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EFFECTS OF LEARNING ACTIVITY PACKAGE ON STUDENTS' ACADEMIC PERFORMANCES IN DIGESTIVE AND CIRCULATORY SYSTEMS

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DECLARATION

STUDENT'S DECLARATION

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

SIGNATURE: ______________________________

DATE: _____________________________________

SUPERVISOR'S DECLARATION

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

NAME: Prof. Charles Kwesi Koomson

SIGNATURE: _____________________________

DATE: ___________________________________

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DEDICATION

I dedicate this work to my husband Mr. Kondo Godwin, My children, Mr. Dugah Joshua, my father Mr Daniel Dodor and all my family and friends for their financial and spiritual support during my stay in UEW.

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All glory and honour be unto my Creator for his grace and wisdom he lavishly bestowed on me throughout my academic life, especially during this project work. My profound gratitude goes to my hardworking supervisor, Prof. Charles K. Koomson for his immense, valuable and relentless effort for making this research work a reality.

My prayer for him is to live long in health and wealth.

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ABSTRACT

This study aimed to investigate the effect of a Learning Activity Package (LAP) on students' academic performance in digestive and circulatory systems. The quasi-experimental design involved a pre-test and post-test non-equivalent group design, with 88 students in total divided into experimental and control groups. The experimental group consisted of 45 Year 2 General Arts students in Anlo senior high school and the control group, 43 Year 2 General Arts students from Zion College senior high school. These two schools were purposively sampled. The experimental group was taught using the LAP while the control group received conventional method. Achievement Test (AT) was used to collect data which consisted of twenty multiple-choice questions with four possible answers, labelled A to D, short answers items, practical test and essay type test were generated from the various subunits which was analysed using inferential and descriptive statistics. Results showed that the experimental group had mean score 33.07 and the control group, 25.05 with significant differences (p = 0.001) which is less than 0.05 significant value, this indicated that there was statistically significant difference between mean score of student taught digestive and circulatory system using LAP and those taught using conventional method. Comparing performance of male and female, females performed better on average, of mean score 34.83 and male 33.77 with p-value (0.073) which is greater than 0.05 level of significant, therefore there was no statistically significant difference between mean scores of males and females student taught digestive and circulatory system using LAP , Under the experimental group, mean scores 42.62, 32.16 and 28.93 for high, average and low ability group respectively, while the control group recorded mean scores of 32.09, 24.27 and 19.94 for high, average and low ability group respectively, a significant value (p = 0.001) showed that LAP was particularly effective for low-achieving students, as they showed notable gains. Furthermore, the experimental group had significantly higher mean scores compared to the control group, with a practically significant difference in scores. Overall, the findings suggest that the use of LAP as a teaching method improve students' academic performances in digestive and circulatory systems. Based on these findings, it is recommended that instructors should consider integrating the learning activity package (LAP) in their teaching approach. Further, additional resources and support should be provided to low-ability students to ensure their success.

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CHAPTER ONE

INTRODUCTION

1.0 Overview

This chapter contains information on the background to the study, the statement of the problem, the purpose of the study, the objectives of the study, and the research questions. Additionally, the delimitations of the study and limitations encountered in this study are also stated. The chapter also presents the significance of the study, the operational definition of terms and the organization of the rest of the study report in the following chapters.

1.1 Background to the Study

Science education plays a critical role in national development by equipping learners with the knowledge, skills, and attitudes required to understand the natural world and apply scientific principles to everyday life. At the secondary school levels, science education aims not only at the acquisition of factual knowledge but also at the development of scientific literacy, problem-solving abilities, and informed decision-making skills (UNESCO, 2017). Through effective science instruction, students are empowered to understand phenomena affecting their health, environment, and technological advancement, thereby becoming responsible and productive members of society.

Biology, as a core branch of science education, is particularly significant because it focuses on the study of life and living systems. It helps students understand life processes, structures, functions, and interactions within organisms and between organisms and their environment (Campbell et al., 2018). Biology education enables learners to relate abstract scientific concepts to real-world situations such as nutrition,

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disease prevention, personal hygiene, and health management. Consequently, a strong foundation in biology is essential for promoting health awareness and improving quality of life, especially among school-age learners. Among the key biology topics taught at senior high school levels are the digestive and circulatory systems, which are fundamental to understanding human survival and wellbeing.

Digestive system is responsible for breaking down food into nutrients, which the body uses for energy, growth, and cell repair (Johnson & Brown, 2019). Circulatory system is vital for transporting these nutrients, along with oxygen, to cells throughout the body and removing waste products (Lee & Kim, 2022). Understanding the interrelationship between these two systems helps students appreciate how body systems work together to maintain homeostasis. Such knowledge is directly applicable to daily life, influencing students' choices regarding diet, lifestyle, exercise, and disease prevention.

Understanding these systems also is essential for students as they form the foundation for more advanced topics in biology and health sciences (Smith, 2020). The teaching and learning of biology, particularly human systems such as the digestive and circulatory systems, present a significant challenge to educators and learners alike. These systems involve intricate processes and anatomical structures that are often abstract and difficult for students to grasp through traditional lecture-based methods alone (Okebukola, 2005).

Students' academic abilities are influenced by the teaching method, which can be seen in their level of proficiency. Diamond and Onwuegbuzie (2016) argued that the learning outcomes of diverse instructional approaches can be influenced by differences in teaching methods, emphasizing that variations in intellectual functioning among students necessitate distinct instructional strategies. The persistent reliance on teacher-

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centred approaches in science classrooms has contributed to low achievement and poor retention of biological concepts (Udo & Udofia, 2014).

Studies have demonstrated that teaching techniques exhibit diverse effects on students of different academic abilities (low, average and high) with one group receiving more benefit from a specific teaching method than the other (Nyarko, 2014; Ezeh, 2019; Udeji, 2017). According to Ezeh (2019) and Udeji (2017), the success of high-ability groups is determined by the methods used, while Nyarko (2014) found that some students are not as gifted in science. The teaching method used may not be appropriate for all groups, leading to this outcome.

Considering the preceding information, it may be essential to determine whether the student's academic ability group (low), average, or high) warrants a particular teaching approach. Evidence suggests that effective teaching can make learning more engaging and have a greater impact. Sander (2019) argues that effective teaching enhances learner retention, while inadequate teaching leads to poor learning outcomes and lower achievement. Effective teaching is characterized by the use of well-planned, learner-centered instructional strategies that actively engage students in the learning process and promote meaningful understanding rather than rote memorization. When learners are actively involved, they are more likely to retain concepts for longer periods and apply their knowledge to new and real-life situations. Teachers should use a variety of teaching methods to adapt their teaching techniques to students' individual interests. , abilities, and learning styles. The use of diverse approaches such as inquiry-based learning, collaborative activities, demonstrations, and practical experiences helps to accommodate learner diversity and sustain students' motivation. This instructional

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flexibility not only supports deeper cognitive processing but also enhances learners' confidence and participation in classroom activities.

Different approaches are employed in the teaching of biology topics to ensure meaningful learning. Lecture method, demonstration method (where appropriate), discovery, project, and inquiry are all examples of such teaching methods.

Traditional lecture-based methods may not effectively engage students or accommodate diverse learning styles, leading to gaps in understanding (Johnson & Brown, 2019). Science teachers in senior high schools of Ghana are consistently using one type of teaching method and continue to do so, as evidenced by literature (Nyarko, 2014).

Nyarko (2014) argues that the approach of teaching biology topics in a one-dimensional, fixed manner failed to recognize the individuality and uniqueness of science. Moreover, it doesn't foster the advancement of reasoning abilities and processes in students with diverse intellectual abilities. It seems that the customary approaches taken by science educators in biology classes do not account for the uniqueness of students (Anderson, 2018).

The aim of this study is to determine the effect of the Learning Activity Package (LAP) on students' academic performances in digestive and circulatory systems. In response to these challenges, educational stakeholders have advocated for the integration of learner-centred approaches that foster engagement, critical thinking, and independent learning. One such innovation is the Learning Activity Package (LAP), which serves as a structured instructional tool designed to meet diverse learning needs.

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Learning Activity Packages (LAP), as innovative teaching methods, shown to enhance student engagement and understanding by providing interactive and hands-on learning experiences (Doe, 2021).

Learning activity package (LAP) is a teaching approach that emphasizes student engagement, with teachers leading them through interdisciplinary activities and problems to enhance their learning. Depending on the instructional goals of the unit or module, the Learning Activity Package may incorporate various instructional techniques, such as diagrams, models, and interactive activities, which cater for different learning preferences and promote active learning (Lee & Kim, 2022).

The use of web pages or websites by teachers creating learning activity packages is a viable method for accommodating varying instructional styles. It is possible to find instructional content in the form of text, audio or video links, interactive activities, assignments, evaluation guides, and any other required content on the webpage or site (Njoku & Akamobi 2015).

The use of LAP is a learner-centred activity that emphasizes individualism and results in improved academic performances. For this reason, I seek to investigate whether LAP can influence students' academic performances when used as a pedagogical approach to teach digestive and circulatory system.

1.2 Statement of the Problem

The persistent low academic performances of students in biology, particularly in human body systems such as the digestive and circulatory systems, has become a source of concern for educators, curriculum planners, and policymakers (Enohuean, 2018). These topics, though crucial to biological literacy and health awareness, are often considered

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difficult due to their abstract and technical nature (Okebukola, 2005). Studies have shown that many students struggle to understand the interrelated structures and functions of organs within these systems, leading to misconceptions and poor achievement in examinations (Yelkpieri et al., 2012).

One of the key factors contributing to this poor performance is the continued reliance on traditional lecture-based teaching methods, which do not actively engage students in the learning process (Udo & Udofia, 2014). Such teacher-centred approaches tend to ignore the individual differences in learners' pace, learning styles, and prior knowledge. As a result, students often lose interest and motivation, leading to disengagement and reduced academic performance (Egbe, 2016).

The lack of engaging student-centered instructional approaches remains a major challenge in many classrooms settings, particularly in science education. Teaching is often dominated by teacher-centered method such as lectures, note dictations, rote memorization, where students assume a passive role as recipients of information rather than active participants in the learning process. This instructional approach limits opportunities for learners to explore concepts, ask questions, collaborate with peers and construct knowledge through meaningful learning experiences. (Goodwin, 2024; Amoakwah, 2024). Even when teachers attempt to adopt learner-centered strategies, such practices are often implemented superficially, resulting in minimal student participation and limited learning gains (Nelson & Bramwell-Lalor, 2023).

Recent studies indicate that instructional approaches such as cooperative learning, problem-based learning, inquiry-based learning, and project-based le arning are frequently underutilized or poorly facilitated, thereby failing to promote deep engagement and conceptual understanding (Goodwin, 2024). For instance, group work

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may be reduced to unstructured discussions without clear roles or guidance, while inquiry activities may focus on procedural completion rather than exploration and reasoning. Such practices do not fully embody the principles of student-centered learning and often leave students disengaged, confused, or dependent on the teacher for answers (Goodwin, 2024; Nelson & Bramwell-Lalor, 2023).

Structural and contextual factors further contribute to the lack of engaging student-centered instruction. Large class sizes, limited instructional time, examination-driven curricula, and inadequate instructional resources constrain teachers' ability to design and sustain interactive learning environments (Amoakwah, 2024). Additionally, insufficient professional development limits teachers' pedagogical competence and confidence in managing student-centered classrooms, leading many to revert to safer, teacher-dominated approaches even when they recognize the value of learner engagement (Nelson & Bramwell-Lalor, 2023).

Moreover, research suggests that students who are accustomed to traditional, teacher-led instruction may initially resist student-centered approaches due to unfamiliarity with self-directed learning, collaborative responsibility, and open-ended problem solving (Goodwin, 2024). Without adequate scaffolding, feedback, and supportive classroom norms, such resistance can reinforce low engagement and undermine the effectiveness of student-centered strategies. Consequently, the absence or weak application of engaging instructional approaches limits students' development of critical thinking, problem-solving skills, and the ability to apply knowledge to real-life contexts (Amoakwah, 2024).

The innovative methods, such as Programmed Instruction (PI) and Computer Assisted Instruction (CAI), have been supported by numerous studies, but their implementation

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in Ghana is almost impossible due to the lack of computer systems and large classes. Thus, there is a need to explore alternative child-centred approaches that are affordable, easily accessible, and adaptable and combine package learning with practical activities.

A technique that allows teachers to quickly identify problems in a student and allow students to assess their own progress with immediate knowledge of the outcome such as Learning Activity Packages (LAPs) should be used. These instructional tools are designed to promote self-directed learning, provide immediate feedback, and encourage active participation factors that are essential for meaningful understanding of scientific concepts (Arends, 2014; Offiong & Eniayeju, 2013).

While several studies have highlighted the general benefits of LAPs in science education, limited research has focused specifically on their effectiveness in enhancing student understanding and performance in the digestive and circulatory systems.

This gap I n the literature raises important questions as to whether LAPs truly affect students' academic performance in these core biology topics, and also, whether LAP can address the diverse learning needs of students more effectively than traditional methods. Without answers to these questions, teachers may lack evidence-based guidance on adopting more effective strategies in biology instruction.

Therefore, this study seeks to investigate the effect of Learning Activity Packages on students' academic performance in digestive and circulatory systems, with the aim of providing empirical evidence to support innovative teaching practices in biology.

1.3 Purpose of the Study

The purpose of this study was to examine the effects of Learning Activity Package (LAP) on students' academic performances in digestives and circulatory systems.

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1.4 Objectives of the Study

The objectives for this study include:

1. Examine the difference between the academic performances of students taught digestive and circulatory system using the LAP and those taught using a conventional method.
2. Evaluate the effect of the learning activity package on academic performances of male and female students in the digestive and circulatory systems.
3. Assess the effect of the LAP on the academic performances of students of different ability groups in digestive and circulatory systems. .

