

UNIVERSITY OF EDUCATION, WINNEBA



**INVESTIGATING THE RELATIONSHIP BETWEEN LEARNING STYLES
AND ACADEMIC PERFORMANCE IN INTEGRATED SCIENCE AT
MAYERA AND KATAPOR M/A JHS**



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AND ACADEMIC PERFORMANCE IN INTEGRATED SCIENCE AT
MAYERA AND KATAPOR M/A JHS**



**A dissertation submitted to the school of graduate studies in
partial fulfilment of the requirement for the award of
the degree of Master of Education
(Science Education)**

**Department of Science Education
Faculty of Science Education**

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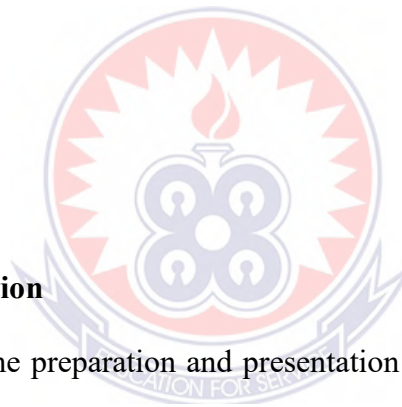
DECLARATION

Student's Declaration

I, **Miriam Ocloo**, 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 in this university or elsewhere.

SIGNATURE:

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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/dissertation/project as laid down by the University of Education, Winneba.

NAME OF SUPERVISOR: Prof. Charles Kwesi Koomson

SIGNATURE:

DATE:

DEDICATION

This dissertation is dedicated to my kids and family.



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I wish to express my deepest gratitude to the Almighty God for His guidance, strength, and grace throughout the journey of this dissertation. His presence has been my anchor in moments of uncertainty and fatigue.

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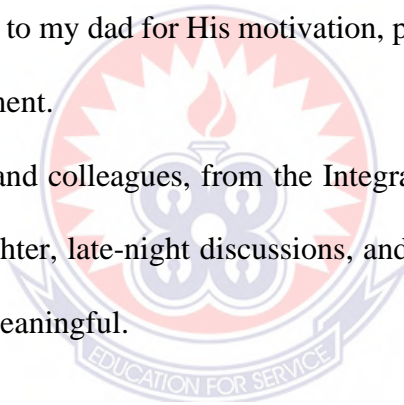
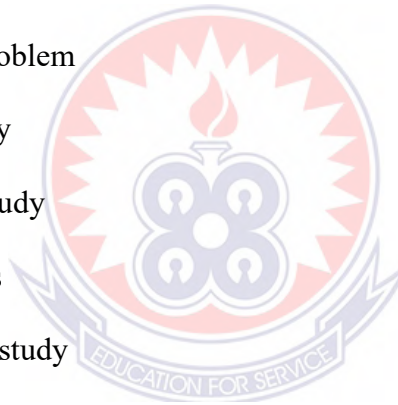


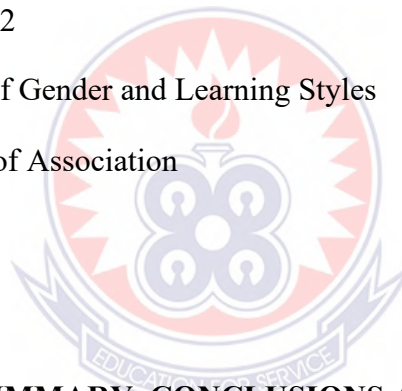
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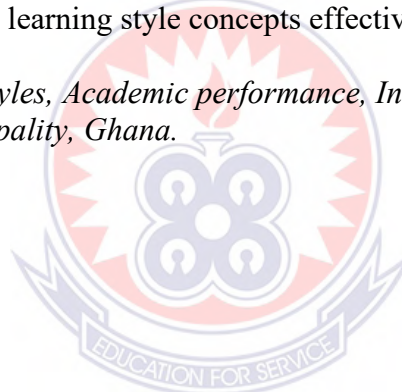
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ABSTRACT

The persistent low performance of Ghanaian students in Integrated Science has generated national concern among educators and policymakers. This study examined the relationship between learning styles and academic achievement in Integrated Science among Junior High School students in the Ga West Municipality of the Greater Accra Region, Ghana. A correlational research design was employed to determine the extent of association between students' learning style preferences and their performance in Integrated Science. Data were obtained through structured questionnaires and achievement scores. The study revealed that the dominant learning style among students was the visual style, followed by Kinaesthetic and auditory styles. No statistically significant difference was found between the learning style preferences of male and female students. However, a positive correlation existed between learning style preferences and academic performance in Integrated Science. The findings indicate that aligning teaching methods with students' preferred learning styles can enhance comprehension and academic outcomes in science education. The study recommends that teachers adopt instructional approaches that accommodate diverse learning styles and that educational authorities provide adequate teaching resources, including audio-visual aids and laboratory facilities, to support experiential learning. Regular in-service training should also be organized to equip teachers with pedagogical strategies that integrate learning style concepts effectively.

Keywords: *Learning styles, Academic performance, Integrated Science, correlational study, Ga West Municipality, Ghana.*



CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Learning styles are commonly used in educational psychology to describe theories that explain the different ways individuals prefer to receive, process, and retain information (Pashler et al., 2008). These theories suggest that learners vary significantly in how they approach learning tasks; while some prefer visual methods such as diagrams and charts, others favour auditory methods like listening and discussion, and some learn best through kinesthetic or hands-on activities. The concept of learning styles gained significant popularity during the 1970s and has since influenced educational practice worldwide (Coffield et al., 2004). During this period, educators increasingly embraced the idea that understanding students' preferred ways of learning could improve teaching effectiveness. Frameworks such as the VAK (Visual, Auditory, Kinesthetic) model became widely used, with proponents like Honey and Mumford (1986) encouraging teachers to assess learners' preferences and adapt their instructional methods accordingly.

However, the application of learning styles in education remains a subject of ongoing academic debate. Scholars such as Kirschner and van Merriënboer (2013) and Newton (2015) argue that the widespread educational use of learning-style classifications often exceeds the available scientific evidence. Similarly, Rogowsky et al. (2015) found that while learners may identify preferred learning modalities, these preferences do not always translate into improved academic outcomes when instruction is strictly matched to them.

Despite these criticisms, individual differences in learning approaches are widely acknowledged as critical to effective education. Entwistle and McCune (2004) emphasize that students differ considerably in how they study, solve problems, and engage with educational content, employing diverse strategies such as note-taking, highlighting, or practical experimentation. Understanding these differences can support more effective learning by helping educators design instructional approaches that accommodate varied learner needs (Cuevas, 2015). Furthermore, Murphy (2004) highlights that frameworks like VAK can help learners recognize their strengths, while Dunn and Griggs (2000) stress that acknowledging learner diversity is essential for improving the overall classroom climate and student achievement.

In science education specifically, learning preferences play a particularly vital role. Integrated Science is a subject that requires students to engage with abstract concepts, practical experiments, visual models, and theoretical explanations simultaneously. Felder and Silverman (1988) note that some learners process information more effectively through visual means, while others benefit from verbal or experiential learning opportunities. Brown (2003) argues that students are more likely to succeed academically when instructional strategies align with their learning preferences, especially in conceptually demanding subjects. Therefore, a reliance on only one instructional mode such as the traditional teacher-centred lecture approach may disadvantage certain learners and hinder their comprehension of scientific principles.

Additionally, research has shown that sociocultural and demographic factors may shape these learning preferences. Charlesworth (2008) found that cultural background can influence how learners engage with instructional materials, suggesting that educational strategies should be responsive to contextual differences. This makes localized studies on learning styles highly relevant.

Although substantial international research exists on learning styles, relatively few studies have explored this concept within the Ghanaian educational context, particularly at the Junior High School (JHS) level. Tachie (2010), in one of the limited local studies, found that organizing students according to their preferred learning styles improved science performance in selected Basic Schools in the Greater Accra Region. Given the persistent poor performance of many students in Integrated Science at the basic school level, understanding the role of learning styles may provide valuable, context-specific insights for improving instructional practices. Therefore, this study seeks to investigate the relationship between learning styles and academic achievement in Integrated Science among JHS students at Mayera and Katapor M/A JHS in the Ga West Municipality, aiming to contribute to the knowledge base on learner diversity and inform more effective science teaching strategies.

1.2 Statement of the Problem

Integrated Science is a core subject in the Basic Education Certificate Examination (BECE), making it crucial for students' progression to Senior High School (SHS). Despite its importance, persistent poor performance in the subject remains a major national concern. Chief examiners' reports, including observations by Fletcher (2016), highlight a downward trend in JHS Integrated Science performance, with many students obtaining grades that disqualify them from SHS admission. This underachievement is

frequently linked to ineffective teaching methodologies, inadequate instructional materials, and insufficient learner engagement.

