a property of igneous rocks
    a. They are shiny
    b. They are very hard
    c. They are stratified
12. Rocks that are formed from accumulation of sediments due to heat and pressure is known as
    a. Igneous rocks
    b. Sedimentation rocks
    c. Metamorphic rocks
13. The process in which rocks breakdown into smaller particles is known as
    a. Soil formation
    b. Weathering of rocks
    c. Whethering of rocks
14. Which of the following is an agent that can cause biological weathering?
    a. Hydration
    b. Hydrolysis
    c. Roots of plants

15. Which of the following is an example of chemical weathering
    a. Oxidation
    b. Construction of roads
    c. Erosion
16. The mass per unit volume of a body is known as ….
    a. Pressure
    b. Weight
    c. Density
17. The SI unit of Density is
    a. Kg/cm^3
    b. Kg/m^3
    c. kg/m^3
18. Calculate the density of a body with the mass of 5g and a volume of $10cm^3$.
    a. 2 kg/cm^3
    b. 0.5 g/cm^3
    c. 0.5 g/m^3
19. The ratio of density of substance to the density of water is called …..
    a. Ratio density
    b. Relative density
    c. Irregular density
20. When two liquids of different densities are mixed, the liquid with the higher density will be
    a. On top
    b. down
    c. none of the above
21. The SI unit of Energy is
    a. Power
    b. Joules
    c. Watt
22. Pick the odd one out
    a. Electrical energy
    b. Potential energy
    c. Kinetic energy

23. Calculate the kinetic energy of a body of mass 12.0g travelling with a velocity of 5m/s.
    a. 1.5J
    b. 150J
    c. 0.15J
24. Calculate the potential energy of a body of mass 0.12kg with a height of 5m above the ground level. (Take g=10ms^{-2})
    a. 3.0J
    b. 6.0J
    c. 60.0J
25. The energy possessed by a body by virtue of its motion is known as
    a. Potential energy
    b. Kinetic energy
    c. Motion energy



Thank you.

Appendix P

The Original VAK Learning Styles Self-Assessment Questionnaire

VAK Learning Styles Self-Assessment Questionnaire VAK Test

It‟s best to complete the questionnaire before reading the accompanying explanation.

Circle or tick the answer that most represents how you generally behave.

1. When I operate new equipment I generally:
   a) read the instructions first
   b) listen to an explanation from someone who has used it before
   c) go ahead and have a go, I can figure it out as I use it
2. When I need directions for travelling I usually:
   a) look at a map
   b) ask for spoken directions
   c) follow my nose and maybe use a compass
3. When I cook a new dish, I like to:
   a) follow a written recipe
   b) call a friend for an explanation
   c) follow my instincts, testing as I cook
4. If I am teaching someone something new, I tend to:
   a) write instructions down for them
   b) give them a verbal explanation
   c) demonstrate first and then let them have a go
5. I tend to say:
   a) watch how I do it
   b) listen to me explain
   c) you have a go
6. During my free time I most enjoy:
   a) going to museums and galleries
   b) listening to music and talking to my friends
   c) playing sport or doing DIY
7. When I go shopping for clothes, I tend to:
   a) imagine what they would look like on