1.5 Research Questions

The study will be guided by the following research questions:

1. What is the difference between the academic performances of students taught digestive and circulatory system using the LAP and those taught using a conventional method?
2. What is the effect of learning activity package on academic performances of male and female students in the digestive and circulatory system?

3. What is the effect of learning activity package on academic performances of students of different ability groups in digestive and circulatory system?

1.6 Null Hypotheses

Ho1: There is no statistically significant difference between the mean scores of students taught digestive and circulatory system using the LAP and those exposed to a conventional method.

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Ho2: There is no statistically significant difference between the mean score of male and female students taught using Lap and those taught using conventional method.

Ho3: There is no statistically significant difference between the mean scores of students belonging to different ability groups, taught digestive and circulatory system using the LAP.

1.7 Significance of the Study

The findings will provide evidence on how Learning Activity Packages (LAPs) enhance understanding and retention of complex biological concepts such as the digestive and circulatory systems. This could result in improved academic performances and foster deeper interest in science subjects.

Biology teachers will benefit from insights into effective instructional strategies that promote student-centred learning. The study will demonstrate how LAPs can be used to address individual learning differences and engage students more actively in the learning process.

Future researchers in science education can use the study as a reference or basis for further investigations into the application of activity-based learning strategies in other science topics and educational settings.

Additionally, the research will aid in the creation of evidence-based biology teaching methods. It can be useful to pinpoint the precise elements, such as activity kinds, interaction levels, and scaffolding levels—that contribute to the effectiveness of learning activity packages.

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Furthermore, the study can help educational institutions and policymakers understand how well learning activity packages can raise students' performances. This may result in the inclusion of these teaching and learning techniques in the curriculum, which could improve educational quality and encourage pupils to succeed academically.

1.8 Scope of the Study

This study focuses on evaluating the effect of Learning Activity Packages (LAPs) on academic performances of students in the concept of digestive and circulatory system at senior high schools in Anloga District. Only the digestive and circulatory systems were covered. Moreover, general science curriculum was the subject of the inquiry.

Only form two (2) General Art students from two coeducational senior high schools in Ghana participated in the study.

Form two (2) General Arts students were used for the study because the topics were in their syllabus. The subunits developed were:

Parts of the human digestive system

Functions of the part of the digestive system

Process of digestion

Parts of the human heart

The blood

Blood vessels

The study focuses specifically on biology, with emphasis on two human systems: the digestive system and the circulatory system. Other areas of biology are not covered.

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The study was limited to the use of Learning Activity Packages (LAPs) as the primary intervention. Other teaching methods such as project-based learning or digital tools are not part of the study.

The study was conducted in selected secondary schools within Anloga district. Its findings may not be generalized to schools outside this area without further validation.

1.9 Limitations of the Study

Limitations are potential weaknesses in a research study that are often beyond the researcher's control and may affect the interpretation, generalizability, or outcomes of the findings (Ghazvini, 2025). In this study, some limitations were identified.

Firstly, the challenge this study faced was absenteeism on the part of some of the students, Student absenteeism during the intervention phase also presented a significant limitation. Some students were absent due to ill health and personal reasons, which may have introduced bias and affected the consistency of the result. Absenteeism was addressed through the organization of makeup sessions for students who missed key intervention lessons.

Secondly, the study focused only on students' academic performances, which was measured using an achievement test. Other important learning outcomes such as students' attitudes, interest, motivation, and retention of knowledge were not examined. Therefore, the results reflect performances outcomes only and not the overall learning experience of the students.

Thirdly, the study was conducted using a quasi-experimental design, where intact classes were used instead of randomly assigned groups. This may have introduced some

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pre-existing differences among students, which could have influenced the results despite the use of statistical controls.

Finally, the study was limited to only two biology topics the digestive and circulatory systems. As a result, the findings may not be generalized to other biology topics or science subjects without further investigation.

Despite these limitations, the study provides valuable insights into how learning activities package can impact students' academic performances in digestive and circulatory systems within a real classroom context.

1.10 Operational Definition of Terms

The following lists some of the terminology used in this study along with their definitions.

Circulatory System: A biological system consisting of the heart, blood, and blood vessels, responsible for transporting nutrients, oxygen, and waste products throughout the body.

Digestive System: The body system responsible for the breakdown of food, absorption of nutrients, and elimination of waste. It includes organs such as the mouth, stomach, intestines, and associated glands.

Engagement: The degree of attention, curiosity, and interest that students show in the learning process, often reflected in participation, effort, and enthusiasm during lessons.

Learning Activity Package (LAP): A structured instructional tool that contains learning objectives, reading materials, guided activities, and self-assessment tasks designed to promote independent and active learning at the student's own pace.

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Traditional Teaching Method: A teacher-centred instructional approach characterized by lectures, note-taking, and minimal student interaction or hands-on activity.

Academic Performance: The level of achievement or proficiency demonstrated by students in educational tasks, typically measured through tests, quizzes, or examinations

Motivation: An internal state or condition that activates and directs behaviour toward learning goals. In this study, it refers to the willingness and drive of students to engage in learning biology topics.

Ability level: This describes what a learner can currently accomplish on their own with a high accuracy rate. Another name for ability level is independent level.

Learners with High Ability [HAL]: Students who are more proficient than their peers of a similar age in one or more domains are considered high-ability learners. These domains include sophisticated thought processes, learning speed, and intellectual capacity.

Low Ability Learners [LAL]: Learners with lower learning needs and slower learning rates are considered LALs. Compared to their peers, this set of students might not be as intellectually proficient.

Pre-test: An initial assessment of students' strengths given prior to the experiment.

Post-test: After the experiment, students take a test, which is utilized in conjunction with the pre-test to gauge their progress and the efficacy of the treatment.

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The term "student performance" describes the degree of proficiency shown by pupils in their comprehension and application of particular biology subjects. Scores on tests, quizzes, and evaluations are only a few ways to gauge this.

Effect: The extent to which the learning activity package has impact on students' academic performance in the chosen biology topics, as anticipated. This can be assessed by comparing the students' performance scores before and after the intervention and determining how much they have improved.

1.11 Organization of the Rest of the Study

There are five chapters in this study. The first chapter has already been covered. . Chapter two comprises of review of related literature. It begins with an overview of the chapter and then a review of related literature under various strands. Chapter three consists of the research methodology. It is structured into the overview, the study's design, population and sampling procedure, instrumentation, the instruments' validity, the instruments' reliability, data collection, and data analysis. Chapter four contains a presentation and analysis of the results. Chapter five covers the summary of findings, conclusion, recommendations and suggestions for further study Appendices and references were then included.

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CHAPTER TWO

LITERATURE REVIEW

2.0 Overview

This chapter reviewed the literature under several strands that was pertinent to this investigation. This chapter also reviewed the study's theoretical foundation, conceptual framework, and empirical literature.

2.1 Theoretical Foundations of LAP

The foundation for this research is based on constructivist learning theories, which highlight the importance of students being actively engaged in their educational journey. Learning Activity Packages (LAPs) align with constructivist principles by enabling learners to build knowledge through guided exploration, personalized activities, and self-evaluation. Bruner (1996) states that students achieve optimal learning when they uncover knowledge independently through engaging in relevant tasks. LAPs align strongly with this assumption by structuring learning into guided activities that require learners to explore, hypothesize, and reflect.

Despite its strengths, constructivism has been criticized for placing high cognitive demands on learners, particularly those with lower prior knowledge. This critique is important in the context of senior high school biology, where abstract concepts such as digestion and circulation can overwhelm learners if insufficient scaffolding is provided. LAPs partially address this limitation by offering structured tasks and guided activities; however, the extent to which scaffolding is adequate remains an empirical question that this study seeks to address. Additionally, LAPs incorporate aspects of mastery learning, organizing instructional resources in such a way that students can only advance after reaching a certain level of proficiency (Bloom, 1976). The theory posits that with

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sufficient time and appropriate instructional strategies, nearly all learners can achieve mastery. LAPs embody this principle by allowing learners to progress through content at their own pace and revisit activities until a defined level of competence is achieved. However, mastery learning has been criticized for its practical demands, including increased instructional time and assessment workload. LAPs offer a flexible structure that can partially mitigate these challenges by embedding formative assessment and feedback within learning activities. In biology education, where it is essential for students to comprehend abstract and intricate processes like digestion and circulation, LAPs serve to connect theoretical knowledge with its practical application. By delivering information in modular and task-based formats, LAPs facilitate a more personalized and manageable learning experience, thereby improving academic outcomes and motivation.

The learning activities package, the constructivist learning theory, particularly Kolb's experiential learning theory and Dewey's (1997) idea of progressive learning, serves as the theoretical foundation for innovative teaching. The progressive learning hypothesis was introduced by Dewey (1997). According to Dewey's view, learning should be approached through problem-solving. He felt that in order for children to learn, he should be put in a situation where he must solve a problem, given the tools he needs, and then left to figure it out on his own. All of the learner's senses are actively engaged with the idea being studied in this kind of learning. The involvement of several sense organs in learning ensures meaningful and more permanent learning. Teaching science in particular, using LAP, allows learners to interact with objects and phenomena for a better understanding using the sense organs during the teaching-learning processes. Thus, the use of LAP in teaching biology in senior high schools draws inspiration from Dewey’s theory of progressive learning. According to Dario et al. (2016), the

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experiential learning theory was propounded by psychologist David Kolb. The principle says, students can translate their experiences into knowledge by creating it. The learning theory explains how students' emotions are affected during the learning process by experience, cognitive capacity, and learning environment.

As a result, Kolb's experiential learning model emphasizes how students acquire experience by developing conceptual and tangible concepts through active experimentation and reflective observations (Dario et al., 2016). The pedagogical approach of the learning activity bundle for biology instruction is compatible with the experiential learning model. Through active engagement with materials, the LAP pedagogy assists students in developing the ability to gain tangible experiences. Additionally, the students' tangible experiences can be transformed by active experimentation and observation. The experiential learning theory is used to model the learning activity package. Teachers are supposed to help students learn by guiding them through activities that will improve their capacity to acquire tangible learning experiences. A critical limitation of experiential learning theory is its assumption that all learners can effectively reflect on and conceptualize experiences without explicit instructional support. In practice, some students may engage in activities without achieving meaningful conceptual understanding. This underscores the importance of teacher guidance within LAP implementation, reinforcing the idea that LAPs are not self-sufficient instructional tools but pedagogical frameworks that require skilled facilitation.

The reviewed theories suggest that effective learning occurs when instruction is learner-centered, experiential, and responsive to individual differences. LAPs represent a pedagogical convergence of constructivist, experiential, and mastery-oriented

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principles. However, the literature reveals gaps concerning how these theories interact in practice, particularly in relation to students of differing ability levels and within real classroom constraints. Focusing on the digestive and circulatory systems and analyzing outcomes across low, medium, and high ability groups, the study responds directly to gaps identified in the literature. Furthermore, it seeks to determine whether LAPs can balance learner autonomy with instructional structure, thereby addressing key criticisms of constructivist and experiential learning theories.

This study contributes to the literature by testing these theoretical assumptions within a concrete educational context, thereby strengthening the link between theory and classroom practice.

2.1.1 Learning Activity Packages (LAPs) and Theories of Learning

Learning Activity Packages (LAPs) have been extensively acknowledged for its' capacity to customize education and improve student performance. Offiong and Eniayeju (2013) discovered that students who engaged with LAPs in the sciences achieved substantially better results compared to their peers who were taught through conventional methods. LAPs address diverse learning preferences and speeds, which is essential in classrooms with mixed abilities. Although these findings provide strong support for the use of LAPs, many studies focus primarily on test scores as indicators of effectiveness. As a result, less attention is given to how LAPs influence students' cognitive engagement, understanding of concepts, or learning across different ability levels. This narrow focus limits the extent to which conclusions can be generalized, particularly in biology where conceptual understanding is as important as achievement

Arends (2014) contended that LAPs, when properly structured, function as effective instructional resources that synthesize objectives, content, activities, and evaluation. By

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doing this, they offer a comprehensive learning experience that can strengthen both theoretical knowledge and practical competencies. While this framework supports effective teaching, most studies assume that LAPs are well designed without evaluating the quality of their construction. Consequently, improvements in student performance may be attributed to well-prepared instructional materials rather than the LAP strategy itself. This observation suggests that the effectiveness of LAPs depends largely on thoughtful instructional design, an issue that is not adequately addressed in much of the existing literature.

Farrant (2012) pointed out that according to Piaget's theory of cognitive development, intellectual growth occurs through the active engagement of the child with their surroundings. This indicates that the foundation of learning relies on the child's capability to interact with both the physical and social environments. Piaget believed that a child needs to engage with objects in their environment to learn effectively. Therefore, active participation by the child is essential, which can take the form of hands-on activities, visual exploration, or mental manipulation.

According to Piaget, a child's mental activities are structured into frameworks known as "schemas," which represent clusters of related cognitive processes. Woolfolk and Nicolich (2018) suggested that in the framework proposed by Piaget, the schema is fundamental to cognitive organization. This means it serves as the foundational component of thought. Piaget asserted that the mental processes involved in cognitive organization are characterized by adaptation, which comprises two interrelated but distinct operations: assimilation and accommodation. In the assimilation process, a child integrates new experiences into existing mental frameworks, whereas accommodation involves altering mental structures in response to environmental

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influences. Accommodation requires modifying oneself to accommodate new information, while assimilation entails adjusting that information to fit the pre-existing cognitive structure.

The Piagetian perspective places the child as the central figure in the educational context. Consequently, the teacher’s role is to create scenarios that promote exploration and manipulation of both objects and concepts. As Awotua-Efebo (2016) stated, learners should be encouraged to "do" and progress at their own pace. An individual achieves a genuine understanding of a concept only when they construct it independently. When we present information or educational materials too rapidly, we inhibit the learner's ability to reinvent the concept on their own due to insufficient grasp of its structure.