A major contributing factor in many Ghanaian JHS classrooms is the over-reliance on teacher-centred, lecture-based instruction. These traditional methods force students into passive roles, failing to accommodate their diverse cognitive needs and learning preferences. As Montgomery and Groat (2000) note, when instructional strategies do not align with how learners naturally process and retain information, students struggle to grasp scientific concepts. Often, learners underperform not because they lack intellectual ability, but because the teaching methods employed do not match their preferred learning styles.

While various factors contribute to this trend, the insufficient consideration of students' individual learning styles in lesson delivery remains a significant, yet under-explored, issue within schools in the Ga West Municipality. Consequently, there is a pressing need to investigate the relationship between students' preferred learning styles and their academic performance in Integrated Science. Understanding this dynamic at Mayera and Katapor M/A JHS will provide evidence-based insights into how teaching strategies can be adapted to bridge this instructional mismatch, ultimately improving students' comprehension and academic outcomes in science.

1.3 Purpose of the study

The purpose of this study was to investigate the relationship between students' learning styles and their academic achievement in Integrated Science at Mayera and Katapor.

1.4 Objectives of the study

The objectives of the study were to determine:

1. determine the dominant learning style preference of students in the Ga West Municipality.
2. Compare the relationship between the learning style preferences of male and female students.
3. Assess the relationship between learning styles and academic performance

1.5 Research Questions

1. What is the dominant learning style preference of students in the selected JHS?
2. What is the relationship between learning styles and academic performance?
3. What is the relationship between the learning style preferences of male and female students in Mayera M/A and Katapor M/A JHS

1.6 Significance of the study

The findings of this study are anticipated to be of significant benefit to key stakeholders within Ghana's educational system and may inform meaningful improvements in teaching and learning practices. For students at Mayera and Katapor M/A JHS the study offers an opportunity to gain a clearer understanding of their own learning preferences. Such awareness can help them identify the approaches through which they learn best and adopt study strategies that align with those preferences.

For instructors at Mayera and Katapor M/A JHS, the results provide useful guidance for designing lessons, selecting instructional methods, and planning classroom activities that promote higher levels of engagement and comprehension. An appreciation of learners' preferred styles can support more intentional instructional planning, encourage the use of varied teaching techniques, and ultimately strengthen

students' academic achievement.

Teachers, may also benefit from increased sensitivity to the diverse learning styles present in their classrooms. This understanding can reduce frustration for both learners and educators, foster a more supportive classroom climate, and enable teachers to tailor instruction more effectively. By acknowledging and responding to these differences, educators can create learning environments that accommodate individual needs and promote optimal learning for all students.

1.7 Delimitations

This study was delimited to students from Mayera M/A JHS and Katapor M/A JHS, both situated in the Ga West Municipality. These schools were selected due to the limited time available for the research and financial constraints, which made it impractical to include additional schools or extend the study to a broader geographical area.

The research further focused exclusively on second-year Junior High School (JHS 2) students. This group was intentionally chosen because learners at this level are generally familiar with the JHS structure and are better positioned to comprehend and respond appropriately to the research instruments. Restricting the study to JHS 2 students was therefore intended to enhance the reliability of the data and ensure that participants had adequate exposure to the JHS learning environment.

1.8 Limitations to the Study

The researcher made three separate visits before receiving permission to administer questionnaires and collect data. Similarly, a few students were initially reluctant to complete and submit the questionnaires. Through detailed explanations of the study's

purpose, assurances of confidentiality, and gentle encouragement, most students eventually participated and returned the completed instruments.

Another constraint was financial in nature, which impacted logistical aspects of the research, including transportation to the selected schools and the printing of questionnaires. Despite these challenges, careful planning and efficient use of available resources enabled the researcher to collect the necessary data successfully.

1.9 Operational definition of terms

Academic Performance: Academic performance refers to the extent of knowledge and understanding that a student has acquired through formal schooling. In this study, it is specifically measured by students' scores on the Integrated Science Achievement Test (ISAT), reflecting their ability to apply acquired knowledge and skills to solve problems.

Visual Learning Style: A visual learner prefers to process information through observed or seen materials, such as pictures, diagrams, charts, demonstrations, handouts, videos, or flip-charts. Individuals with this preference often use expressions like "show me" to indicate their learning approach.

Auditory Learning Style: An auditory learner favors acquiring information through listening. This includes listening to spoken words from teachers or peers, as well as sounds and verbal explanations, as the primary mode of understanding.

Kinesthetic Learning Style: A kinesthetic learner prefers learning through physical activity and hands-on experiences. This involves touching, handling, performing tasks, and engaging in practical activities to grasp concepts effectively.

1.10 Organisation of the Study

This study is structured into five chapters. Chapter One serves as the introduction, providing the background to the study, statement of the problem, purpose, objectives, research questions, significance, delimitations, operational definitions, and the overall organization of the study. Chapter Two presents a review of relevant literature. Chapter Three describes the research methodology, including the research design, population, sampling techniques, and data collection procedures. Chapter Four reports and discusses the research findings. Finally, Chapter Five provides a summary of the findings, draws conclusions, and offers recommendations based on the study.



CHAPTER TWO

REVIEW OF LITERATURE

2.0 Overview

This chapter presents a comprehensive, critical review of existing literature and empirical studies relevant to the investigation of learning styles and academic performance in Integrated Science. The review is structured to build a logical foundation for the study. It begins by defining the concept of learning styles and tracing its historical evolution in educational discourse. Next, it establishes the theoretical framework underpinning the study, thoroughly examining Cognitive, Behaviourist, Constructivist, and Information Processing theories to explain how students internalize scientific concepts. The chapter then provides an in-depth exploration of the Visual, Auditory, and Kinesthetic (VAK) model adopted for this research. Following this, it critically analyses the concept of academic performance, reviews empirical studies on the relationship between specific learning styles and science achievement, and addresses the ongoing criticisms in the field. Furthermore, it explores the demographic variable of gender in relation to learning style preferences, and finally synthesizes these findings to outline the practical implications for teaching Integrated Science at the Junior High School level.

2.1 Concept of Learning Styles

The concept of learning styles is rooted in the idea that individuals possess unique cognitive, affective, and physiological traits that dictate how they perceive, interact with, and respond to learning environments (Keefe, 1979). In educational psychology, learning styles are theoretical frameworks that attempt to account for the consistent differences in the ways individuals acquire, process, store, and retrieve information.

Proponents argue that when students are taught in a manner that aligns with their preferred learning style, their comprehension, retention, and academic motivation increase significantly (Felder & Silverman, 1988).

The concept gained massive traction in the 1970s as the educational paradigm shifted toward student-centered learning. Educators began to realize that a "one-size-fits-all" approach was ineffective, leading to the development of numerous learning style inventories designed to help teachers diagnose and adapt to student differences. Over the decades, models such as Kolb's Experiential Learning Theory, Gardner's Multiple Intelligences, Dunn and Dunn's Learning Style Model, and the VARK framework have been widely utilized in schools globally.

Despite this widespread popularity, the concept of learning styles remains one of the most heavily debated topics in educational research. Critics, including Pashler et al. (2008) and Newton (2015), argue that the literature suffers from methodological flaws, such as relying on students' self-reported preferences rather than objective measures of actual learning efficacy. They highlight the "meshing hypothesis" the idea that matching a teaching method to a learning style improves outcomes and note that rigorous experimental evidence supporting this hypothesis is strikingly sparse. Furthermore, some scholars warn that rigidly categorizing students into specific learning styles can lead to "pigeonholing," where students become reluctant to engage with material presented in non-preferred modalities.

However, while the strict "matching" of instruction to styles may lack robust empirical backing, the underlying premise that learners have diverse preferences and strengths remains widely acknowledged. Rather than viewing learning styles as absolute prescriptions for teaching, many modern educators utilize them as a framework for

ensuring instructional variety, thereby making classrooms more inclusive and engaging for diverse learner populations.

2.2 Theoretical Framework

To thoroughly understand how learning preferences influence academic outcomes in Integrated Science, this study is anchored in a synthesis of four major learning theories. These theories provide distinct but complementary lenses through which the learning process can be analysed.

2.2.1 Cognitive Learning Theory

Cognitive Learning Theory represents a paradigm shift from external behaviour to internal mental processes. Pioneered by theorists such as Jean Piaget and further developed by Bruner, this theory describes learning as an active process of acquiring, organizing, and restructuring mental structures (schemas) to process, store, and retrieve information (Rivard, 1996). Unlike behaviourism, cognitive theory emphasizes internal processes like thinking, memory, perception, problem-solving, and metacognition.

According to Di Vesta (1987), cognitive learning styles reflect the specific ways learners select, encode, store, and retrieve information from memory. For instance, a student who prefers visual learning likely relies on the visuospatial sketchpad of their working memory to create mental images of scientific diagrams, whereas an auditory learner might rely more heavily on phonological loop processes to rehearse verbal explanations. Bruner (1966, as cited in Tachie, 2010) emphasized that learners actively categorize information and that intellectual development relies on discovery learning allowing students to explore and construct knowledge independently. In Integrated Science, cognitive theory suggests that abstract concepts (like atomic structure or photosynthesis) can only be mastered if the teacher presents them in ways that align

with the students' cognitive processing strengths, bridging the gap between prior knowledge and new, complex information.