b) discuss them with the shop staff

c) try them on and test them out

8. When I am choosing a holiday I usually:

a) read lots of brochures

b) listen to recommendations from friends

c) imagine what it would be like there

9. If I was buying a new car, I would

a) read reviews in newspapers and magazines

b) discuss what I need with my friends

c) test-drive lots of different types

10. When I am learning a new skill, I am most comfortable:

a) watching what the teacher is doing

b) talking through with the teacher exactly what I‟m supposed to do

c) giving it a try myself and work it out as I go

11. If I am choosing food off a menu, I tend to:

a) imagine what the food will look like

b) talk through the options in my head or with my partner

c) imagine what the food will taste like

12. When I listen to a band, I can‟t help:

a) watching the band members and other people in the audience

b) listening to the lyrics and the beats

c) moving in time with the music

13. When I concentrate, I most often:

a) focus on the words or the pictures in front of me

b) discuss the problem and the possible solutions in my head

c) move around a lot, fiddle with pens and pencils and touch things

14. I choose household furnishings because I like:

a) their colours and how they look

b) the descriptions the sales-people give me

c) their textures and what it feels like to touch them

15. My first memory is of:

a) looking at something

b) being spoken to

c) doing something

16. When I am anxious, I:
    a) visualise the worst-case scenarios
    b) talk over in my head what worries me most
    c) can‟t sit still, fiddle and move around constantly
17. I feel especially connected to other people because of:
    a) how they look
    b) what they say to me
    c) how they make me feel
18. When I have to revise for an exam, I generally:
    a) write lots of revision notes and diagrams
    b) talk over my notes, alone or with other people
    c) imagine making the movement or creating the formula
19. If I am explaining to someone I tend to:
    a) show them what I mean
    b) explain to them in different ways until they understand
    c) encourage them to try and talk them through my idea as they do it
20. I really love:
    a) watching films, photography, looking at art or people watching
    b) listening to music, the radio or talking to friends
    c) taking part in sporting activities, eating fine foods and wines or dancing
21. Most of my free time is spent:
    a) watching television
    b) talking to friends
    c) doing physical activity or making things
22. When I first contact a new person, I usually:
    a) arrange a face to face meeting
    b) talk to them on the telephone
    c) try to get together whilst doing something else, such as an activity or a meal
23. I first notice how people:
    a) look and dress
    b) sound and speak
    c) stand and move

24. If I am angry, I tend to:
    a) keep replaying in my mind what it is that has upset me
    b) raise my voice and tell people how I feel
    c) stamp about, slam doors and physically demonstrate my anger
25. I find it easiest to remember:
    a) faces
    b) names
    c) things I have done
26. I think that you can tell if someone is lying if:
    a) they avoid looking at you
    b) their voices changes
    c) they give me funny vibes
27. When I meet an old friend:
    a) I say "it"s great to see you!"
    b) I say "it"s great to hear from you!"
    c) I give them a hug or a handshake
28. I remember things best by:
    a) writing notes or keeping printed details
    b) saying them aloud or repeating words and key points in my head
    c) doing and practising the activity or imagining it being done
29. If I have to complain about faulty goods, I am most comfortable:
    a) writing a letter
    b) complaining over the phone
    c) taking the item back to the store or posting it to head office
30. I tend to say:
    a) I see what you mean
    b) I hear what you are saying
    c) I know how you feel

Now add up how many A"s, B"s and C"s you selected.

A"s = B"s = C"s =

If you chose mostly A"s you have a **VISUAL** learning style.

If you chose mostly B"s you have an **AUDITORY** learning style.

If you chose mostly C"s you have a **KINAESTHETIC** learning style.

Some people find that their learning style may be a blend of two or three styles, in this case read about the styles that apply to you in the explanation below and consider how this might help you to identify learning and development that best meets your preference(s).

Someone with a **Visual** learning style has a preference for seen or observed things, including pictures, diagrams, demonstrations, displays, handouts, films, flip-chart, etc. These people will use phrases such as „show me", „let"s have a look at that" and will be best able to perform a new task after reading the instructions or watching someone else do it first. These are the people who will work from lists and written directions and instructions.

Someone with an **Auditory** learning style has a preference for the transfer of information through listening: to the spoken word, of self or others, of sounds and noises. These people will use phrases such as „tell me", „let"s talk it over" and will be best able to perform a new task after listening to instructions from an expert. These are the people who are happy being given spoken instructions over the telephone, and can remember all the words to songs that they hear!

Someone with a **Kinaesthetic** learning style has a preference for physical experience - touching, feeling, holding, doing, practical hands-on experiences. These people will use phrases such as „let me try", „how do you feel?" and will be best able to perform a new task by going ahead and trying it out, learning as they go. These are the people who like to experiment, hands-on, and never look at the instructions first!

People commonly have a main preferred learning style, but this will be part of a blend of all three. Some people have a very strong preference; other people have a more even mixture of two or less commonly, three styles. When you know your preferred

learning style(s) you understand the type of learning that best suits you. This enables you to choose the types of learning that work best for you. There is no right or wrong learning style. The point is that there are types of learning that are right for your own preferred learning style. Please note that this is not a scientifically validated testing instrument – it is a free assessment tool designed to give a broad indication of preferred learning style(s).