This theory has significant implications for implementing Learning Activity Packages in biology education. Firstly, Piaget’s theory posits that cognitive development arises from the child’s active interaction with their environment. This supports the researcher’s advocacy for the use of Learning Activity Packages, which are focused on student engagement, and activity-driven strategies where the teacher facilitates learning by guiding students through various tasks and challenges that enhance their achievements.

Additionally, Piaget’s theory underscores the necessity for active involvement, which the Learning Activity Package Strategy promotes. This is because, in LAPs, educational materials are divided into smaller, sequential steps that build from what is known to what is unknown, increasing in complexity. A child must grasp a step before advancing to the next, thus ensuring active participation in the learning journey. Additionally, there are numerous tasks that require the learner to engage independently, which

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promotes an active approach to the learning experience. Other educational theories relevant to Learning Activity Packages include Ausubel’s theory, which suggests that meaningful learning occurs when new information is connected to existing knowledge within the learner's cognitive framework. Ausubel’s theory has important implications for Learning Activity Packages, particularly when the learner's interests and abilities are taken into account. These factors serve as the foundation for developing new learning packages that cater to the unique needs of each learner. A learner's prior knowledge may influence their progress with the Learning Activity Package. Consequently, the Learning Activity Package is structured to allow the learner to advance at their own pace and in a manner that suits them. (Abu, 2018). While several studies reference this theory, few explicitly measure learners’ prior knowledge or examine how it affects learning outcomes when LAPs are used. This represents a gap in the literature, particularly in relation to mixed-ability classrooms. . Most existing studies focus on overall achievement and do not sufficiently examine LAP use in specific biology topics such as the digestive and circulatory systems.

In response to these gaps, the present study investigates the effect of Learning Activity Packages on students’ academic performance in the digestive and circulatory systems, with particular attention to learners’ ability levels. By grounding the study in established learning theories and addressing limitations identified in previous research, this study seeks to provide evidence that is both pedagogically relevant and contextually appropriate for secondary school biology instruction.

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2.2 Conceptual Framework

The Learning Activity Package represents a novel strategy that facilitates personalized learning. It is an adaptation of instructional programming. As noted by Smith (2019), a Learning Activity Package serves as a means of communication between students and teachers, providing instructions for activities aimed at achieving specific performance outcomes. Developed by teachers, this instructional strategy originated at Nova High School in Florida (Cardarelli, 2012). According to him, a LAP is a booklet focused on a particular topic that includes objectives associated with it, a variety of activities designed to meet these objectives, and assessments to evaluate whether these objectives have been attained. Additionally, a LAP consists of sequentially organized sets of learning tasks tailored to achieve the designated objectives. The package encompasses diverse activities aimed at reaching these goals. Moreover, it includes evaluation methods to ascertain whether the objectives have been successfully achieved. Romisowski (2014) characterized the LAP as a format that is a booklet on a specific subject, which contains objectives tied to the topic, a range of activities to accomplish those objectives, and assessments to ascertain if the objectives have been fulfilled. This signifies that the LAP enhances classroom learning, presenting even the most challenging subjects in manageable steps so that all students can progress at their own pace. The entire learning process is centred on the students. The teacher only intervenes when necessary. As stated by Smith (2019) and Cardarelli (2012), the components of a LAP include the title or topic and objectives, a pre-test, activities, quizzes, and a post-test.

• Topic and Subtopics: The first introduction of students to the LAP is through the declaration of the topic and subtopics. The topic should reflect the core theme or main idea of the workload. Depending on the volume of content, this main idea may be subdivided into secondary themes, which are the sub-topics. The extent to which this topic is covered is determined by the individual teacher, the type of student engaging with the LAP, and the duration the student has been using it.

• Rationale: After settling on the topic and subtopics, the rationale typically follows. This rationale is a written explanation aimed at providing learners with an understanding of why this topic is important to study. It should convey the overarching purpose of the package and its significance to the student's academic journey. It must be clear and brief. It should connect with prior and future learning activities. The rationale may take various forms, such as a film designed to inspire interest, a presentation to a large group, an engaging experiment, an exploratory study, or a written explanation that clarifies the topic's relevance within the broader context of the student's education or everyday life.

• Behavioural Objectives: A set of well-defined behavioral objectives is a crucial element for directing or organizing the learner's actions. These objectives should be articulated in terms of what the student will be able to accomplish after finishing the LAP. Various factors, including the domain (whether cognitive, affective, or psychomotor), the quantity of objectives, and the anticipated performance levels, are shaped by both the content and its structure. The extent of these objectives varies according to the developmental level of the students involved. Within the LAP, the role of these objectives is to convey targets to the students, so they should be expressed in clear language.

• Pre-test: After the intent and specific performance criteria (objectives) of the Activity Package have been communicated to the learners, a self-assessment should be offered.

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This assessment can be directed by either the student or the teacher, but should fulfill the following roles:

i. allows the student to skip the Activity Package if they already meet the performance criteria.

ii. guides the students toward those sections of the Activity Package that they need to focus on; and

iii. enables the students to evaluate their progress level before receiving the teacher's assessment. In other words, if the pre-test is effectively conducted, it will help identify weaknesses beforehand and direct the student to appropriate activities, providing them not with failure, but with success, thus ensuring a more positive, rewarding learning experience.

• Learning Activity: The activities within the LAP aim to offer students a multi-media, multi-modal, multi-level pathway to achieve the objectives of the LAP. The multimedia components direct students to resources such as readings, transparencies, audio tapes, filmstrips, demonstration models, etc., catering to the individual learner's learning style. The multi-modal strategies include flexible programs, large group, small group, and independent activities. The multi-level approach allows learners to begin at the foundation of their specific weaknesses. The learning activity implemented by the researcher was in the format of a booklet, requiring students to engage with the activities autonomously.

• Quizzes: Integrated into the LAP is the principle that if something is valuable to teach, it is equally important to determine whether it has been learned. Regular quizzes provide students with feedback on their progress and help correct their mistakes by directing them to remedial activities. This process fosters continuous learning

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development. All quiz items are created to assess specific objectives and align with those objectives.

Post-test: The post-test assesses how well students meet all the objectives of the LAP. The evaluation from the post-test is not a conclusion, but rather the start of diagnosing each student's individual weaknesses; it marks the beginning of seeking more suitable activities; and it initiates the analysis and evaluation of our teaching methods. Through the LAP, the post-test takes on a comprehensive evaluation role, assessing not just the student, but also the effectiveness of the teacher and the program itself. The post-test used in this study served as a tool to compare the effectiveness of the LAP against the expository method (lecture method). According to Smith (2019), some benefits of LAP are:

i. breaking down materials into smaller parts;
ii. instruction shifts to a student-centred approach (as students engage in Learning Activities independently);
iii. Students show greater interest in lessons because they are actively participating. Psychological research by Bruner, Gagne, Piaget, and others, as cited by Blair and Stone (2015), indicates that students become more enthusiastic when they engage in the learning activities themselves.
iv. LAP allows students the time needed to process and integrate information. As stated by Chauhan (2015), Piaget maintained that true learning cannot occur unless a child mentally engages with the information and actively processes and integrates what they encounter in their surroundings;
v. the instructional materials can be organized using a teaching package or booklet;
vi. the teacher is relieved from routine tasks and drills;

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vii. It fosters self-confidence in students, enabling them to approach and resolve problems in their learning experiences.

viii. It cultivates scientific attitudes in students, including open-mindedness, curiosity, determination, and more.

ix. It promotes meaningful learning (Wandesee, 2010).

LAPs are not inherently effective; their success depends on the alignment of objectives, activities, and assessment. Also LAPs promote learner autonomy, teacher guidance remains essential, especially for complex biology concepts and prior knowledge and ability level significantly influence how students benefit from LAPs, yet these variables are often insufficiently examined in previous studies. Finally, most existing studies emphasize achievement outcomes without adequately considering subject-specific challenges in biology. These insights directly shape the present research on the effect of Learning Activity Packages on students' academic performance in the digestive and circulatory systems. By focusing on carefully designed LAPs, this study addresses concerns about instructional quality rather than assuming the strategy's effectiveness. The study also recognizes the complexity of biological systems and therefore examines effects of LAP within a specific content area rather than across general science achievement. Furthermore, by comparing LAP with the expository method, the study responds to gaps in the literature regarding the relative effects of learner-centered and teacher-centered approaches.

Based on the aforementioned benefits, it is apparent that utilizing the LAP method is expected to improve performance. This is the rationale behind the researcher examining the effects of LAP in teaching digestive and circulatory system as a topic and its impact on academic performance.

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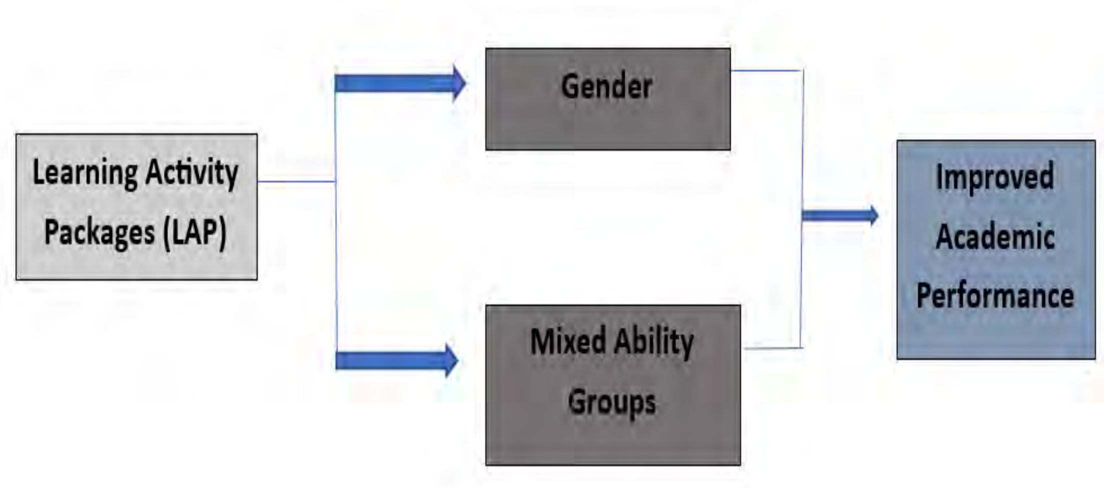

Figure 1: The Learning Activity Package Pathway (Source: Dodor, 2025)

The framework illustrates how the Learning Activity Package (LAP) serves as the independent variable influencing students' academic performance dependent variables in the digestive and circulatory systems. The relationship between LAP and performance is mediated by learner-related and instructional factors such as gender, and ability level. Control variables are held constant to ensure that observed differences in academic performance are attributable to the instructional strategy rather than extraneous factors. This framework provides a theoretically grounded and empirically justified basis for investigating the effects of LAPs in teaching the digestive and circulatory systems at Anlo senior high secondary school.

2.2.1 Empirical studies of LAP

Empirical evidence from science education research indicates that Learning Activity Packages (LAPs) are effective instructional strategies for improving students' academic performance, retention, and engagement. Several studies conducted across different science disciplines have demonstrated that LAPs provide meaningful learning experiences that surpass the outcomes of conventional lecture-based instruction.

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Numerous empirical studies substantiate the effectiveness of Learning Activity Packages (LAPs) in science education. For instance, Offiong and Eniayeju (2013) carried out a quasi-experimental study revealing that students taught with LAPs exhibited significant improvements in science achievement. Likewise, Egbe (2016) discovered that LAPs enhanced both the performance and self-efficacy of biology students. These studies provide strong support for the effectiveness of LAPs, their reliance on quasi-experimental designs suggests limited control over extraneous variables, thereby restricting the extent to which causal conclusions can be drawn

Previous research has shown that the learning activity package is effective in enhancing students' retention of knowledge in science subjects. In a related study, Abu (2018) explored the effectiveness of individualized and lecture-based instructional methods for teaching biology at the senior secondary level and concluded that students' retention of knowledge in biology was significantly greater through the use of the learning activity package compared to the traditional lecture method. Additionally, Udu (2018) investigated the effectiveness of cooperative learning, learning activity package, and lecture-based teaching in increasing students' academic retention in chemistry. This study revealed that chemistry students who learned through the learning activity package pedagogy had a superior retention of concepts compared to those instructed with the traditional lecture method. Although these studies confirm the superiority of LAPs in promoting retention, they largely focus on comparisons with teacher-centered approaches, leaving unanswered questions about how LAPs perform relative to other constructivist instructional strategies.

The learner-centered nature of LAPs is further emphasized in the work of (Arseneau et al. 2014), who argued that learning activity packages provide structured learning

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frameworks while allowing students the autonomy to progress at their own pace. This flexibility accommodates individual differences in learning speed and style, thereby fostering deeper understanding. However, most empirical studies do not explicitly measure the cognitive processes underlying these outcomes, resulting in a gap between the theoretical foundations of LAPs and empirical validation of their mechanisms.

Contextually, research conducted in developing countries such as Nigeria, Kenya, and Tanzania suggests that LAPs are adaptable and effective even in resource-limited educational environments. Adeyemo (2015), for instance, reported that students taught using LAPs exhibited superior problem-solving skills and conceptual understanding compared to those taught through lecture methods. Despite these encouraging findings, the majority of existing studies address general science or broad biology topics rather than specific and conceptually demanding areas such as human physiological systems. The empirical studies reviewed provide strong justification for investigating the effects of Learning Activity Packages on students' academic performance in the digestive and circulatory systems. Although previous research has established the general effectiveness of LAPs in biology and other science subjects, there is limited empirical evidence on their application to complex physiological systems that require high levels of conceptual understanding.

By focusing on the digestive and circulatory systems, the present study addresses an important gap in the literature. These topics involve abstract processes and interrelated functions that students often find difficult to comprehend when taught using lecture-based methods. The learner-centered and self-paced nature of LAPs may therefore offer a more effective means of facilitating understanding and improving academic performance in these areas. Also, the present study extends existing research by

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providing subject-specific empirical evidence within the context of secondary school biology. The findings are expected to contribute to instructional practice, curriculum development, and policy decisions by demonstrating whether LAPs can enhance students' academic performance in challenging biology topics.