2.2.2 Behaviourist Learning Theory

Behaviourist theory, rooted in the works of Watson (1913), Pavlov (1927), and Skinner (1953), conceptualizes learning as a measurable change in observable behaviour resulting from environmental stimuli. The core premise is that learning occurs through the formation of associations between a stimulus and a response (S-R). Skinner's operant conditioning is particularly relevant to classroom learning; it posits that behaviours followed by positive reinforcement (praise, good grades) are likely to be repeated, while those followed by punishment are suppressed.

In the context of science education, behaviourism explains how students acquire foundational scientific skills, vocabulary, and laboratory protocols. For example, a teacher using direct instruction, drill-and-practice, and immediate feedback is employing behaviourist principles. However, when applied to learning styles, behaviourism has limitations. A purely behaviourist approach might ignore why a kinesthetic student is fidgeting and failing to pay attention to a lecture, viewing it simply as "off-task behaviour" to be punished, rather than recognizing it as a manifestation of an unmet learning need. Therefore, while behaviourism provides useful tools for classroom management and reinforcing correct scientific procedures, it must be integrated with cognitive theories to address the internal processing differences highlighted by learning style theories.

2.2.3 Constructivism as a Learning Theory

Constructivism argues that knowledge is not passively received from the environment but is actively constructed by the learner. Piaget's cognitive constructivism emphasizes individual sense-making where learners assimilate new information into existing schemas or accommodate those schemas when new information contradicts prior knowledge. Vygotsky's social constructivism, on the other hand, emphasizes that knowledge is co-constructed through social interaction, language, and cultural tools.

A central tenet of Vygotsky's theory is the Zone of Proximal Development (ZPD), which is the gap between what a learner can do independently and what they can achieve with guidance from a more knowledgeable other (e.g., a teacher or peer). Constructivism has profound implications for learning styles in science. When science teachers employ hands-on experiments (for kinesthetic learners), group debates (for auditory learners), or concept mapping (for visual learners), they are not just "matching" a style; they are providing the active, sensory, and social experiences necessary for students to construct their own deep understanding of natural phenomena (Lorsbach & Tobin, 1992; Scott, 1987). Constructivism validates the use of multimodal teaching because it recognizes that different students require different types of sensory and social interactions to successfully build scientific knowledge.

2.2.4 Synthesis of the Theoretical Perspectives

No single theory is sufficient to explain the complexities of classroom learning. In investigating the relationship between learning styles and academic achievement in Integrated Science, a synthesized approach is most appropriate. Cognitive theory explains how visual, auditory, and kinesthetic preferences dictate the internal encoding and storage of scientific facts. Constructivism explains why active, multimodal

experiences are necessary for students to build deep conceptual understanding rather than just memorizing facts. Behaviourism provides the framework for reinforcing these multimodal learning behaviours through feedback and assessment. Integrating these perspectives creates a robust theoretical foundation that justifies why a varied, multimodal instructional approach is essential for optimizing science achievement.

2.2.5 Information Processing Theory

Information Processing Theory (IPT), initially proposed by Atkinson and Shiffrin (1968), provides a highly specific mechanical model of cognition. It conceptualizes the human mind as a computer system where information flows through three distinct memory stores: Sensory Memory, Short-Term Memory (STM), and Long-Term Memory (LTM).

IPT is highly relevant to the VAK learning style model. When a teacher presents a science lesson, the information first enters the students' Sensory Registers. If a student is a visual learner, their visual sensory register is highly attuned to pick up diagrams and board writings; if auditory, their auditory register captures the teacher's tone and explanations. Information must then be actively processed in the Short-Term Memory (which has limited capacity and duration) before being encoded into Long-Term Memory for later retrieval during exams. If a teacher only uses lectures, the visual learner's sensory register is under-stimulated, making it harder for them to encode the information into STM and subsequently into LTM. Therefore, learning styles can be understood as individual differences in how efficiently students move information through these cognitive processing stages based on the sensory channel through which the information is delivered.

2.3 The Visual, Auditory, and Kinesthetic (VAK) Learning Style Model

Among the numerous learning style frameworks, this study adopts the Visual, Auditory, and Kinesthetic (VAK) model, as articulated by Chislett and Chapman (2005). The VAK model is a sensory modality-based framework that categorizes learners based on which sensory channel sight, hearing, or touch/movement is most effective for their information processing. It evolved from earlier psychological concepts in the 1920s and remains highly popular in basic education due to its practical simplicity (Clark, 2011). According to Clark (2000), while all individuals use all three modalities to some extent, one or two usually dominate. The characteristics of each modality are detailed below:

2.3.1 Characteristics of Visual Learners

Visual learners process and retain information most effectively through seeing and observing. They have a highly developed visuospatial memory, meaning they think in pictures, images, and spatial relationships rather than in words. In the classroom, they benefit immensely from visual aids such as charts, graphs, maps, diagrams, overhead projectors, and videos. They are the students who prefer to sit at the front to avoid visual obstructions and who take detailed, color-coded notes to visualize the information later (Shaw, 2012). Banner and Rayner (2000) note that visual learners are excellent at recognizing patterns and relationships in presented material. Importantly, research by Constantinidou and Baker (2002) demonstrated that using visual presentations significantly aids all learners, not just those with a visual preference, highlighting the universal pedagogical value of visual aids.

2.3.2 Characteristics of Auditory Learners

Auditory learners rely heavily on the phonological processing of information. They acquire knowledge best through listening to spoken words, participating in discussions,

and verbalizing their own thoughts. They are highly sensitive to the nuances of language, such as tone, pitch, volume, and speed, which help them interpret the underlying meaning of a lesson. Unlike visual learners, written text alone may have little impact on auditory learners until it is read aloud or discussed. They thrive in classroom environments that encourage peer-to-peer discussions, storytelling, debates, and the use of mnemonics or rhymes (Shaw, 2002). While they excel in verbal expression and oral examinations, Banner and Rayner (2000) point out that they may experience difficulties with reading comprehension and written tasks if the information is not verbalized.

2.3.3 Characteristics of Kinesthetic Learners

Kinesthetic (or tactile) learners learn through physical movement, touch, and direct hands-on interaction with their environment. They are often referred to as "doers." Because their cognitive processing is closely linked to motor memory and physical sensations, they struggle significantly in traditional, sedentary classroom environments where they are expected to sit still and listen for extended periods (Montemayor & Aplatén, 2009). Instead of just listening to a description of a scientific process, kinesthetic learners need to manipulate objects, conduct experiments, build models, or engage in role-playing to truly understand the concept (Kinsella, 1995). For these learners, physical engagement is not a distraction from learning; it is the primary vehicle through which learning occurs.

2.4 Learning Styles and Academic Performance in Integrated Science

Integrated Science at the Junior High School level is a unique subject that amalgamates concepts from biology, chemistry, physics, and earth science. It requires students to transition seamlessly between highly abstract theories (e.g., atomic theory) and highly

practical applications (e.g., laboratory titrations). The demanding nature of this subject makes the alignment between instructional delivery and student learning preferences a critical factor in determining academic performance.

2.4.1 The Role of Auditory and Kinesthetic Modalities in Science

While traditional science classrooms heavily favour visual and read/write modalities (e.g., copying notes from the board and reading textbooks), auditory and kinesthetic preferences play a massive, often underutilized, role in science mastery. For auditory learners, performance in Integrated Science improves when teachers use Socratic questioning, allow students to explain concepts to peers (peer tutoring), or use audio-visual resources like science podcasts and educational songs to explain complex processes like osmosis or the carbon cycle (Miller et al., 2020).

For kinesthetic learners, the laboratory is the most vital learning space. Chien et al. (2016) conducted a study demonstrating that students with a kinesthetic preference achieved markedly higher academic scores in science when they engaged in hands-on, interactive laboratory sessions compared to traditional lecture-based instruction. The tactile experience of using a microscope, mixing chemicals, or building electrical circuits allows kinesthetic learners to convert abstract scientific formulas into concrete, physical memories, thereby improving their recall and application during examinations (Woolfolk & Margetts, 2013).

2.4.2 The Role of Read/Write Modality in Science

Although this study focuses on the VAK model, it is important to acknowledge the Read/Write preference (from Fleming's VARK model), as it is the style most heavily rewarded by traditional examination systems. Students with this preference excel at defining scientific terms, writing structured essays, and summarizing textbook chapters.

However, in Integrated Science, relying solely on read/write methods can be detrimental if students cannot visualize the phenomena they are writing about. Therefore, learners with this preference benefit from activities that bridge the gap between theory and practice, such as writing detailed laboratory reports, designing experimental procedures, and synthesizing research findings (Honey & Mumford, 2006).

2.4.3 Mixed Evidence and Criticisms in the Literature

Any rigorous academic review must address the controversies surrounding learning styles. The fundamental question is: Does matching instruction to a student's preferred learning style actually improve their academic performance?

A highly influential meta-analysis by Pashler et al. (2008) reviewed the existing literature and found that very few studies had utilized the rigorous experimental designs necessary to prove the "meshing hypothesis." They concluded that there is insufficient evidence to justify the massive amount of time and money spent on categorizing students into learning styles. Similarly, Coffield et al. (2004) warned that learning style inventories often lack reliability and validity, and that labelling students might limit their educational opportunities by excusing them from challenging non-preferred tasks.

Despite these valid criticisms, the practical consensus in education has shifted toward a more nuanced understanding. The failure of the strict "matching" hypothesis does not mean that learning preferences do not exist; rather, it suggests that students benefit most from multimodal instruction. When teachers integrate visual, auditory, and kinesthetic activities into a single lesson, they ensure that every student has a point of access to the material, while also strengthening the less dominant modalities of all learners (Dunn & Dunn, 2009). Therefore, academic performance in Integrated Science is less about

matching a style perfectly, and more about ensuring that teaching strategies provide rich, multi-sensory inputs that cater to the diverse cognitive needs of the entire classroom.

2.5 Learning Styles and Gender

Beyond cognitive and sensory preferences, demographic variables such as gender have been widely investigated to determine whether biological sex or gender socialization influences learning style preferences. The exploration of gender differences in learning styles is particularly relevant in science education, as persistent gender gaps in Science, Technology, Engineering, and Mathematics (STEM) participation and achievement have been a global concern.

A prevalent argument in early educational literature was that males and females are socialized differently, which in turn shapes their cognitive preferences. Some researchers have hypothesized that due to societal conditioning, boys are encouraged to engage in more physical, spatial, and risk-taking activities, leading to a higher prevalence of kinesthetic and visual learning preferences among males. Conversely, girls have historically been socialized to be more verbal, collaborative, and attentive to instructions, suggesting a higher prevalence of auditory and read/write preferences among females. This aligns with certain neurological theories suggesting differences in brain lateralization between sexes, which might predispose males to excel in spatial-visual tasks and females in language-based tasks.

However, empirical studies examining the relationship between gender and the VAK learning styles have yielded highly mixed and contradictory results. While some studies have found statistically significant differences aligning with the socialization hypothesis, a growing body of modern research suggests that these differences are

minimal or non-existent. Many contemporary studies indicate that both male and female students equally utilize and prefer visual, auditory, and kinesthetic modalities. The apparent differences observed in older studies are increasingly attributed to environmental factors such as the specific teaching methods they have been exposed to rather than innate gender-based cognitive differences.

In the context of Junior High School Integrated Science, assuming that all boys are kinesthetic learners and all girls are auditory learners can lead to detrimental instructional stereotyping. If a teacher automatically assigns hands-on laboratory tasks only to boys and verbal reading tasks only to girls, they risk alienating students whose individual preferences do not align with these gender stereotypes. Therefore, current best practices in science education advocate for a gender-inclusive approach to learning styles. Educators are encouraged to assess students based on their individual sensory preferences rather than their gender, ensuring that all students regardless of whether they are male or female are provided with equitable opportunities to engage in visual, auditory, and kinesthetic science activities. Understanding that gender may not be a definitive predictor of learning style helps teachers create a more equitable science classroom that challenges traditional STEM gender norms.

2.6 Implications for Teaching Integrated Science

The review of literature yields significant implications for how Integrated Science should be taught at the Junior High School level, particularly in contexts like the Ga West Municipality where resource constraints and traditional "chalk-and-talk" methods are prevalent.

Firstly, the literature mandates a shift from teacher-centered to student-centered, multimodal pedagogy. An effective Integrated Science teacher must learn to design

lessons that incorporate all three VAK modalities. For example, a lesson on the human digestive system should begin with a diagram on the board (Visual), followed by a class discussion or verbal explanation of the chemical breakdown of food (Auditory), and culminate in a hands-on physical model-building activity or an interactive simulation (Kinesthetic). This layered approach ensures that no student is left behind due to a mismatch in sensory processing (Basham et al., 2016).

Secondly, the integration of educational technology provides a powerful solution to the challenge of multimodal teaching. Tools such as PhET interactive simulations, virtual laboratories, and educational videos allow teachers to provide rich visual and kinesthetic experiences even when physical laboratory equipment is unavailable. Hall and Ponton (2016) found that students exposed to technology-enhanced, multimodal content consistently outperformed those taught via traditional lectures, as the technology engaged multiple sensory pathways simultaneously, leading to deeper cognitive processing.

Finally, the findings underscore the necessity for continuous professional development for science teachers. Teachers must be trained not just on the theoretical definitions of VAK styles, but on the practical, logistical strategies for implementing multimodal lessons within their specific classroom constraints. By moving beyond rigid labelling and embracing flexible, multi-sensory instruction, educators can create a more equitable and effective learning environment that maximizes academic performance in Integrated Science for all students, regardless of their individual learning preferences or gender.

2.7 Summary

In summary, this chapter has comprehensively reviewed the literature relevant to the investigation of learning styles and academic performance in Integrated Science. The review established that while the strict "matching" of instruction to learning styles faces valid empirical criticisms, the existence of diverse learning preferences remains an undeniable reality in classrooms. The chapter grounded the study in a synthesis of Cognitive, Behaviourist, Constructivist, and Information Processing theories, demonstrating how students uniquely encode and retrieve scientific information based on their dominant sensory modalities.

An in-depth exploration of the VAK model revealed the distinct characteristics of visual, auditory, and kinesthetic learners, highlighting the necessity for multimodal teaching in a complex subject like Integrated Science. The review of empirical evidence showed that while multimodal instruction improves science achievement, the relationship between learning styles and academic performance is nuanced. Furthermore, the examination of gender and learning styles concluded that gender is not a reliable determinant of sensory preference, warning against instructional stereotyping in the science classroom.

Ultimately, the literature affirms that the goal of science education should not be to rigidly categorize learners, but to equip teachers with the pedagogical skills to deliver rich, varied, and multi-sensory instruction. This synthesized understanding forms the basis for the research methodology adopted in the subsequent chapter, which details the design and procedures used to investigate these dynamics among JHS students in the Ga West Municipality.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Overview

This chapter gives a full description of the study area and the steps that were taken to do the research. It describes the methodological framework used to meet the study's goals and makes sure that the research process is rigorous and trustworthy. The chapter talks about the research design that was used, the population and sampling methods, and the size and criteria for the sample. It also talks about the research tools used to gather data, including how they were made, how they were used, and the steps taken to make sure they were valid and reliable. The chapter aims to be open and allow the study to be repeated by showing these methodological parts. It also wants to make sure that the results are both credible and useful.

3.1 The study area

The study took place in the Ga West Municipal Assembly, which is one of the twenty-nine administrative districts in the Greater Accra Region of Ghana. Amasaman is the capital city of this district (Ga West Municipal Assembly, 2023). The municipality is in the western part of the region and has a mix of peri-urban and rural communities. This shows both traditional and new urban settlements. According to the 2021 Population and Housing Census (Ghana Statistical Service, 2021), Ga West has a population of about 314,299 people, with 155,543 males (49 %) and 158,756 females (51 %).

The area is home to a wide range of cultures, with the Ga-Dangme ethnic group being the largest. There are also a lot of Akan, Ewe, and other ethnic groups living there. Education is a big part of life in the community. There are many basic and secondary

schools in the municipality, which makes it a great place to study how students learn and do well in school. The municipality's demographic traits, diverse settlement patterns, and presence of educational institutions create a suitable context for analyzing the correlation between learning styles and academic performance in Integrated Science.

Its accessibility and proximity to Accra also make it easier to collect data from schools in both urban and peri-urban areas. This lets the study look at how students' learning behaviors change depending on where they go to school.



Figure 1: Map of Ga West Municipal

3.2 Research design

Research design is how a study is planned and carried out, including the methods and steps used to answer the research question or problem (Singh, 2023). Designing a study aids the researcher in planning and executing the study effectively to achieve the desired outcomes, thereby enhancing the likelihood of acquiring information pertinent to the actual situation. The study utilized a correlational research design.

Gay (1996) characterized correlation research as the process of gathering data to ascertain the existence and extent of a relationship between two or more measurable variables. In correlational studies, data is gathered without altering the variables. The researcher aimed to identify the correlation between learning styles and academic performance. The variables were neither addressed nor altered. There was no examination of cause-and-effect relationships. The correlational study design was deemed the most suitable for this research, as the investigator sought to examine the relationship between students' study styles and their academic performance. Creswell (2008) corroborates this by asserting that correlational studies are performed to illustrate associations between variables, without inferring causality.

3.3 Study Population

Park (1997) define a population as the complete collection of all elements individuals, objects, or events that meet specific criteria pertinent to a particular study. For this study, the target population was all Junior High School (JHS) students who lived in the Ga West Municipality of the Greater Accra Region of Ghana. This larger group is the whole group to which the study's results could be applied.