2.2.2 Gender influence and students' academic retention in science subjects

Gender influence on students' knowledge retention has been a topical issue in education. However, there are conflicting research findings on this issue. For example, Bosede (2010) and Ezeudu (2013) found that gender significantly influences students' knowledge retention in science subjects. Specifically, Ezeudu (2013) found that female students performed better than their male counterparts when taught some concepts in physics and chemistry, respectively. Also, Agomuoh (2010) reported male students' higher knowledge retention in science subjects than their female counterparts. In contrast, Nzewi (2010) reported a non-significant influence of gender on students' knowledge retention in science subjects. These contradictory findings on gender influence on students' knowledge retention in science subjects also necessitated this study. This study, therefore, evaluated the potency of LAP pedagogy in fostering students' retention of knowledge in science subjects using the lecture method as control and gender as a moderating variable.

Quite a good number of studies have been conducted on either science achievement or science achievement and retention of students. For instance, Ajit (2019) carried out a study in Egypt on the relationship between abstract concept achievement and prior knowledge formal reasoning ability and gender in Biology using a sample of 160 secondary school students (85 males and 75 females). After analyzing the data using mean and standard deviation to test research questions and analysis of co-variance to

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test hypotheses, he found that prior knowledge and formal reasoning ability play a major role in students' achievement of abstract concepts, and secondly that the effect of students' prior knowledge on achievement seems to exceed that of formal reasoning ability. Gender had little effect on the achievement of abstract phenomena. The above study, however, has no clear view of the relationship between gender and science achievement and retention. A study on the major influences on science achievement in a developing country Kenya, carried out by Tawari (2016) in physics; using a sample of 424 respondents found after data analysis that the school and teacher characteristics play a more significant role in shaping science attitude and achievement in developing countries like Kenya than in developed countries. There were significant differences between boys and girls in student motivational orientation and achievement with boys performing better, but the relationship between gender and achievement was indirect and mediated through variations in the different types of secondary schools and the teachers assigned to them. Conversely, the prior idea of the students before formal instructions took place was not considered by the researcher.

Overall, the literature demonstrates a tendency to prioritize achievement outcomes over retention, and to focus on traditional lecture-based instruction, with limited exploration of learner-centered pedagogies. This creates a conceptual gap regarding how innovative instructional strategies such as Learning Activity Packages can enhance both performance and retention while potentially minimizing gender disparities. The inconsistencies and gaps identified in the literature provide a strong rationale for the present study on the effects of Learning Activity Packages (LAPs) on students' academic performance and retention in the digestive and circulatory systems.

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Treating gender as a moderating variable rather than a primary determinant, the study responds directly to the call for more nuanced analyses of gender influence in science education. The use of LAPs addresses the overreliance on lecture-based instruction observed in many previous studies. As a learner-centered approach, LAPs are designed to promote active engagement, self-paced learning, and immediate feedback factors that research suggests can enhance both achievement and retention irrespective of gender, focusing on digestive and circulatory systems fills a content-specific gap, as much of the reviewed research concentrates on physics, chemistry, or abstract biology concepts, rather than on human biology topics that are foundational and conceptually integrated. These systems require deep understanding and long-term retention, making them suitable for evaluating the effectiveness of LAPs.

Finally, by simultaneously examining academic performance and retention, the present study is to assess sustained learning outcomes. This contributes to science education literature by providing empirical evidence on whether innovative pedagogies like LAPs can reduce gender-based disparities in science learning.

2.2.3 Students' ability-level and performance in science

One related element influencing success in science is the skill level of students. Research by Anderson (2018) indicates that academic performance in a typical classroom varies among students. Some excel and are considered high achievers, others perform at an average level and are labelled as middle achievers, while some struggle and are classified as low achievers. It has been noted that no two individuals are entirely identical in their overall attributes. Typically, one might expect that high-ability learners would consistently outperform both average and low-ability learners across most subjects; however, studies have shown that this is not always the case. This is

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evidenced by research conducted by Abu (2018), which revealed that some students possess exceptional talents but do not excel in science. Freeman (2020) examined how fieldwork as a teaching strategy impacted achievement in Biology. The findings were significant for the above-average ability group but showed no significant effect for those in the below-average group.

Additionally, Bosede (2010) investigated the factors impacting concept development in the Nigerian Integrated Science Project and found that mental ability level, among other factors, plays a role. Nzewi (2010) explored how prior knowledge of behavioral objectives and study questions affect achievement in Biology, concluding that despite students' ability levels, there were significant achievements recorded. Ezeh (2019) researched the influence of advance organizers on student achievement, interest, and retention in Integrated Science, categorizing students into low and high ability levels. The analysis, utilizing a 2 x 2 analysis of variance, revealed no statistically significant difference in interest levels between the low and high ability groups, yet a significant difference existed in terms of performance, with high ability students achieving better results. Georgiou's et al. (2011) conducted a study on physical-science knowledge and achievement patterns at the primary-secondary transition, involving 976 seventh and eighth-grade students from nine urban and semi-urban middle secondary schools in Greece. The analysis, which utilized mean percentage scores and standard deviations, showed that only 128 students (13.1%) achieved commendable scores ("able" students), while just 58 students (5.9%) scored exceptionally well ("top" students). Male "able" and "top" students outnumbered and outperformed their female counterparts. There was a notable increase in the gender gap, especially among higher achievers favouring boys. This research relied on mean percentages to compare gender and ability levels, utilizing only two categories: "able" and "top." No evidence of

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reliability testing was presented. These gaps are among those this present study aims to address. The reviewed literature highlights that students' ability levels are crucial to their achievement, indicating a correlation with intelligence, yet there is inconsistency in the group's performance across various teaching methods and strategies. This variability in student achievement at different ability levels underscores the necessity for this study, which examined the impact of the Learning Activity Package (LAP) on the academic performance of students with varied ability levels in digestive and circulatory systems.

2.2.4 Related empirical studies on individualized instruction and learning activity packages (LAP)

The following empirical research has been conducted by various researchers to explore the impact of individualized instruction and Learning Activity Package methods on students' performance, specifically in science subjects. Tawari (2016) examined the relative effectiveness of two science teaching methods (Biology) at the junior secondary school level in Nigeria. The methods analyzed were individualized instruction and the conventional (lecture) approach regarding students' academic performance. The study involved a total of one hundred and forty Form II students selected from four classes across two mixed school types in Benin City. A pre-test-post-test control group experimental design was employed for the investigation. The instrument used was a performance rating scale in biology, which included a questionnaire as well as multiple-choice objective achievement tests. The pre-test and post-test questions were derived from the concept of the mammalian skeleton taught. The raw scores from students under both instructional methods in the experimental and control groups were analyzed using factorial analysis of covariance. The findings indicated that individualized instruction was significantly more effective than the conventional approach concerning

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students' performance. However, Tawari's study did not specify the exact type of individualized instruction utilized. Additionally, both schools were used for both experimental and control groups, leading to potential contamination as the groups could interact. There was no effort made by the researcher to ensure the homogeneity of the two classes. Burnside (2011) conducted a study that explored the development, implementation, and assessment of a Learning Activity Package focused on computer use. This Learning Activity Package included a self-paced word processing tool for language arts, developed collaboratively by teachers and computer specialists. The development of the LAP was a collaborative effort between teachers and subject specialists. The results indicated that the LAP was successful in teaching writing tools through computers. Furthermore, students reported enjoying the process of independent learning.

However, there was no indication of whether the subjects were homogenous or equivalent. Igbanugo (2016) investigated the effectiveness of individualized instruction through offering diverse learning opportunities. The subjects comprised 20 undergraduate students from Baruch College of Medicine in New York. The researcher created and validated a Learning Activity Package on blood pressure, which served as the treatment for the students. The results following the pre-test and post-test indicated that all students mastered the concept, achieving an 80% success rate as the benchmark. In this study, all 20 undergraduate students constituted the experimental group, and there was no control group included. The researcher did not compare the LAP with other instructional methods. Moreover, the study did not address the homogeneity of the subjects, as they were chosen from different classes, despite being older and not all being in the same year. The study also did not report the genders of the participants involved. Smith (2019) conducted a comparative evaluation of three teaching methods:

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Socratic dialogue, lecture, and personalized system of instruction (PSI). The classroom sizes for the three methods were 22 students, 24 students, and 21 students, respectively. The study utilized a pre-test and post-test assessment along with a questionnaire designed to gather students' feedback and attitudes towards the three methods, which was administered after the post-test.

The findings indicated that students had a more favourable view of the PSI. The subjects who experienced PSI demonstrated a better performance rating compared to the two other methods. The research results indicated an overall higher rating for the PSI when compared to the other two methods, but no specifics about those methods were provided. Hwong (2013) explored the impact of cooperative and individualized learning on the achievements and attitudes of future elementary music teachers. The study involved 43 prospective music teachers. The outcome showed that the cooperative instructional method boosted achievement more than the individualized approach. The success of cooperative learning may be attributed to the inherently collaborative nature of music, which necessitates a collective effort for effective production. Abu (2018) examined the efficacy of individualized versus lecture-based instructional methods in teaching biology at the senior high level in two schools located in the Accra township of Ghana. A total of 80 participants were randomly selected for the study. The instruments employed included multiple-choice assessment tests and pre/post-treatment tests. Data collected were analysed using the t-test statistic. The results indicated that the individualized instructional method (LAP) improved students' achievement in biology, regardless of their prior academic performance. However, the research was restricted to two schools in Accra, and the researcher did not account for extraneous variables that could have compromised the study's validity, such as irregular participation and inter-group contamination. Mukaila (2010) investigated LAP and

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conventional teaching methods along with students' cognitive preference styles as factors influencing secondary school students' achievement in heat-related physics concepts. The study included 284 senior secondary two physics students selected from six widely spaced co-educational schools in Abeokuta, Nigeria. Data collection utilized three instruments: a physics achievement test, a cognitive preference style inventory for physics, and a locus of control scale. Analysis of the collected data was conducted using analysis of covariance (ANCOVA) and the Schaeffer multiple range test as a post-hoc analysis. The results demonstrated that the LAP instruction group performed significantly better than the conventional groups. Nonetheless, there was no notable main effect of gender on physics achievement [F (1) 283 = 1.979, P > 0.005]. Interaction effects were significant between treatment and locus of control [F (2), 283 = 5.031, p < 0.05], as well as cognitive preference style and gender [F (3), 283 = 2.993, p < 0.05] in relation to physics achievement. The relatively large sample in the study likely enhanced the generalizability of the findings. However, the limitation of the research to only heat-related concepts in physics poses a risk to its generalizability.

Ajiboye and Ajitoni (2018) carried out research on the impact of Full and Quasi-Participatory Learning Strategies on the Environmental Knowledge of Senior Secondary Students in Nigeria, highlighting implications for classroom application. The research employed an experimental design with two participatory teaching approaches full and quasi-participatory aimed at educating secondary school students in Nigeria about specific environmental concepts. A total of 360 students were randomly chosen from a secondary institution in Kwara State and distributed among three treatment groups. Five hypotheses were examined at a significance level of p < .05. The investigation utilized a pre-test, post-test, control, and quasi-experimental framework, structured as a 3 x 3 x 2 factorial design. The gathered data were analysed

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using analysis of covariance (ANCOVA) to test the hypotheses and identify differences between the groups, with pre-test scores serving as covariates. Additionally, the t-test and Schaeffer Multiple Range test were applied when notable differences were found to identify the sources of those differences. Multiple Classification Analysis was conducted to evaluate the performance of each group. The findings indicated that students who were instructed through participatory methods outperformed those in the traditional lecture group. The large sample size used in this research may have facilitated more robust generalizations of the findings. Nevertheless, the limitation of the study to solely environmental education concepts raises concerns regarding its generalizability. The aforementioned literature suggests that different individualized instructional methods had distinct effects on academic achievement. This underscores the necessity for the current study, which aimed to examine the influence of the Learning Activity Package (LAP) on students' academic performance in digestive and circulatory sytems.

2.3 Student Achievement in Digestive and Circulatory Systems in Ghana

The teaching and learning of the digestive and circulatory systems occupy a central place in Ghana's basic and secondary science curriculum because of their relevance to human health, biological literacy, and everyday decision-making. Despite their importance, persistent evidence from curriculum evaluations, assessment reports, and empirical studies indicates that student achievement in these areas remains inconsistent. A critical examination of the literature reveals that the problem is not merely content difficulty but a complex interaction of curriculum intent, instructional practices, language factors, and systemic inequities. These issues provide a compelling justification for exploring innovative instructional strategies such as Learning Activity Packages (LAPs).

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The revised science curriculum introduced by the National Council for Curriculum and Assessment emphasizes competency-based, learner-centered, and inquiry-driven instruction. In theory, this curriculum is well aligned with the conceptual demands of topics such as digestion and circulation, which require learners to visualize processes, interpret cause effect relationships, and apply knowledge to health-related contexts. systems (NaCCA, 2019). However, the literature suggests a significant disconnect between curriculum aspirations and classroom realities. While policy documents promote hands-on and activity-oriented learning, studies indicate that many teachers struggle to operationalize these principles due to limited resources, large class sizes, and insufficient professional development. This disconnect implies that curriculum reform alone is insufficient to improve learning outcomes unless it is supported by practical instructional tools that translate abstract competencies into structured classroom experiences. LAPs, by design, offer such structure by breaking content into sequenced, learner-managed activities, suggesting their potential to bridge the gap between curriculum theory and classroom practice. Empirical studies and national examination reports consistently show that Ghanaian students experience conceptual difficulties in understanding the digestive and circulatory systems. Research by Buabeng and Ntow (2013) highlights that students often resort to rote memorization rather than conceptual understanding, particularly when dealing with internal biological processes that cannot be directly observed. This problem is reinforced by West African Examinations Council Chief Examiners' reports, which repeatedly identify misconceptions such as confusion between arteries and veins, misunderstanding of blood oxygenation, and weak explanations of peristalsis.