But because of practical issues like accessibility, time limits, and resource availability, the study only looked at a population that was easy to reach from a few schools in the municipality. The accessible population specifically comprised second-year Junior High School (JHS 2) students from Mayera M/A JHS and Katapor M/A JHS. These schools were intentionally chosen to exemplify the study area and yield pertinent data for fulfilling the research objectives.

3.4 Sample and Sampling procedure

Sampling is the process of picking a small group of people to represent the whole group (Park 1997). The target population was all Junior High School (JHS) students who lived in the Ga West Municipality of the Greater Accra Region of Ghana who were identified as underperforming in Integrated Science. Both schools had a lot of students, so they split them into two groups, "A" and "B," to keep class sizes manageable.

The study's sample consisted of 280 JHS 2 students from both schools. The choice of these students was based on the evaluation of the 2023 Basic Education Certificate Examination (BECE) results, which showed that the schools were not meeting the Ga West Municipal Education Directorate's standards for Integrated Science. Since all students in the designated population were incorporated into the study, the sampling method utilized can be categorized as a census.

The study used a census method to make sure that all JHS 2 students who met the criteria were included. This got rid of sampling bias and made the results more complete. This method was especially suitable in this context as it enabled the researcher to encompass the complete spectrum of learning styles and academic performance levels among students experiencing difficulties in Integrated Science, thereby offering a more precise and dependable foundation for analysis and interpretation.

3.5 Sample Size Determination and Allocation

The sample size for the study was determined using Cochran's (1977) formula, with a 95 % confidence level, a 5 % margin of error, and an assumed population proportion of 0.5 to maximize variability. After applying the finite population correction and

accounting for a 10 % non-response rate, a final sample size of 280 students was determined to be appropriate for the study.

The sample was taken from two Junior High Schools in the Ga West Municipality to make sure it was representative. These schools were chosen because they were easy to get to and were willing to take part in the study. The target group consisted of students in JHS 2, as they were deemed sufficiently mature to critically evaluate their learning styles and academic performance.

The sample was divided between the two schools based on how many students were eligible at each one. This distribution made sure that the sample accurately represented the number of students at each school. A stratified random sampling method was used in each school to make sure that all class levels and genders were represented.

3.6 Instrumentation

Park (1997) characterise data as “information acquired during a study.” In research, data is the basis for making smart decisions and coming to meaningful conclusions. Hunter and Leahey (2008) assert that the principal aim of utilizing quantitative research methods is to formulate and implement mathematical models, theories, and hypotheses to comprehend phenomena in a systematic and quantifiable manner.

This study utilised an adapted version of the Learning Style Self-Assessment Questionnaire (LSSAQ) created by Chislett and Chapman (2005) for data collection. Moreover, academic performance data were sourced from the Integrated Science Achievement Test (ISAT) results supplied by the Ga West Municipal Education Office. The questionnaire is one of the most common tools used in survey research because it is flexible and works well. Bryman (2004) says that questionnaires are popular for a

number of reasons, including that they are cheap, easy to use, reduce interviewer bias, and are easy to send out and collect.

The survey questionnaire not only has these benefits, but it also lets you gather standardized information about the same variables from everyone in the sample (Zahari 2007). This makes the questionnaire an important tool for getting primary information about people, such as their behavior, attitudes, opinions, and knowledge of certain issues. There were thirty-three (33) questions in the questionnaire, but they were split into two parts. There were eight (8) items in Section A and twenty-five (25) items in Section B. These items were all about questions that helped figure out whether each student learned best by seeing, hearing, or doing things.

3.7 The Integrated Science Achievement Test

Students took the Integrated Science Achievement Test (ISAT) to see how well they performed. There were twenty-five (25) multiple choice questions on the test, covering topics like energy and the variety of matter. The questions were split into two parts. The basics of the people who answered were in Section A. This included their gender, age, grade level or form, school, and program. Section B was about how the people who answered preferred to learn. The first eight questions were designed to test the respondent's basic knowledge. The other 25 items (section B) were based on how the respondents like to learn. The students had enough time to answer the questions. After that, selected integrated science examiners in Senior High Schools collected and graded the items.

3.8 Administration of the questionnaire

The Department of Science Education first gave permission for the study by sending a letter of introduction. Another introductory letter was also obtained from the Ga West

Municipal Directorate of Education to make it easier to get to the chosen schools in the municipality. After these formalities, the researcher went to the chosen schools to tell the school officials and participants about the study and what it was trying to do.

The study's purpose and importance were clearly explained during the visits to make sure everyone understood and worked together. The students were told that they could choose whether or not to take part and that their answers would be kept completely private and secret. After getting permission and building a relationship, copies of the questionnaire were given to students in Junior High School Two (JHS 2) at the chosen schools.

The researcher went over each section and item with the students before they filled out the questionnaires to make sure they understood everything and didn't get confused. The students had enough time to carefully and thoughtfully fill out the questionnaire. After they were filled out, the questionnaires were collected, sorted, and coded in a systematic way so that the data could be analyzed.

3.9 Validity of the Instruments

Validity of a research instrument refers to how well the instrument measures the things it is supposed to measure. Kothari (2004) asserts that validity is an essential component of research quality, as it guarantees that the collected data accurately represents the variables and phenomena being examined. To verify the validity of the research instruments employed in this study, the questionnaires underwent a comprehensive content validity evaluation. This process required a thorough review of the items to see if they fully covered all aspects of the research goals and fit with the study's conceptual framework.

The research supervisor, who has a lot of knowledge and experience in the subject area, also looked over the draft instruments. The supervisor thoroughly assessed each item on the questionnaire for clarity, relevance, appropriateness, and consistency with the study's objectives. The supervisor confirmed that the instruments were both valid and appropriate for data collection after this expert review. This process of expert validation made the data collection tools more credible and trustworthy overall, making sure that they would give the study accurate and useful results.

3.10 Data analysis and presentation

Eshiwani (2004) asserts that the objective of data analysis is to systematize, structure, and derive meaning from research data. In this study, data analysis was undertaken to examine the relationship between students' learning styles and their academic performance in Integrated Science, as well as to determine whether this relationship varied according to gender and grade level. After checking the data from respondents for completeness and accuracy, it was cleaned to get rid of errors, inconsistencies, and missing values. After the data was checked, it was coded and put into the Statistical Package for the Social Sciences (SPSS) for quantitative analysis.

Descriptive statistics were initially employed to encapsulate the fundamental attributes of the data. We calculated frequencies and percentages to show how many students liked each learning style and how learning styles were spread out by gender and grade level. These descriptive results gave a general idea of the most common learning styles among students and showed how learning preferences varied between boys and girls and between different grade levels. To make the descriptive results clearer and easier to understand, they were shown in tables.

Along with descriptive statistics, inferential analyses were used to find out if there was a relationship between learning styles and academic performance in Integrated Science and how strong it was. We used the Pearson Product-Moment Correlation Coefficient (r) to find out how strong and in what direction the linear relationship was between students' preferred learning styles and their academic performance scores. The correlation coefficient, which could be anywhere from -1.0 to +1.0, showed whether the relationship was strong, weak, or not at all. A positive correlation indicated that students who preferred a specific learning style generally achieved superior academic performance, while a negative correlation indicated that such a preference was linked to diminished performance. A coefficient near zero signified an absence of a substantial linear correlation between learning style and academic performance.

To further assess whether the relationship between learning style and academic performance differed across gender and grade levels, the Chi-Square (χ^2) Test of Independence and One-Way ANOVA were used to analyze the data. This non-parametric test ascertained whether the observed disparities in academic performance across the different learning style categories were statistically significant or merely attributable to chance. This analysis aimed to determine if there were significant differences between male and female students regarding the relationship between their preferred learning styles and academic outcomes, as well as whether these patterns were consistent across various forms or grade levels.

To gain a clearer understanding of the impact of gender, distinct analyses were performed for male and female students, facilitating the comparison of correlation coefficients and significance levels between the two groups. The findings were presented in tables that depicted the differences in learning style preferences and related

academic performance by gender. The analysis also looked at differences between grade levels to see if the link between learning style and academic performance was stronger or weaker at certain points in a student's education.

We used tables and correlation matrices to make it easier to understand the results of both descriptive and inferential statistics. The table made it easy to compare the frequencies of different learning styles, the average academic scores, and the correlation values for different genders and grades. This thorough method of analyzing data gave a broad picture and a deep understanding of how learning styles affect academic performance in Integrated Science. Ultimately, the outcomes of these analyses constituted the foundation for discourse and interpretation in the subsequent sections of the study.

3.11 Ethical Issues

The researcher adhered to ethical standards considered suitable for this study. The researcher applied for ethical clearance from the Institutional Review Board at the University of Education, Winneba. The respondents were informed about the study's purpose, and participation was not mandatory. Respondents were asked for their consent because they were asked to sign a consent form on their own. Armiger (1997) asserts that informed consent entails an individual knowingly, voluntarily, and intelligently providing consent in a clear and unequivocal manner. Respondents were promised that their identities would remain secret and private. There were no names or addresses on the questionnaires.

They kept the information they gave secret and only used it for research. Respondents' rights to withdraw from the study at any point were upheld. During the administration of the questionnaires, respondents were not harmed, threatened, or mistreated. There

was no harm to the mind or emotions. There was no copying of any kind. All sources were properly cited and referenced. There was enough time for everyone to fill out the questionnaires.



CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.0 Overview

This chapter presents the results of the study in alignment with the objectives. The chapter further discussed the results to make the findings evident.

4.1 Research Question 1: What is the dominant learning style of JHS students in the Ga West Municipality? To address this research question, questionnaire were administered and results were analysed in Table 1.

4.1.1 Descriptive Statistics of Learning Styles

Table 1 shows the descriptive statistics for the learning style preferences of 280 Junior High School students from two schools in the Ga West Municipality. The descriptive statistics encompass the mean, standard deviation, skewness, and kurtosis for each of the three learning styles: Visual, Auditory, and Kinaesthetic.

Table 1: Descriptive Statistics of Learning Style Preferences among JHS Students

Statistic	Visual	Auditory	Kinaesthetic
Mean	12.18	10.73	11.24
Standard Deviation	2.15	0.90	1.10
Skewness	0.14	-0.21	-0.52
Kurtosis	-0.31	0.42	-0.11
Count (f)	122	74	84
Percentage (%)	43.6	26.4	30.0

N = 280. Acceptable range for skewness and kurtosis = ± 2 (Tabachnick & Fidell, 1996).

(Source: Field Data (2025))

Table 1 shows that all of the skewness and kurtosis values were within the acceptable ± 2 range. This means that the data were normally distributed and didn't have any extreme outliers. This confirms that the answers are statistically sound enough for more in-depth analysis.

Visual learning had the highest mean score ($M = 12.18$, $SD = 2.15$), followed by Kinaesthetic ($M = 11.24$, $SD = 1.10$) and Auditory ($M = 10.73$, $SD = 0.90$) **.

The Visual learning style had the highest standard deviation (2.15), which means that students' answers to Visual-related questions were more spread out than those for the other two styles. The Auditory style, on the other hand, had the lowest standard deviation (0.90), which means that people who said they were auditory learners were more likely to agree with each other.

Visual learners ($n = 122$; 43.6 %) made up the biggest group, followed by Kinesthetic learners ($n = 84$; 30.0 %) and Auditory learners ($n = 74$; 26.4 %). The results show that most of the students in the Ga West Municipality have a visual learning style.

Discussion

The predominance of the Visual learning style among the JHS students in this study aligns with a significant body of international research. Clark (2000) reported that approximately 65% of students in the United Kingdom learn most effectively through visual means, underscoring the widespread prevalence of visual preferences across different cultural contexts. Similarly, a study at the University of Batangas in the Philippines found that 64.44% of first-year General Engineering students were predominantly visual learners, with this proportion rising further to 82.76% among second-year students, demonstrating that visual dominance may intensify with educational progression. At the secondary school level, Nzesei (2015) found in Kenya

that visual modalities were the most favoured among students, a finding that resonates directly with the current study's results for JHS learners in Ga West. Dobson (2009) similarly reported that the visual modality accounted for the largest proportion (36%) of learning style preferences among undergraduates, reinforcing the cross-level and cross-cultural consistency of visual dominance.

The Information Processing Theory (Atkinson & Shiffrin, 1968) provides a compelling theoretical basis for understanding why visual learning tends to be dominant. This theory posits that information passes through sensory memory, short-term memory, and long-term memory, and that the efficiency of this process depends on the modality through which information is encoded. Visual learners rely heavily on imagery and spatial organization, which are cognitively rich encoding strategies that tend to facilitate stronger retention (Rivard, 1996). As the literature reviewed by Banner and Rayner (2000) demonstrates, visual learners are adept at recognising patterns, locating information by its visual position, and navigating complex content, all of which are particularly useful in a science subject like Integrated Science, where diagrams, biological structures, chemical equations, and physical phenomena are routinely presented. Mayer's (2005) cognitive theory of multimedia learning further supports this perspective, arguing that learning is optimised when content is delivered simultaneously through visual and verbal channels, a finding consistent with the utility of visual instructional tools in science education.

Laine et al. (2018) reinforced this point, reporting that students who used visual tools such as concept maps and flowcharts achieved higher academic performance in Integrated Science compared to peers instructed through traditional text-based methods alone. The constructivist perspective similarly affirms the value of visual representations: Vygotsky (1978) advocated the use of models and demonstrations in

learning, while Scott (1987) characterised constructivist science education as a process in which students actively draw upon pre-existing mental representations to interpret new experiences. The visual dominance observed in this study therefore suggests that Ga West JHS students are cognitively predisposed toward constructing understanding through observational and representational means, which is consistent with the VAK model's emphasis on dominant sensory modalities (Chislett & Chapman, 2005; Clark, 2000).

Despite alignment with many international findings, the current study diverges notably from an earlier Ghanaian study. Tachie (2010), in an exploratory survey of JHS students from three districts in the Greater Accra Region, reported that 65% of students preferred the Auditory modality, 25% preferred the Kinaesthetic modality, and only 10% preferred the Visual modality. This stands in direct contrast to the current study's finding of 43.6% Visual, 30% Kinaesthetic, and 26.4% Auditory. Several explanations may account for this divergence. First, the two studies differ in their geographic scope and sample composition: Tachie's (2010) study sampled across three districts in Greater Accra, encompassing 1,334 students, whereas the current study focused specifically on the Ga West Municipality with 280 JHS 2 students. Localised socioeconomic conditions, instructional traditions, and the specific schools selected may have introduced systematic differences in the distribution of learning style preferences.

Second, the temporal gap between the two studies more than a decade may reflect genuine shifts in students' sensory exposure and learning orientations. The proliferation of visual media, digital content, and image-rich learning materials in Ghanaian schools over the intervening period could plausibly have contributed to an increased tendency toward visual learning. Kolb (1986) observed that cultural and demographic factors significantly influence students' preferred modes of learning, and the educational

landscape of Ghanaian basic schools has undergone considerable change since 2010. Charlesworth (2008) similarly found statistically significant differences in learning styles across cultural groups, pointing to the dynamic interplay between sociocultural context and learning preference formation. In this light, the divergence from Tachie (2010) may reflect authentic contextual evolution rather than mere sampling differences.

4.2 Research Question 2:

What is the relationship between students' learning styles and their academic achievement in Integrated Science?

4.2.1 Descriptive Statistics

Table 4 shows the descriptive statistics for academic achievement (Integrated Science scores) based on the students' main learning style. The sample comprised 280 junior high school students divided into three learning style categories: Visual, Auditory, and Kinaesthetic.

Table 2: Descriptive Statistics of Academic Achievement by Learning Style (N = 280)

Learning Style	N	Mean (%)	Std. Deviation	Minimum	Maximum
Visual	122	53.4	13.2	28	82
Auditory	78	49.5	14.5	24	79
Kinaesthetic	80	51.2	13.8	25	80
Total	280	51.7	13.9	24	82

Scores represent students' performance in Integrated Science (0-100 scale).

(Source: Field Data (2025))

4.2.2 One-Way ANOVA

A one-way analysis of variance (ANOVA) was performed to ascertain the presence of statistically significant differences in academic achievement among the three learning style groups.

Table 3: ANOVA

Source	SS	df	MS	F-stat	p
Between Groups	970.41	2	485.21	2.56	0.039*
Within Groups	52301.59	277	188.80	-	-
Total	53272.00	279	-	-	-

* $p < .05$ (significant). $\eta^2 = 0.018$ (small effect size).

(Source: Field Data (2025))

Table 4: Post Hoc Analysis (Tukey HSD)

Pairwise Comparison	Mean Difference	p-value	Interpretation
Visual – Auditory	3.9	0.032*	Significant
Visual – Kinaesthetic	2.2	0.214	Not Significant
Auditory – Kinaesthetic	-1.7	0.371	Not Significant

* $p < .05$.

(Source: Field Data (2025))

4.2.4 Interpretation

The ANOVA results showed a statistically significant difference in students' academic performance based on the three learning styles, $F(2, 277) = 2.56$, $p = .039$, $\eta^2 = 0.018$.

Even though the effect size was small, the result suggests that how you like to learn has a small effect on how well you do in Integrated Science.

Post hoc analysis (Tukey HSD) revealed that Visual learners significantly outperformed Auditory learners (mean difference = 3.9, $p = .032$). However, there were no statistically significant differences observed between Visual and Kinesthetic learners, nor between Auditory and Kinesthetic learners. This means that students' preferred learning style does have some effect on how well they do, but Visual learners tend to do a little better than other types of learners.