Critically, these findings suggest that assessment failures are symptoms of deeper instructional weaknesses. Traditional teaching methods appear inadequate for

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supporting the mental modeling required to understand physiological systems. The literature therefore points to a need for instructional approaches that actively engage learners in observing, simulating, and reflecting on biological processes core features embedded in well-designed Learning Activity Packages.

A recurring theme in the literature is the continued dominance of lecture-based instruction in science classrooms. Amedahe and Owusu (2017) report that many teachers rely heavily on verbal explanations and textbook reading, even when teaching process-oriented topics such as digestion and circulation. This approach limits student participation and reduces opportunities for inquiry, experimentation, and peer discussion. From a critical standpoint, this pedagogical pattern contradicts constructivist learning principles, which emphasize that learners build understanding through active engagement with content. LAPs align strongly with constructivist theory by encouraging learners to work through guided activities, questions, and tasks at their own pace. The literature therefore indirectly supports the use of LAPs as a corrective to passive instructional practices that have been shown to undermine conceptual understanding. The role of language in science learning emerges as a significant but often under-addressed factor. Agrawal and Nyamekye (2021) argue that the use of English as the sole medium of instruction poses challenges for many learners, particularly in rural and peri-urban settings. Scientific terms associated with the digestive and circulatory systems are linguistically dense and conceptually demanding, creating a dual burden of language and content comprehension. Critically, most traditional teaching approaches do little to mitigate this challenge. In contrast, LAPs can incorporate simplified language, visual representations, locally relevant examples, and step-by-step explanations that scaffold both language and content learning. This

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suggests that LAPs may be especially effective in contexts where language barriers contribute to poor academic performance.

The literature also highlights persistent gender and regional disparities in science achievement. Anamuah-Mensah et al. (2004) found that students in urban regions outperform their rural counterparts, largely due to better facilities and teacher availability. Gender differences, often favoring boys, have also been reported in biology-related topics. A critical issue here is that many studies identify these disparities without adequately examining instructional interventions that could reduce them. LAPs offer a promising avenue because they promote learner autonomy, reduce teacher dominance, and allow all students regardless of gender or location to engage actively with learning materials. However, the literature lacks sufficient empirical studies testing whether such structured activity-based approaches can narrow these achievement gaps, revealing a clear research gap.

Several key insights emerge from this review. First, poor student performance in digestive and circulatory systems is strongly linked to instructional methods rather than curriculum content alone. Second, there is a clear mismatch between competency-based curriculum goals and prevailing classroom practices. Third, language difficulties and resource inequities significantly constrain effective learning. Finally, although the literature consistently recommends activity-based and inquiry-oriented instruction, there is limited empirical evidence on specific, structured interventions such as Learning Activity Packages within the Ghanaian context.

The reviewed literature provides a strong rationale for investigating the effects of Learning Activity Packages on students' academic performance in digestive and circulatory systems. By addressing conceptual difficulty, promoting active learning,

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supporting language comprehension, and aligning with national curriculum goals, LAPs represent a theoretically sound and practically relevant intervention. This study therefore responds directly to identify gaps in the literature by empirically examining whether LAPs can improve learning outcomes where conventional teaching methods have fallen short. In this way, the present research is not only grounded in existing scholarship but also positioned to contribute meaningful evidence to science education practice and policy in Ghana.

2.3.1 Instruction of the digestive and circulatory systems

According to Reiss and Tunnicliffe (2001) the digestive and circulatory systems are inherently challenging because they involve invisible internal processes that learners cannot observe directly. While this explanation is widely accepted, it risks oversimplifying the problem by attributing poor understanding primarily to the abstract nature of the content. A more critical reading of the literature suggests that abstraction becomes problematic mainly when instructional strategies fail to support visualization, sequencing, and conceptual integration. Thus, the difficulty lies not only in what is taught but how it is taught. One of the most consistently reported challenges in teaching body systems is the prevalence of misconceptions. According to Çimer (2012) students often possess deeply entrenched alternative conceptions, such as confusing the roles of digestive organs or misunderstanding the flow of blood through the heart and lungs. Simonneaux (2000) further explains that these misconceptions frequently originate from early informal experiences and everyday language, making them resistant to change through conventional instruction, many studies document misconceptions without sufficiently interrogating why traditional instruction fails to correct them. This suggests a limitation in teacher-centered approaches that prioritize content coverage over conceptual restructuring. The implication is that effective instruction must actively

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engage learners in confronting, testing, and reconstructing their prior ideas—an instructional demand that aligns strongly with the structured, reflective nature of Learning Activity Packages.

Although lecture-based instruction remains widespread, it has been repeatedly criticized for promoting rote memorization rather than conceptual understanding. Teaching Approaches: Various instructional strategies have been investigated to tackle these obstacles. Although traditional lecture-based teaching is prevalent, it has faced criticism for encouraging memorization over true understanding (Taber, 2001). To address this issue, many educators incorporate model-based learning, interactive simulations, and problem-based learning techniques to render these systems more relatable. While this critique is well established, a notable weakness in the literature is that many studies stop at criticizing traditional methods without proposing scalable, classroom-friendly alternatives that teachers can realistically implement. This gap is significant for the present study. Learning Activity Packages represent a practical middle ground between idealized inquiry-based teaching and real classroom constraints, as they provide structured activities that guide learners step by step while reducing overreliance on teacher exposition.

Visualisation, Models, and the Role of Technology; Several researchers advocate the use of models, simulations, and visual tools to improve understanding of body systems. For instance, Gambari et al. (2016) report that 3D models and virtual dissections significantly enhance students' ability to visualize anatomical structures. Similarly, Rutten et al. (2012) demonstrate that animations and simulations support comprehension of dynamic processes such as peristalsis and blood circulation. However, a critical concern is that much of this research assumes the availability of

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advanced technological infrastructure, which may not be realistic in many school contexts, particularly in developing countries. Moreover, technology alone does not guarantee learning; without guided tasks and reflective questions, digital tools risk becoming passive visual aids. This highlights the importance of integrating technology within structured learning activities—an approach inherent in well-designed Learning Activity Packages, which can function with or without high-end technology.

Inquiry-Based and Constructivist Instructional Strategies: Constructivist approaches emphasize learning as an active process in which students build new knowledge based on prior understanding. Studies by Yager and Akçay (2010) show that hands-on activities, experiments, and collaborative learning improve engagement and retention when teaching body systems. Activities such as measuring pulse rates or tracing food pathways encourage learners to connect abstract concepts to observable phenomena.

Despite their effectiveness, inquiry-based strategies are often criticized for being time-consuming and demanding high levels of teacher expertise. This limitation underscores the need for structured inquiry tools that maintain learner activity while providing instructional guidance. Learning Activity Packages respond to this need by embedding inquiry within carefully sequenced tasks, thereby making constructivist learning more manageable and consistent.

Addressing Misconceptions through Assessment and evaluation: The literature strongly emphasizes the role of formative assessment in identifying and correcting misconceptions. Treagust (2006) argues that effective instruction should begin with diagnosing students' prior knowledge and tailoring learning experiences accordingly. While this recommendation is theoretically sound, many classrooms lack systematic tools to operationalize it. Learning Activity Packages can incorporate diagnostic

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questions, self-check tasks, and feedback loops within the learning process, making misconception detection an integral part of instruction rather than an add-on activity.

Several critical insights emerge from this review. First, student difficulties with the digestive and circulatory systems stem largely from instructional limitations rather than content complexity alone. Second, misconceptions persist because traditional teaching methods rarely engage learners in conceptual reconstruction. Third, while visual tools and inquiry-based strategies are effective, their impact depends on structured guidance and contextual feasibility. Finally, there is a notable gap in empirical research examining structured, activity-based instructional packages that integrate visualization, inquiry, and formative assessment in a coherent framework.

The reviewed literature provides a strong conceptual foundation for investigating the effects of Learning Activity Packages on students' academic performance in the digestive and circulatory systems. LAPs directly address the identified weaknesses of traditional instruction by promoting active engagement, supporting visualization, confronting misconceptions, and aligning with constructivist learning principles. By empirically examining the effectiveness of LAPs, the present study responds to a clear gap in the literature and contributes evidence-based guidance for improving biology instruction

2.4 Digestive and Circulatory Systems as a Topic

The human body encompasses intricate organ systems that work together to sustain life. Among the most crucial of these systems are the digestive system and the circulatory system. They are the most conceptually demanding topics in biology due to their complexity, abstract internal processes, and high level of interdependence. Although they are foundational to understanding human survival and health, the literature

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suggests that their instructional treatment often prioritizes factual coverage over conceptual integration.

A critical review of existing studies reveals a gap between advances in biological knowledge and pedagogical practices that effectively support student learning, thereby underscoring the need for structured, activity-based instructional interventions such as Learning Activity Packages. The digestive system involves a coordinated sequence of mechanical, chemical, and regulatory processes distributed across multiple organs. As described by Tortora and Derrickson (2018), digestion is not a linear process but an integrated system involving accessory organs and complex feedback mechanisms. That is the process of digestion initiates in the mouth and progresses through the oesophagus, stomach, small intestine, and large intestine, with the liver, pancreas, and gallbladder serving as accessory organs. Similarly, Guyton and Hall (2016), emphasize enzymatic and hormonal regulation as central to digestive efficiency.

While these authoritative accounts deepen scientific understanding, they also highlight a pedagogical challenge: the level of abstraction in such explanations often exceeds students' cognitive readiness, especially at basic and secondary levels. The literature rarely interrogates how learners are expected to meaningfully internalize these interrelated processes through conventional instruction. This disconnect suggests that student difficulties arise not from a lack of information but from insufficient instructional scaffolding that links processes, structures, and functions in an accessible way. Mayer (2009) demonstrated that interactive and visual instructional tools significantly enhance students' understanding of digestion processes. However, a critical issue is that many studies emphasize tools rather than instructional design.

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Visuals alone do not guarantee learning; without guided tasks, prompts, and reflection, learners may passively observe rather than actively process information.

Moreover, emerging research on gut micro biota by Turnbaugh et al. (2006) illustrates how scientific knowledge of digestion is expanding beyond traditional textbook narratives. Yet, school curricula and classroom practices often lag behind these developments, presenting digestion as a static process rather than a dynamic system influenced by internal and external factors. This mismatch further complicates student understanding and reinforces the need for instructional approaches that encourage exploration, questioning, and system-level thinking—features that can be embedded within Learning Activity Packages. The circulatory system, commonly known as the cardiovascular system, is responsible for the transportation of nutrients, gases, hormones, and waste products throughout the body. Primarily comprising the heart, blood, and blood vessels, this system plays a vital role in maintaining homeostasis and delivering nourishment to cells. According to Marieb and Hoehn (2019) dual circulatory pathway pulmonary and systemic circuit facilitates the efficient oxygenation of blood and its distribution to tissues. While such explanations are scientifically accurate, they demand high levels of spatial reasoning and abstraction from students. Advanced physiological studies, such as those by Bers (2002) focus on molecular mechanisms like ion channels and signaling pathways. Although these studies enrich scientific discourse, they offer limited guidance on how foundational concepts should be introduced pedagogically. Similarly, population-based research by Benjamin et al. (2023) links lifestyle factors to cardiovascular health, yet classroom instruction often fails to connect these real-life implications to underlying biological mechanisms. This gap between scientific relevance and classroom practice weakens conceptual understanding and reduces students' ability to apply knowledge

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meaningfully an issue that structured learning activities can potentially address. The interrelationship between the digestive and circulatory systems represents one of the most conceptually rich yet poorly taught aspects of human biology. Sherwood (2016) explains how nutrients absorbed in the digestive tract are transported through the hepatic portal circulation, illustrating the functional integration of both systems. Despite this, instructional approaches often treat these systems in isolation, encouraging fragmented learning.

Critically, the literature shows that students rarely develop a systems-thinking perspective when instruction is compartmentalized. Conditions such as atherosclerosis or celiac disease demonstrate how dysfunction in one system affects the other, yet these integrative examples are underutilized pedagogically. This highlights a major instructional weakness: students are expected to understand interdependence without being guided through structured activities that make such connections explicit.

Several important insights emerge from this review. First, the digestive and circulatory systems are cognitively demanding not only because of their complexity but because traditional instruction inadequately supports process visualization and system integration. Second, advances in scientific understanding have not been matched by corresponding advances in instructional design at the classroom level. Third, students struggle most when learning is fragmented, abstract, and teacher-centered, particularly when systems are taught independently rather than interactively. Most importantly, while the literature consistently advocates interactive, visual, and inquiry-based learning, there is limited empirical focus on structured instructional packages that systematically integrate these elements into everyday classroom practice.

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These insights directly inform the present study on the effects of Learning Activity Packages on students' academic performance in the digestive and circulatory systems. LAPs offer a pedagogically coherent response to the identified challenges by sequencing learning tasks, promoting active engagement, supporting visualization, and emphasizing system interdependence. By embedding guided activities, reflective questions, and application tasks, LAPs can transform complex biological content into manageable learning experiences. Consequently, this study is positioned to address a critical gap in the literature by empirically examining whether Learning Activity Packages can enhance students' academic performance in digestive and circulatory system that have historically posed significant learning difficulties.

Instruction in the digestive and circulatory systems occupies a strategic position in biology and health education because these systems underpin learners' understanding of human survival, health maintenance, and disease prevention. Despite their importance, a substantial body of literature indicates that students across different educational contexts struggle to develop coherent and scientifically accurate understandings of these systems. A critical examination of existing studies reveals that these difficulties are not merely due to content complexity but arise from deeper pedagogical, cognitive, and instructional design issues.

2.4.1 Recent investigations on teaching the digestive and circulatory systems

Teaching Strategies and Pedagogical Approaches: Various studies have examined the effectiveness of interactive and learner-centred teaching methods for these systems. Research conducted by Boakye and Ampiah (2017) revealed that utilizing models and simulations greatly improved students' comprehension of the circulatory system.