4.2.5 Discussion

These findings strongly corroborate earlier empirical studies. Nzesei (2015), in a study among Kenyan secondary school students, reported a positive and statistically significant relationship between learning styles and academic achievement, particularly highlighting that students whose preferred styles aligned with instructional methods performed better academically. Similarly, Dobson (2009) found that visual learners often demonstrated stronger academic outcomes, particularly in disciplines requiring conceptual visualization and structured information processing. Since Integrated Science frequently involves the interpretation of graphs, diagrams, laboratory observations, and visual models, students with visual learning preferences may naturally adapt more effectively to such instructional demands.

The present findings are also supported by constructivist learning theory, which emphasizes that learners actively construct knowledge through interactions with educational materials and experiences. Visual instructional resources such as models, simulations, and charts may enhance schema development and cognitive organization among learners, thereby improving comprehension and retention. This aligns with

Information Processing Theory, which posits that students learn more effectively when instructional materials are presented in formats compatible with their preferred cognitive processing channels.

However, the current findings diverge from the studies of Day, Raven, and Newman (1997) as well as Shih and Gamon (2002), both of whom reported no significant relationship between learning styles and academic achievement, particularly within web-based and technology-mediated learning environments. These inconsistencies may be explained by contextual differences, including subject matter, educational setting, cultural factors, and methodological variations. For instance, web-based learning environments often incorporate multimodal instructional strategies that simultaneously cater to diverse learning preferences, thereby reducing the performance disparities associated with specific learning styles. In contrast, traditional classroom settings such as those in Ga West Municipality may rely more heavily on specific teaching approaches, making learning style differences more pronounced.

The small effect size reported in this study warrants careful interpretation. While statistically significant, the relatively limited explanatory power of learning style indicates that educational achievement is multifaceted and cannot be solely attributed to learning preferences. Hattie (2009) emphasized that variables such as teacher effectiveness, feedback quality, and student motivation often exert stronger influences on academic performance than individual learner characteristics alone. Therefore, although visual learning preferences may offer certain advantages, overemphasizing learning styles without considering broader pedagogical and contextual variables may oversimplify academic success.

Pedagogically, these findings carry significant implications for science education. The superior performance of Visual learners suggests that science teachers should incorporate more visual instructional strategies, including concept maps, diagrams, animations, laboratory demonstrations, videos, and graphic organizers, to enhance conceptual understanding. At the same time, teachers should avoid exclusive reliance on any single instructional mode. Given the presence of Auditory and Kinaesthetic learners, differentiated instruction that integrates lectures, discussions, practical experiments, collaborative tasks, and visual supports would likely produce more inclusive and effective educational outcomes. This aligns with Arsian and Aksu's (2005) recommendation that diverse teaching strategies are essential for addressing the heterogeneous learning needs of students.

Furthermore, the relatively lower performance of Auditory learners may indicate that lecture-dominated instructional practices alone may be insufficient for optimizing science achievement. Science educators may need to supplement oral explanations with richer multimodal resources to ensure equitable learning opportunities for all students. Such an approach would not only support diverse learners but also potentially improve overall academic outcomes across the student population.

In conclusion, the study demonstrates that learning style preference has a statistically significant, though modest, influence on students' academic achievement in Integrated Science. Visual learners exhibited the highest academic performance, significantly outperforming Auditory learners, thereby reinforcing the educational value of visually enriched science instruction. Nevertheless, because the effect size remains small, learning style should be viewed as one contributing factor among many. Effective science education should therefore prioritize flexible, multimodal, and learner-centered

pedagogies that accommodate varying preferences while simultaneously addressing broader determinants of academic success.

4.3 Research Question 2

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

4.3.1 Crosstabulation of Gender and Learning Styles

A cross-tabulation was conducted to analyse the correlation between gender (male/female) and students' predominant learning style (Visual, Auditory, Kinaesthetic).

Table 5: Learning Style and Gender of Respondents (N = 280)

Gender	Visual	Auditory	Kinaesthetic	Total
Male (n = 137)	52 (38.0 %)	38 (27.7 %)	47 (34.3 %)	137 (49 %)
Female (n = 143)	70 (48.9 %)	40 (28.0 %)	33 (23.1 %)	143 (51 %)
Total (N = 280)	122 (43.6 %)	78 (27.9 %)	80 (28.5 %)	280 (100 %)

(Source: Field Data (2025))

4.3.2 Chi-Square Test of Association

A Pearson Chi-Square test was conducted to determine whether a significant association existed between students' gender and their preferred learning style.

Table 6: Pearson Chi-Square test of association

Test Statistic	Value	df	p-value
Pearson χ^2	4.23	2	0.121
Cramér's V	0.087	-	-

$\alpha = 0.05$ significance level. (Source: Field Data (2025))

4.3.3 Interpretation

The chi-square analysis, $\chi^2 (2, N = 280) = 4.23, p = .121$, indicates that there is no statistically significant association between gender and learning style preference among the respondents. This suggests that male and female students in the Ga West Municipality did not differ meaningfully in their preferred learning styles. The effect size (Cramér's $V = 0.087$) further supports this conclusion, showing a very weak association. Nevertheless, minor gender tendencies were observed:

- Females slightly favoured the Visual learning style (49 %),
- Males showed a more even distribution across Visual (38 %), Kinaesthetic (34 %), and Auditory (28 %) styles.

4.3.4 Discussion

This outcome strongly corroborates the findings of Park (1997), whose comparative study across multiple cultural groups found that while contextual and cultural factors may shape learning preferences, gender itself had minimal influence on students' learning style choices. Park's work suggested that learning preferences are more closely linked to environmental exposure, instructional experiences, and cognitive development than to biological sex. In the context of the present study, this alignment implies that students in Ga West Municipality are influenced more by shared educational structures, classroom environments, and curricular experiences than by

gender-specific predispositions. The consistency between Park's findings and this study reinforces the growing argument that gender-based assumptions regarding how students learn may be overstated, particularly in structured educational systems where boys and girls are exposed to similar pedagogical practices.

Furthermore, Kolb's (1986) assertion that demographic variables may interact with learning styles, but are often overshadowed by broader cultural and experiential factors, also supports the current findings. Since both male and female students within the Ga West Municipality likely experience comparable socio-cultural and educational conditions, their learning preferences may naturally converge. This may explain why visual learning emerged as the dominant style across both genders, reflecting the likely emphasis on visual instructional methods such as textbooks, diagrams, chalkboard illustrations, and demonstrations commonly employed in Ghanaian basic schools.

The present findings, however, differ somewhat from Tachie (2010), whose study in selected basic schools in the Greater Accra Region suggested that gender differences were more pronounced in students' learning style patterns. Tachie's work implied that male and female students may respond differently to certain pedagogical strategies, thereby necessitating differentiated instructional groupings. The divergence between Tachie's findings and the current study may be attributed to differences in sample composition, geographical scope, temporal context, or methodological design. While Tachie's study may have captured localized or school-specific gender variations, the broader sample in the Ga West Municipality may reflect a more integrated educational environment where gender disparities in learning preferences are less pronounced. It is also possible that evolving educational reforms, increased gender parity in schooling,

and more standardized instructional methods have gradually reduced historical gender-based differences in learning styles over time.

The weak association observed in this study also resonates with Dunn and Griggs' (2000) perspective that although learners possess unique preferences, these are highly individualized and should not be generalized solely on demographic variables such as gender. This means that instructional planning should prioritize learner diversity at the individual level rather than relying on broad gender categorizations. For science education in particular, where conceptual understanding often requires multiple modes of engagement, depending on gender stereotypes to guide instructional design may be ineffective.

Educationally, these findings carry important implications for teaching Integrated Science in the Ga West Municipality. Since both male and female students demonstrated substantial representation across visual, auditory, and kinesthetic styles, teachers should avoid gender-biased instructional assumptions and instead adopt inclusive, multimodal pedagogical strategies. For instance, science lessons should simultaneously incorporate visual aids such as charts, models, and videos; auditory methods such as explanations, discussions, and storytelling; and kinesthetic approaches such as laboratory experiments, practical demonstrations, and hands-on activities. Such balanced instruction ensures that all learners, regardless of gender, are adequately supported.

Moreover, the predominance of visual learning among both genders suggests that enhancing visual instructional resources may significantly improve comprehension for the majority of students. However, because a considerable proportion of both males and females also preferred auditory and kinesthetic modes, overreliance on visual

instruction alone could disadvantage a substantial segment of learners. Therefore, diversified teaching remains essential for equitable academic achievement.

In conclusion, the study demonstrates that gender is not a major predictor of learning style preference among JHS students in the Ga West Municipality. This finding supports existing literature, particularly Park (1997), while partially contrasting with Tachie (2010). The results emphasize the importance of designing instructional approaches based on diverse learner needs rather than gender categories. Consequently, educators should focus on flexible, multimodal teaching strategies that accommodate the full spectrum of learning preferences, thereby fostering improved academic performance in Integrated Science for both boys and girls.



CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Overview

This chapter presents the summary of the findings, conclusion and recommendations.