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Likewise, Tamakloe et al. (2019) highlighted the benefits of using interactive diagrams, peer instruction, and hands-on experiments in the education of the digestive system.

Teacher Knowledge and Preparedness: As noted by Owusu-Asante (2020), numerous science teachers in Ghana struggle to explain physiological processes due to insufficient content knowledge and a lack of teaching materials. For instance, the intricate functioning of the small intestine or the anatomy of the heart is frequently taught in a theoretical manner because of the absence of practical models and laboratory equipment.

Student Misconceptions

Research conducted by Adjei and Ababio (2018) indicated that students often hold misconceptions regarding the functions of organs such as the pancreas, liver, or the heart's ventricles. These misunderstandings are largely a consequence of rote memorisation and a lack of conceptual clarity during teaching.

Instructional Materials and Technology Use: Recent studies have observed that incorporating digital tools, such as animations and virtual laboratories, improves understanding. Amoako and Donkor (2021) discovered that schools that adopted ICT-based instruction achieved better student performance in evaluations concerning both systems compared to those relying on conventional methods.

Curriculum and Assessment Issues: Curriculum evaluations, including the National Pre-Tertiary Curriculum Framework (NaCCa, 2019), advocate for a more practical and inquiry-oriented approach to science education. Nevertheless, Adu-Gyamfi and Brenya (2022) pointed out that assessment practices still tend to prioritize factual recall rather

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than analytical and practical comprehension, constraining students' ability to apply their knowledge of these systems in real-world situations.

Recent findings highlight the need to:

Offer more professional development opportunities for biology teachers.

Enhance the availability of teaching resources and digital tools.

Encourage active learning techniques.

Align assessments with inquiry-based pedagogical strategies.

Implementing these changes is likely to improve the teaching and learning of the digestive and circulatory systems throughout schools in Ghana.

2.5 Approaches to Teaching the Digestive and Circulatory Systems

The education of human body systems, especially the digestive and circulatory systems, is vital in biology teaching. Researchers have investigated various instructional methods over time to improve students' grasp and retention of these intricate topics.

Conventional Lecture-Based Approaches: Historically, lecture-based teaching has been the primary method used in science classrooms. Tekkaya et al. (2001) noted that although lectures can efficiently present a wide array of information, students frequently encounter difficulties in understanding the physiological processes. Abstract subjects such as enzyme functionality or blood circulation might not be well comprehended without additional instructional strategies.

Utilization of Models and Diagrams: Visual tools like charts, models, and diagrams have proven to be beneficial. Yip (1998) pointed out that three-dimensional models of organs and systems help students visualize spatial relationships, enhancing their

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understanding. Animated diagrams can further clarify dynamic processes, such as peristalsis or blood circulation within the heart.

Inquiry-Based and Problem-Solving Techniques: Inquiry-based learning motivates students to formulate questions, explore, and develop their own insights. Lazonder and Harmsen (2016) discovered that guided inquiry is especially advantageous for middle and high school students, fostering improved critical thinking and a deeper level of understanding. This method promotes greater engagement and retention when applied to the digestive and circulatory systems.

Incorporating Technology and Multimedia: The use of simulations, videos, and interactive software has revolutionized biology teaching. Akpan and Andre (2000) found that computer-based simulations greatly enhanced students' comprehension of the circulatory system, particularly in relation to the heart's anatomy and functionality. Emerging tools like gamification and augmented reality are also becoming popular in this area.

Experiential Activities and Experiments: Engaging in hands-on activities such as dissections (either real or virtual), building models, or simulating digestion with common items (like crackers, plastic bags, and soda as stomach acid) supports experiential learning. Freeman et al. (2014) emphasized that active learning methods yield better outcomes than traditional teaching approaches in STEM disciplines.

Collaborative Learning and Peer Instruction: Group activities and discussions led by peers can be effective for learning. Johnson and Johnson (2009) demonstrated that cooperative learning boosts academic performance and interpersonal abilities. When

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students explain concepts to one another, such as detailing how the heart circulates blood, they often attain a deeper level of understanding.

Contextual Learning and Real-Life Relevance: Teaching these systems within the framework of everyday health such as connecting digestion to nutrition or linking circulatory health to physical activity makes the learning experience more pertinent. Gilbert (2006) contended that contextual learning enhances motivation and helps students recognize the significance of their studies.

2.5.1 The lecture teaching method

This approach to teaching is primarily centred on the teacher, with students playing a peripheral role, as the instructor presents a pre-designed lesson to the class, occasionally utilizing instructional materials (Nwagbo, 2019). According to McCann and Johannessen (2015), when employing this method, the educator discusses science while the students engage in reading about it. Awotua-Efobo (2016) noted that the teacher arrives in the classroom equipped with a substantial amount of information, typically sourced from books, and begins to relay that information to the students. The teacher introduces ideas or concepts, elaborates on them, assesses them, and concludes with a summary of the key points, allowing students to listen and take notes. Often, during the lecture, students are not encouraged to ask questions; when questions do arise, they generally seek clarification on important facts. The lecture method can be advantageous for teaching specific biological topics or can be effectively paired with other techniques to teach certain biological concepts. Nevertheless, Eya and Igbokwe (2000) have identified several drawbacks of this method:

- It fails to cultivate students' practical skills in science, as they remain passive listeners.

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- It does not accommodate the diverse learning needs of students, leading slower learners and those who struggle academically to be taught at a pace that may be overwhelming, potentially resulting in poor performance and disengagement.
- The technique only engages the auditory sense, making it unsuitable for teaching science in secondary education. Tawari (2016) emphasized that comprehensive learning occurs when a student employs all of their senses during the learning experience.
- A significant limitation of the lecture method is its fundamentally one-way communication style. The listening students often lack opportunities to shape the flow of information, resulting in minimal interaction and feedback, which are crucial for effective learning. When overused, the lecture method can promote intellectual inertness, contrary to the goals of learning, and may fail to cultivate inquiry and problem-solving skills in students. To address some of these shortcomings, there may be a need for a more individualized instructional approach, such as the Learning Activity Package (LAP). Despite strong evidence, these approaches are often difficult to sustain due to time constraints and teacher workload. LAPs address this challenge by embedding inquiry, collaboration, and reflection into structured, self-guided learning materials.

Several critical insights emerge from this review. First, poor student performance in digestive and circulatory systems is largely a consequence of instructional design weaknesses rather than content difficulty alone. Second, while learner-centred strategies are effective, they are often implemented in fragmented and unsystematic ways. Third, misconceptions persist because traditional and lecture-based methods do not promote conceptual restructuring. Finally, there is a clear disconnect between curriculum intentions and classroom assessment practices.

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These insights directly inform the present study on the effects of Learning Activity Packages on students' academic performance in the digestive and circulatory systems. LAPs offer a structured, learner-centred, and resource-efficient instructional approach capable of addressing teacher constraints, correcting misconceptions, promoting active learning, and aligning instruction with curriculum goals. By empirically examining the impact of LAPs, this study responds to a clearly identified gap in the literature and contributes practical evidence toward improving teaching and learning digestive and circulatory systems.

2.5.2 Question and answer (citation)

Question and answer are characterized as a strategy for both instruction and oral assessment that relies on the nature and application of questions. Techniques for questioning represent fundamental and effective methods for encouraging student thinking and learning (Dancy et al., 2016). This approach is applicable across all teaching styles and methods.

2.5.3 Discussion

An approach centred around discussion is a vital aspect of any educational setting that enables students to articulate their thoughts (Dancy et al., 2016). It can be implemented at the onset of a topic to gauge students' prior beliefs regarding the subject matter or at the conclusion of a subtopic by introducing a new scenario and prompting students to relate it to what they have just acquired. The discussion method is a pedagogical technique involving the sharing and exchanging of ideas, experiences, and perspectives (Dancy et al., 2016). The advantages of this method include a deeper understanding among learners, increased motivation, enhanced student engagement, development of leadership skills, improvement in organizing and presenting ideas coherently, and

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fostering collaboration among students. However, the discussion method also has its drawbacks, such as being time-intensive, often requiring a smaller group of learners for effective use, and the possibility that more outspoken students may monopolize the conversation.

2.5.4 Brainstorming

Brainstorming is an instructional technique where any student's response relevant to a specific topic is deemed acceptable (MIE, 2014). The benefits of brainstorming include promoting exploration, critical analysis, and problem-solving skills, fostering a sense of teamwork and group unity in addressing challenges, encouraging creative idea generation, and supporting the initiative in finding solutions to problems. The challenges of brainstorming can include being time-consuming if not well-organized, being more effective with a limited number of participants, and requiring thorough preparation.

2.5.5 Peer instruction

Peer Instruction (PI) is a research-informed teaching method aimed at enhancing interaction in large introductory science courses (Fagen & Mazur, 2013). This approach seeks to increase student engagement with the material and foster intellectual involvement during lectures. PI creates an organized environment where students can share their thoughts and address their misunderstandings through peer discussions (Gok, 2012). This collaborative learning technique promotes skills in critical thinking, problem-solving, and decision-making (Rao & Di Carlo, 2019). A notable benefit of this method is its capacity to actively engage students, rendering lessons more interesting while simultaneously offering teachers valuable insights into the class's comprehension and knowledge.

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Although numerous teaching strategies have been explored in academic literature, there is no single approach that is universally endorsed. Both student and teacher focused on instructional methods as important in the educational landscape with each proving effective depending on the specific context in which they are used (Haas, 2012; Gulobia, et al., 2018). For instruction to reach its full potential, a combination of these strategies should be employed, as education encompasses a variety of methods and environments.

2.5.6 Presentation

The presentation teaching method aims to inspire listeners to embrace a new concept, modify an existing belief, or act based on a particular premise. Its advantages include enhancing student mastery of the subject, fostering student confidence, providing a valuable learning experience, and encouraging students to research extensively to gather materials. On the downside, the presentation method has some drawbacks; learners may compile incorrect information, students with lower confidence may struggle to participate in the activity, and it can be time-consuming due to the presenter dedicating considerable time to collecting relevant data (Gok, 2012).

2.5.7 Seminar

The seminar approach involves a structured group that typically occurs after a formal lecture or following some experience (Kimweri, 2014). The strengths of the seminar method lie in its ability to challenge and evaluate students' comprehension skills, enhance their understanding and questioning abilities, and develop competencies in self-reliance, cooperation, responsibility, and report writing, along with presentation skills for peer dialogue and decision-making. However, the seminar method also faces certain limitations; it requires sufficient time for learners or presenters to prepare,

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quieter students may struggle to participate effectively during discussions, and more vocal participants may dominate the conversation.

2.5.8 Demonstration

The demonstration technique involves a practical showcase or exhibition of a process to illustrate or highlight the underlying principles or actions involved (Kimweri, 2014). Demonstration as a teaching tool is essential and plays a crucial role in skills training; however, for a demonstration to be effective, it needs to be followed closely by a practical session to reinforce what has been taught (Kimweri, 2014). The advantages of the demonstration method include providing learners with real-world experiences related to their studies, capturing their interest, and enhancing their retention of information. On the flip side, the demonstration approach can be time-consuming and costly, necessitates thorough preparation, practice, and rehearsal beforehand, requires sufficient teaching and learning materials for a successful demonstration, and is generally more effective with smaller groups of learners. Additional teaching methods include role-play, case studies, and field trips.

2.5.9 Individualised instruction

The literature on individualized instruction is focused on the recognition that learners differ in ability, pace, motivation, and learning styles, and that effective instruction should be responsive to these differences. While scholars such as Hwong (2013), Chauhan (2015), and Offorma and Ofuefuna (2018) strongly advocate individualized instruction as a means of improving learning outcomes, a critical analysis reveals that its effectiveness is highly dependent on context, instructional design, and teacher competence. The conceptual strength of individualized instruction lies in its learner-centered orientation. By allowing learners to progress at their own pace, individualized

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instruction is theoretically well suited to addressing learner diversity and reducing frustration caused by content that is either too difficult or already mastered. However, much of the literature presents these benefits in idealized terms, often without sufficient empirical evidence from real classroom environments, particularly in resource-constrained settings. This suggests that while individualized instruction is pedagogically sound, its practical implementation may not always yield the expected outcomes unless enabling conditions are present.

Offorma and Offoefuna (2018) and Chauhan (2015) emphasized that individualized instruction transforms the teacher's role from an information provider to a facilitator of learning. Although this role shift aligns with constructivist learning principles, it assumes that learners possess a certain level of self-regulation and motivation. In subjects such as biology, where concepts like the digestive and circulatory systems involve complex processes and interrelationships, complete learner independence may be challenging. This highlights a limitation in the literature, as few studies critically examine the balance between learner autonomy and teacher guidance in individualized instructional settings.

The classification of individualized instructional methods such as PSI, SDII, IS, CAI, and LAP demonstrates that individualization exists on a continuum, determined by who sets the objectives, selects the materials, and controls the learning process. While this classification provides conceptual clarity, the literature often fails to compare these methods empirically within the same subject area. Consequently, claims about the superiority of individualized instruction remain generalized rather than evidence-based. This gap justifies the present study's focus on one specific individualized strategy, the

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Learning Activity Package, rather than treating individualized instruction as a single homogeneous approach.

The Learning Activity Package is frequently portrayed as a structured and manageable form of individualized instruction, where objectives are predetermined, activities are sequenced, and assessment is integrated. This structure distinguishes LAP from more open-ended individualized methods such as Independent Study. However, critics argue that predetermined objectives and activities may limit learner creativity if not carefully designed. In biology education, where understanding systems such as digestion and circulation requires both procedural and conceptual knowledge, overly rigid sequencing could restrict deeper understanding. This suggests that LAP effectiveness depends not merely on its structure, but on how flexibly it accommodates conceptual integration.

The literature also highlights several benefits of individualized instruction, including self-paced learning, criterion-referenced assessment, and increased learner engagement. While these advantages are compelling, they are often reported without adequate consideration of logistical challenges such as time management, curriculum coverage, and resource availability. Neville's (2000), critique of packaged learning in the United Kingdom illustrates that even in advanced educational systems, individualized and packaged instruction faced challenges related to teacher preparedness, relevance of materials, and infrastructure. This critique is particularly important for developing contexts such as Ghana, where such challenges may be more pronounced.

Despite these limitations, the literature suggests that individualized instruction has gained wider acceptance due to advancements in science and technology. However, the success of such methods depends heavily on teacher training, availability of materials,

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and effective scheduling. This indicates that individualized instruction should not be viewed as a universal solution, but as a strategy whose effectiveness is context-dependent.

Several important insights emerge from the critical review of individualized instruction. Individualized instruction is theoretically effective in addressing learner diversity, but its success depends on careful instructional planning and teacher competence. Learner autonomy must be balanced with instructional guidance, especially in complex subjects like biology. Although multiple individualized instructional methods exist, there is limited subject-specific empirical evidence comparing their effectiveness. Also contextual factors such as resources, teacher preparation, and curriculum demands significantly influence the outcomes of individualized instruction.

These insights directly inform the design and focus of the present study on the effect of Learning Activity Package on students' academic performance in the digestive and circulatory systems. Given the practical constraints associated with fully individualized instruction, LAP was selected as a structured and feasible strategy that allows individual pacing while maintaining instructional control. The study acknowledges the complexity of biology concepts and therefore adopts LAP as a guided individualized approach rather than a completely self-directed model.

2.6 Summary of Literature Review

There is ample evidence indicating poor performance in science, likely due to a lack of suitable strategies for improving achievement and retention. This is particularly noticeable in biology, which serves as a foundational course for further studies in related scientific fields. Consequently, it is important to investigate methods and strategies that facilitate meaningful learning in biology through the Learning Activity

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Package (LAP). A comparison was also made between lecture-based and individualized instructional methods, each showing distinct advantages and disadvantages. It is clear that no single teaching method is ideal for every educational context and concept within science; however, methods that promote active involvement from learners in the teaching and learning process are generally favored. LAP represents one of these methods. Overall, prior research on individualized instructional approaches has revealed inconsistencies regarding the effectiveness of the Learning Activity Package compared to conventional methods. Tawari (2016), Burnside (2011), Smith (2019), and Igboanugo (2016) recognized individualized instruction as more effective. Meanwhile, Hwong (2013) found that cooperative learning surpassed the individualized method of instruction in effectiveness. The literature reviewed up to this point has focused on the efficacy of individualized teaching methods, without specifically addressing the use of LAP. Most of the studies have been conducted in other disciplines such as physiology, psychology, computer science, music, and physics. According to the existing literature, no research has explored the effect of LAP on students' academic performance in digestive and circulatory systems. Therefore, this study aimed to investigate the effects of the Learning Activity Package (LAP) on students' academic performance in digestive and circulatory systems.

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CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Overview

This chapter outlines the general strategy for conducting the research. It specifically details the research approach, study's design, location, population, sampling methods, classification of ability groups, data collection instruments, development of the learning activity package, validation and instrumentation, item analysis, reliability of the instruments, control of extraneous variables, experimental procedures, data collection methods, and data analysis methods.

3.1 The Research Approach

The Research approach to the study was strictly quantitative. The Researcher adopted quantitative research approach because it allows her to collect and analyse numerical data objectively, draw generalization conclusion based on statistical evidence and focuses on measurable outcome (test scores) and allowed comparison between groups

3.2 Design of the Study

The study was structured as a quasi-experimental design, utilizing a pre-test and post-test approach with Non-equivalent groups. This design is commonly utilized in classroom experiments where experimental and control groups are formed from existing classes, making randomization impractical. Consequently, intact classes were employed without any random assignment of research participants.

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3.3 Area of the Study

The Volta Region of Ghana is home to various schools, including Anlo Senior High School (ANSECO) and Zion College Senior High School (ZICO). The research was conducted at two Senior High Schools located in the Anloga District.

3.4 Population of the Study

The study's target population included all Senior High Schools within the Volta Region of Ghana. The accessible population consisted of Form two (2) students enrolled in General Arts at both Anlo Senior High School and Zion College Senior High School during the study period. Form two (2) was chosen because the biology topics addressed in this research were designed for that year, as outlined in the general science syllabus provided by the Ghana Education Service for Senior High Schools. The choice of co-educational secondary schools was based on the fact that gender is a variable in the study.

3.5 Sample and Sampling Technique

The study involved a sample of 88 students in total (42 males and 46 females), who were taken from two intact classes that were conveniently chosen from both Senior High Schools. Among these 88 students, 45 were selected from Anlo Senior High School while 43 were selected from Zion College Senior High School. From the two selected classes, one from each school (ANSECO) was assigned to the Learning Activity Package instruction (LAP), while the other school (ZICO) employed the lecture method of instruction. The class designated for LAP served as the experimental group, while the class taught via lectures acted as the control group. The experimental group included an intact class from Anlo Senior High School, whereas the control group

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was from Zion College Senior High School. The experimental group consisted of 23 females and 22 males, and the control group included 23 females and 20 males.

3.5.1 Classification into ability groups

The students who participated in the study were classified into three the high, average and low abilities. This classification was done based on the average performance of a student in year one (1) Integrated Science exams (that is the average of first and second semester examination scores: from 0 – 34% were classified as low ability group. Those who scored from 35 to 67% in the average ability group and 68% and above were classified as having high ability levels).

3.6 Instrument for Data Collection

Data was collected using an Achievement Test (AT) that was created by the researcher. Two Achievement Tests with parallel items were developed; one served as a pre-test, and the other functioned as a post-test. Each Achievement Test consisted of twenty multiple-choice questions with four possible answers, labelled A to D, short answers items, practical test and essay type test were generated from the various subunits. The achievement test questions were set from the subunits under the digestive and circulatory systems that were taught during the intervention period of the study. Also, observation was carried out using observation checklist.

3.7 Validation of the Instrument

Achievement Tests and observation checklist underwent both face and content validation processes.

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3.7.1 Face validation

For face validation, the instruments were assessed by three experts; one from the Measurement and Evaluation Department and two from the Science Education Department. The instruments were evaluated based on the clarity of the questions posed, the proper phrasing of the items, and the suitability of the language for the students' level of comprehension. As a result, the validators provided feedback that led to the modification or rejection of certain items. Following this validation process, the instruments were revised to incorporate the validators' suggestions.

3.7.2 Content validation

To affirm content validity, the researcher created a table of specification. This table was used to determine how many items would be developed from each subunit. In doing this, the researcher considered the relative breadth of the subunits, ensuring that larger subunits received more questions compared to smaller ones. Ultimately, a total of 20 multiple-choice questions, short answer items, practical test and essay type test were generated from the various subunits.

3.8 Reliability of the Instrument

The reliability of the instruments was determined through a test-retest method. The pre-Achievement Test and post-Achievement Test, which were parallel tests, were administered to 40 form-two students of Anlo Senior High School not participating in the main study, and after a two-week interval, the tests were re-administered to assess stability. The scores obtained were utilized to establish reliability.

The coefficient of equivalence was determined for both the pre-Achievement Test and post-Achievement Test. This was achieved using the scores from the initial testing of both instruments on the students. The purpose of this reliability assessment was to ensure that both forms of the Achievement Test included items of similar quality. The scores were analysed using Pearson's Product Moment Correlation Coefficient, yielding a correlation coefficient of 0.79 for the instrument, indicating that it was reliable for the study.

3.9 Design of Learning Activity Package [LAP]

The learning activity package (LAP) is a comprehensive set of instructional materials created to encourage independent learning. It is generally utilized in classroom environments or for remote learning and aims to offer students a structured and meaningful educational experience.

A LAP usually comprises a list of learning objectives, a collection of materials (including readings, videos, and other resources), and a range of activities for students to engage in to meet the learning objectives. These activities are often organized as worksheets, quizzes, or other interactive tasks designed to enhance students' engagement with the material and to help them apply what they have learned.

Learning Activity Packages (LAPs) are frequently utilized in subjects that demand significant independent effort, such as science and math, but they can be applied to any area of study. They are especially beneficial for self-motivated students who prefer to work autonomously, as well as for those who require extra assistance or who are having difficulty grasping a specific concept.

Creating a Learning Activity Package (LAP) typically comprises several essential steps to ensure its effectiveness in achieving the desired learning outcomes. For this study, the following key steps were undertaken in the development of the LAP:

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Define the learning objectives: The initial task in crafting the LAP was to delineate the learning objectives that students were expected to accomplish. These objectives were specific, measurable, and in alignment with curriculum standards.

Collect materials: After identifying the learning objectives, various materials that would aid students in meeting these goals were compiled. These resources included textbooks, articles, videos, models, and additional tools.

Design activities: The subsequent step involved creating activities that would facilitate student engagement with the subject matter and assist in achieving the learning objectives. This included worksheets, quizzes, simulations, and other interactive tasks.

Structure the LAP: After the activities were created, they were systematically arranged in a logical order to guide students through the learning experience.

Pilot the LAP: Prior to implementing the LAP with students, it was advisable to conduct a pilot test with a small group to identify any potential areas for improvement.

Execute the LAP: Once the LAP was refined based on feedback from the pilot test, it was considered ready for student implementation. Clear instructions and support were provided to assist students as they navigated through the activities.

Assess the LAP: Ultimately, the efficacy of the LAP was evaluated by examining student learning outcomes and collecting feedback from the participants. This feedback could be utilized to enhance and improve the LAP for future applications.

3.9.1 Experimental Procedure

The following procedures were employed in administering the instruments.

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3.9.2 Pre-test session

Prior to the treatment, the research participants took a pre-test. The test was conducted by the regular general science teachers for the control group, who had received training. I taught the experimental group at Anlo Senior high school. The scripts were graded. The pre-test served to: Assess the students' initial understanding of the materials they would study subsequently; Evaluate the comparability of the two groups (experimental and control) based on their pre-test scores.

3.9.3 Treatment

The treatment for this study involved teaching the students about the various sub-units of the digestive and circulatory systems through two different instructional methods (the LAP and the conventional Method) while they engaged in the activities. The experimental group was instructed utilizing the LAP, while the control group received instruction via the conventional method.

3.9.3.1 The Experimental group

The experimental group was educated using the Learning Activity Package. The LAP clearly outlined the introduction and main objectives for each topic. The framework and different activities were specified for the students to complete. Each student received the LAP and was expected to perform the activities independently, applying the concept of self-pacing. The students were encouraged to seek the teacher's assistance when necessary to discuss any challenges related to the concept being studied.

3.9.3.2 The control group

The lecture approach was employed in teaching the control group. During this approach, the teachers communicated the essential concepts and principles throughout

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the lesson. The students listened attentively and took relevant notes. The instruction for both the experimental and control groups took place during the regular school general science classes, utilizing the lesson notes developed by the researcher.

3.9.3.3 Post-test session

Following the treatment, the post-Achievement Test was administered to both the control and experimental groups. The researcher assessed the scripts and recorded the students' scores.

3.10 Method of Data Collection

The pre-Achievement Test was given to the participants before the treatment, which lasted eight weeks. At the conclusion of the treatment, a parallel test (post-Achievement Test) was also administered. Scores for both the experimental and control groups were documented accordingly. Each test item in both the pre-test and post-test was awarded one mark, with the highest possible score being 50 and the lowest being zero.

3.11 Methods of Data Analysis

The researcher utilized mean scores and standard deviation to analyse the data and answer the research questions. The mean was chosen as it is a reliable measure of central tendency, while the standard deviation serves as the best estimate of variability. The analysis of variance (ANOVA) and the t-test were conducted to evaluate the hypotheses formulated for the study at a 0.05 level of significance. ANOVA was employed to account for potential initial differences in ability levels among the research participants.

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CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 Overview

This Chapter presents the relevant data for answering the research questions and for testing the hypotheses. The analysis and results are presented in tables according to the research question and hypotheses. A discussion of the main findings was done alongside the presentation.

4.1 Research Question one

What is the difference between the academic performances of students taught digestive and circulatory system using the LAP and those taught using a conventional method?

Table 1

Effect of Treatment on Control and Experimental Groups

Group	N	Mean	Std. Deviation
Experimental	45	33.07	7.87
Control	43	25.05	7.26

The mean score and standard deviation scores of students on the post-achievement test showing the effect of the treatment on control and experimental groups are presented in Table 1. Based on the descriptive analysis, it appears that the experimental group scored higher on the post-test compared to the control group. The mean score of 33.07 for the experimental group suggests that, on average, participants in this group performed better on the post-test compared to the control group who had a mean score of 25.05.

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Moreover, the degree of variability or dispersion in the data is shown by the standard deviation per group. In contrast to the control group (7.26), the experimental group's standard deviation (7.87) was larger, indicating that the experimental group's scores were more variable. The experimental group had a higher average score, but there was also a greater range of values within that group. All things considered, these results point to the possibility that the experimental group's performance on the post-test was enhanced by the intervention or treatment they received.

Testing hypothesis one: There is no statistically significant difference between the mean scores of students, taught digestive and circulatory system using the LAP and those exposed to a conventional method.

The experimental and control groups' scores were compared using inferential testing to see if the difference was statistically significant or the result of chance. Presented next is the outcome of the inferential testing.

Table 2

t-Test: Two-Sample Assuming Unequal Variances

Groups	**N**	**Mean**	**Std. Dev.**	**Df**	**T**	**P**
Experimental	45	33.07	7.87	86	6.17	0.001
Control	43	25.05	7.26			

The experimental group seemed to have a higher mean score (33.07) than the control group (25.05), according to the mean scores of the two groups. The statistical significance difference in the mean scores between the two groups, p-value of 0.001 is provided by the t-test analysis. P-value of 0.001 is less than predetermined alpha level of 0.05, it implies that there is sufficient data to reject the null hypothesis, which states that there is no statistically significant difference between the mean scores of students

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who were taught the digestive and circulatory systems utilising LAPs and those who were taught using conventional methods.