The chapter ended with the suggesting for further research.

5.1 Summary of Findings

The first goal was to find out what learning style students in the Ga West Municipality preferred most. The results showed that students had all three types of learning styles: visual, kinesthetic, and auditory. However, there were clear differences in which style was most common. The Visual learning style had the highest mean ($M = 12.17$, $SD = 2.15$) and frequency (43.6 %), followed by Kinesthetic ($M = 11.23$, $SD = 1.10$; 30.0 %) and Auditory ($M = 10.72$, $SD = 0.90$; 26.4 %). This means that most students learn best when they see things like diagrams, charts, videos, and demonstrations.

The second objective investigated the correlation between learning style preference and gender. The Chi-square test indicated no statistically significant correlation between gender and learning style preference, $\chi^2(2, N = 280) = 4.23$, $p = .121$. There was a small difference between the number of females who preferred Visual and Kinesthetic styles, but it wasn't significant.

The third goal looked at how learning styles affected how well students did in Integrated Science. The One-Way ANOVA results showed a statistically significant but weak link, $F(2, 277) = 2.56, p = .039, \eta^2 = .018$. Visual learners did a little better in Integrated Science ($M = 66.3, SD = 13.1$) than Kinaesthetic ($M = 63.9, SD = 13.4$) and Auditory learners ($M = 61.8, SD = 12.9$). The results indicate that aligning teaching strategies with students' preferred learning styles positively influences academic performance.

5.2 Conclusions

In regard to the first objective, the study determined that the Visual learning style is the predominant learning preference among JHS students in the Ga West Municipality. The majority of students favored learning via visual media, including images, diagrams, and practical demonstrations. This finding underscores the necessity for science educators to prioritize visual aids to augment comprehension and engagement.

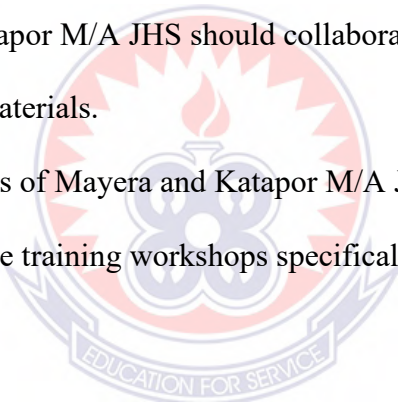
Concerning the second objective, it was determined that learning style preference is not significantly associated with gender. Both male and female students exhibited comparable learning tendencies. This means that science teachers can plan lessons that work for all students without having to separate boys and girls.

The study found that learning style has a significant but weak link to academic performance in Integrated Science, which is the third goal. Students whose learning styles aligned with the instructional methods exhibited superior performance compared to those whose preferences were insufficiently addressed. So, changing the way you teach to match how students like to learn can help them do better in science.

The results show that the Municipality's low science scores may be due to a mismatch between how teachers teach and how students like to learn. To improve learning outcomes, it is important for teachers to be aware of and responsive to different learning styles.

5.3 Recommendations

- A. Integrated Science teachers in these two schools should intentionally prioritize the use of visual aids such as diagrams, charts, videos, and real-life specimens during lesson delivery to enhance comprehension.
- B. The school administrations and Parent-Teacher Associations (PTAs) of Mayera and Katapor M/A JHS should collaborate to procure adequate science apparatus and materials.
- C. The headteachers of Mayera and Katapor M/A JHS should organize localized, regular in-service training workshops specifically for their Integrated Science teachers.



5.4 Suggestions for Future Research

The following recommendations were put forth in light of the study's findings:

- Future research should conduct a quasi-experimental study within the Ga West Municipality to directly measure the impact of matching instruction to students' specific VAK learning styles versus using traditional teaching methods on Integrated Science academic performance.
- A longitudinal study should be conducted, aiming to identify the predominant learning styles of JHS students.

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APPENDIX A



UNIVERSITY OF EDUCATION, WINNEBA

DEPARTMENT OF SCIENCE EDUCATION

Questionnaire for Students

This questionnaire is aimed at gathering information from public Junior High School Students in the Ga West Municipality. The study is entitled, ‘The relationship between learning styles and academic performance in integrated science. Findings of this research would help to improve decision-making and enhance academic standards in the Ghana Education Service. Your participation in this study is however optional. Any information you provide in this research would be used for research purposes only and every information you provide would be kept confidential. Please tick the appropriate box the option you agree with.

Scale:

1 = Strongly Disagree 2 = Disagree 3 = Neutral 4 = Agree 5 = Strongly Agree

Section A: Demographic Data of Respondents

1. Gender

a) Male []

b) Female []

2. Age Range

a) 12–14 years []

b) 15–17 years []

c) 18–20 years []

SECTION B: LEARNING STYLES

No.	Statement	1	2	3	4	5
1	I understand better when I see pictures or diagrams.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	I prefer listening to teachers than reading textbooks.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	I enjoy learning through hands-on activities.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	I learn best by watching videos and demonstrations.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	I like to take notes while listening in class.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	I prefer to study in a quiet place.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	I remember things better when I repeat them aloud.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	I learn well when I work with others in a group.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9	I use colors and drawings to help me study.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10	I understand topics better when I practice doing them.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

SECTION C: ACADEMIC PERFORMANCE

No.	Statement	1	2	3	4	5
1	I usually do well in class tests and exams.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	I complete my homework on time.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	I pay attention during lessons.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	I ask questions when I don't understand something.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	I participate actively in class discussions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	I try to improve when I make mistakes in tests.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

7	I study regularly at home.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	I set academic goals for myself.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9	I feel confident about my academic performance.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10	I do better in school now than before.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

SECTION D: INTEGRATED SCIENCE

No.	Statement	1	2	3	4	5
1	I enjoy studying Integrated Science.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	I understand the science topics taught in class.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	I find science experiments interesting.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	I perform well in Integrated Science tests.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	I like using science equipment during lessons.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	I read my Integrated Science textbook often.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	I find Integrated Science easy to understand.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	I participate in science projects or practicals.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9	I want to pursue a science-related career in the future.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10	I believe Integrated Science is important for my future.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

THANK YOU FOR YOUR PARTICIPATION IN THE STUDY!

APPENDIX B



Sample Standardized Test: Learning Styles and Academic Performance in Integrated Science

Section 1: Learning Styles Questionnaire

This section assesses your preferred learning style. For each statement, select the response that best describes how you usually learn or prefer to learn.

Instructions:

- Please read each statement carefully.
- For each statement, choose one of the following responses:

(A) Never (B) Rarely (C) Sometimes (D) Often (E) Always

Statement	A	B	C	D	E
I prefer to learn through hands-on activities, such as experiments or practical tasks.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I find it easy to remember information when I hear it explained.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I can understand complex topics better when I can see diagrams, charts, or visual representations.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I like to take notes and refer to them later during study sessions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I remember instructions better when they are demonstrated physically or visually.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I prefer to listen to audio recordings, such as podcasts or lectures, to understand new concepts.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

When studying, I prefer to walk around or move while reviewing material.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Visual aids like videos or charts help me to understand the content better.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section 2: Academic Achievement in Integrated Science

This section assesses your academic performance in Integrated Science. For each question, choose the correct answer based on your knowledge of the subject.

Instructions:

Choose the best possible answer for each of the following questions.

All questions are multiple-choice.

- Which of the following is a key component of photosynthesis in plants?
(A) Oxygen (B) Carbon dioxide (C) Nitrogen (D) Hydrogen
- What is the main function of the circulatory system?
(A) To regulate body temperature (B) To transport oxygen, nutrients, and waste products (C) To digest food (D) To protect the body from pathogens
- Which of the following is an example of a chemical change?
(A) Ice melting (B) Water boiling (C) Rusting of iron (D) Water freezing
- What type of bond is formed when two atoms share electrons?
(A) Ionic bond (B) Covalent bond (C) Hydrogen bond (D) Metallic bond
- Which of the following is NOT a type of rock?
(A) Igneous (B) Sedimentary (C) Metamorphic (D) Crystal
- What is the function of the skeletal system?
(A) To digest food (B) To provide structure and support to the body (C) To

filter waste (D) To regulate temperature

7. Which of these is an example of a non-renewable resource?

(A) Solar energy (B) Wind energy (C) Oil (D) Biomass

Section 3: Performance Rating

For this section, based on your actual academic performance, provide the scores you achieved in your most recent science exam.

1. What was your score in the last Integrated Science exam?

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2. How confident are you in your ability to apply science concepts in real-life situations?

(A) Not confident (B) Slightly confident (C) Moderately confident (D) Very confident (E) Extremely confident

Scoring for Learning Styles Questionnaire:

Kinaesthetic: High scores on questions 1, 7 indicate kinaesthetic preferences.

Auditory: High scores on questions 2, 6 indicate auditory preferences.

Visual: High scores on questions 3, 5, 8 indicate visual preferences.

Scoring for Academic Achievement:

Each correct answer in Section 2 contributes 1 point.

Total score is calculated out of 15.