This indicates that the experimental group's scores were not just higher but also that there was a practically significant difference between the two groups' results. These findings thus suggest that, in comparison to the control group, the experimental intervention had a moderate and statistically significant impact on the participants' post-test scores. This implies that students' performance in the digestive and circulatory systems benefit from the experimental intervention, which call for more research or practical application.

Table 2 data analysis reveals that students who received LAP instruction outperformed their peers who received conventional method of instruction in the subjects related to the digestive and circulatory systems.

This finding aligns with previous research conducted by Obiakor, Parrish, and Fogelberg (2006), which indicated that Learning Activity Packages (LAPs) were superior to traditional techniques in promoting students' academic success. Because LAPs are student-centred and guarantee students' active participation in the teaching and learning process more than the lecture method does, they are seen to be comparatively superior to the lecture method in improving students' achievement in the digestive and circulatory systems. The student is frequently placed in the role of the passive recipient of the information that the instructor has imparted to him through the conventional technique. Additionally, unlike the conventional method, when the teacher completed the majority of the work for the students, the tasks in the LAPs were completed by the students themselves, at their own leisure, both during and after school hours. Increased attention is always expected when students actively participate and

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employ several sense organs. The treatment group (LAPs) did better than the control group in the post-AT, which is not surprising considering the current conditions in which the lecture technique and LAPs are used in classroom teaching. The aforementioned conclusion about the impact of LAPs on accomplishment, however, does not entirely concur with the results of Joyner and Farmer (2013), who discovered that the cooperative learning approach improves achievement more than the individualized approach used in music instruction. The fact that music is a topic that necessitates coordinated and team effort for optimal output may be the reason for the cooperative learning method's efficacy. Therefore from the result of the findings student taught digestive and circulatory system using LAP performed better than those taught using conventional method

4.2 Research Question two

What is the effect of learning activity package on academic performance of male and female students taught digestive and circulatory system?

Table 3

Students' Performance in Post-AT Based on Sex

	Gender	N	Mean	Std. Deviation
TEST	Male	22	33.77	8.57
	Female	23	34.83	7.20

Based on sex, Table 3 displayed the mean score and standard deviation scores of students on the post-Achievement Test demonstrating the impact of the treatment. Female students obtained a slightly higher mean scores (34.83) and standard deviations (7.20) compared to male students mean scores (33.77) and standard deviations (8.57) on a post-test revealed by the analysis. Based on result, it can be concluded that female

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students outperformed male students on the post-test on average. However, the difference in mean scores was small, indicating that male and female students performed at nearly the same level. .Male students' standard deviation 8.57, suggesting that their results were more diverse, this means that while some male students performed very well, others performed poorly, resulting in a wider spread of scores. Female students with standard deviation 7.20, indicating that there were less variation, they demonstrated more consistent performance.

LAPs are educational resources created to provide students a methodical approach to studying. In order to assist students, gain knowledge and abilities in a certain subject area, they usually consist of a range of activities, including readings, exercises, and exams, LAPs have been utilized in a range of educational contexts. In general, studies on LAPs have shown that they are successful in raising academic achievement and other learning outcomes for students. Nevertheless, little study has been done expressly to look at how gender affects academic achievement in connection to LAPs.

Both male and female students' academic performance increased after using LAPs, according to research by Obiakor et al. (2006) that looked at the usage of LAPs with students with impairments. According to different research by Joyner & Farmer (2013), LAPs helped both male and female students in a college-level statistics course perform better academically.

Overall, the data indicates that LAPs can be useful in enhancing student learning outcomes regardless of gender, even if there is little study explicitly looking at gender variations in academic performance in connection to LAPs. The findings were statistically tested in order to have a better understanding of the possible differences in the effect of LAPs on the academic performance of male and female students.

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Testing null hypothesis two: There is no statistically significant difference between the mean score of male and female students taught digestive and circulatory system using Lap and those taught using conventional method.

Table 4

t-Test: Two-Sample Assuming Unequal Variances

Groups	**N**	**Mean**	**Std. Dev.**	**Df**	**T**	**P**	**Cohen's d**
Male	23	*33.77*	*8.57*	43	0.35	0.073	0.13
Female	22	*34.83*	7.20				

Based on the table 4, a p-value of 0.073 is greater than the significance level (alpha) of 0.05. This implies that null hypothesis is accepted, which state that there is no statistically significant difference between the mean scores of males and females student taught digestive and circulatory system using LAP. The mean scores of males and females on the post-test appear to differ statistically significantly, with females generally performing better, according to the t-test results. The effect size of 0.13 showed that the impact is very small, this means that the difference is not large. According to Cohen (1988), such an effect suggests that the practical difference between groups is negligible. Small effect sizes in gender-based studies have been interpreted as evidence that instructional strategies, rather than gender, account for most of the variance in academic performance. Studies by Mensah (2017) and Boateng (2020) similarly reported small effect sizes in gender comparisons when activity-based or self-paced instructional methods were used in science classrooms.

LAPs have been proven to have favorable benefits on students' learning outcomes, including higher exam scores and retention rates (Pollock et al., 2013). However, educational research has been interested in how LAPs affect various genders. When

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biology was taught using LAPs, the average performance of females was slightly higher than that of male, which is in line with certain findings from other studies.

Ahiaba (2019) found that male and female students exposed to structured learning packages performed similarly in selected biology topics. Likewise, Owusu (2020) observed that gender differences in science achievement diminished when instructional materials were designed to promote independent learning.

It is crucial to remember that this study's impact size was small, indicating that there was not much of a performance gap between females and male. This result contrasts with other earlier research that found greater gender disparities in LAP efficacy. For instance, a research by Eddy and Hogan (2014) discovered that the LAP had a comparatively significant effect size and a greater influence on exam performance for male students than for female students.

The gender disparities in LAP efficacy can be explained in a number of ways. One reason might be that female students are more inclined than male students to engage in LAP activities and utilize the possibilities offered by LAPs. This could be brought on by variations in drive, self-assurance, or cultural influences. Another argument is that the LAP activities could better suit the interests or learning styles of female students than those of male students. (Omoniyi, 2016)

It is crucial to remember that the gender disparities in LAP efficacy that have been noted do not always reflect innate variations in male and female cognitive capacities. Instead, these discrepancies can result from a range of social and environmental elements that affect how male and female students interact with and gain from educational interventions such as LAPs. The conclusion is that, although the impact

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size in this study was small, the discovery that, on average, females outperformed male when digestive and circulatory system was taught using LAP. The small effect size further confirms that LAPs promote gender equity in academic performance.

4.3 Research Question Three

What is the effect of the LAP on the academic performances of students of different ability groups in digestive and circulatory system?

Table 5

Students' Performance in Pre-AT Based on Ability Level

Group	Statistic	High Achievers	Average Achievers	Low Achievers
Experimental	Mean	25.15	17.20	10.47
	SD	3.48	2.62	3.54
	N	13	15	17
Control	Mean	23.26	15.47	10s.63
	SD	1.84	3.02	2.50
	N	11	15	17

**SD = Standard Deviation *N = Number of Students*

According to the various skill levels in the digestive and circulatory systems, Table 5 displays the mean accomplishment and standard deviation scores of the students on the pre-AT. Table 5's data analysis yielded several intriguing results that need discussion. The ability level of the students in the experimental group and the control group has been used to compare their pre-test results.

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First, it can be seen that the experimental group's mean scores for high-ability students are slightly high than those of the control group. It would appear from this that the experimental group's high-ability students' pre-test results are similar to those of the control group.

Second, although the experimental group's average-ability students scored high on average than the control group, the difference between the two mean scores was not highly significant. This implies that the two groups are similar.

Third, there is no discernible difference between the experimental and control groups' mean scores for the low-ability group. This implies that low-ability students in the experimental group had pre-test results that were similar to those in the control group. In conclusion, the results show that prior to the intervention, the pupils in the experimental group were similar to those in the control group.

Table 6

Students' Performance in Post-AT Based on Ability Level

Group	Statistic	High Achievers	Average Achievers	Low Achievers
Experimental	Mean	42.62	32.16	28.93
	SD	4.37	6.52	4.65
	N	13	17	15
Control	Mean	32.12	24.27	19.94
	SD	6.52	3.99	4.21
	N	11	15	17

**SD = Standard Deviation *N = Number of Students*

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Table 6 displays the mean score and standard deviation of student's post-Achievement Test results. The data suggests that the experimental group scored better on the post-test than the control group, with mean scores of 42.62 32.16, and 28.93 for the high, average, and low ability groups, respectively. In contrast, the control group recorded mean scores of 32.12 for the high ability group, 24.27 for the average ability group, and 19.94 for the low ability group.

It is important to note that, the standard deviations for the mean scores of the experimental group were higher than those of the control group. This indicates that there was more variability in the scores of the experimental group, suggesting that the intervention had a differential effect on the students (Joyner & Farmer, 2013).

The high-ability groups mean score of 42.62 and standard deviation of 4.37 indicated that the intervention had a higher effect on them there was a less variation in the result, according to the examination of the post-AT data. Average-ability mean scores of 32.16 and standard deviations 6.52 showed that there was variation in the results. Low-ability groups mean scores of 28.93 standard deviations 4.65 suggesting that there was less variation in the results and students in average and low ability groups also appear to have found the intervention to have a significant influence.

For both the experimental and control groups, it seems that the intervention improved student learning across all ability levels when comparing the pre-test results (Table 5) with the post-test results. The pre-test mean scores for the experimental group were 25.15 for the high ability group for, 17.20 the average ability group, and 10.47 for the low ability group. Their respective scores rose to 42.62, 32.16, and 28.93 on the post-test. This suggests that the intervention improved learning for students of all skill levels, with the low-ability group seeing very noticeable improvements. This implies that the

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intervention worked especially well for pupils who performed poorly. (Parrish et al. 2006)

Likewise, for the control group, the average pre-test scores for the high, average, and low ability groups were 23.26, 15.47, and 10.63, respectively. These scores rose to 32.12, 24.27, and 19.94 on the post-test, respectively. This also suggests that, while the benefits were not as great as those shown in the experimental group, there was some improvement in student learning across the board in the control group.

It's also important to note that the pre-test mean score standard deviations were often lower than the post-test mean scores, indicating that the intervention was more effective in lowering student learning variability. All things considered, these results imply that the intervention improved student learning at every ability level, although the experimental group saw a stronger benefit.

LAPs' effect on student performance has been examined in a number of research (Srisawasdi & Wuttiprom, 2015; Agus et al., 2019; Zhang & Chen, 2019), with encouraging findings. For instance, LAPs enhanced students' chemistry learning success and problem-solving abilities, according to research by Srisawasdi and Wuttiprom (2015). According to another research by Agus et al. (2019), LAPs were successful in improving students' mathematical critical thinking abilities.

Similarly, Zhang and Chen's (2019) meta-analysis of LAPs' impacts on scientific learning revealed that they greatly raised science student success. The study also discovered that a number of variables, including the topic matter, LAP type, and implementation time, influenced how successful LAPs were.

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The results of the analysis presented in the previous discussion, when compared to this previous research, confirm that LAPs had a beneficial effect on the learning of the experimental group of students, especially those with poor ability. On ordinary and high-ability kids, however, the effects of LAPs were less noticeable. Although the benefits were less pronounced than those shown in the experimental group, the control group still demonstrated some increase in student learning.

It is important to note that, according to the literature currently in publication, LAPs can enhance student learning in a variety of subject areas and skill domains, although their efficacy may vary depending on a number of variables (Srisawasdi & Wuttiprom, 2015; Agus et al., 2019; Zhang & Chen, 2019). The results of the current investigation provide further credence to the beneficial effects of LAP on student learning and emphasise the necessity of taking individual student skill variations into account when developing and executing LAPs.

In conclusion, even though the results of the current analysis are consistent with the research on how well LAPs enhance student learning, more study is required to determine the variables influencing LAP efficacy and to determine how best to use LAPs to enhance student learning outcomes.

Testing null hypothesis three: There is no statistically significant difference between the mean scores of students belonging to different ability groups, taught digestive and circulatory system using LAP.

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Table 7

ANOVA table for the experimental and control group

Source of Variation	**SS**	**df**	**MS**	**F**	**P-value**
Between Groups	**4471.35**	5	894.27	34.96	.001
Within Groups	**2097.28**	82	25.58		
Total	6568.63	87			

The analysis of variance (ANOVA) test was used to test this null hypothesis in one method. At 0.05, the significant level was established. The outcome is shown in Table 7. The results of the ANOVA test show that there is a statistically significant difference between the mean scores of the three ability groups, with the p-value of 0.001 being less than the significance level of 0.05. To put it another way, the alternative hypothesis, which holds that there is a significant difference between the means, is accepted in place of the null hypothesis, which claims that there is no significant difference between the mean scores of students belonging to different ability groups, taught digestive and circulatory system using LAP.

Nevertheless, the p-value by itself cannot reveal the direction of the impact or the size of the difference. A post-hoc test (Scheffé Multiple Comparison Test) was used to identify the groups that differed substantially from one another in order to better comprehend the results. Table 8 displays the outcome.

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Table 8

Scheffé Multiple Comparison

I GROUP	J GROUP	Mean Difference (I-J)	Std. Error	Scheffé Critical Value	Sig.	Decision
LA	AA	4.16	4.38	6.11	.303	Not significant
	HA	12.87	1.03	6.54	.000	Significant
AA	LA	13.76	2.38	6.11	.003	Significant
	HA	8.71	2.12	6.35	.002	Significant
HA	LA	19.46	2.03	5.92	.001	Significant
	AA	11.70	2.17	6.85	.001	Significant

LA = low ability; AA = average ability; HA = high ability; * = significant

Within the experimental group, the Scheffé multiple comparison test showed that there was no statistically significant difference between low- and medium-ability students. However, significant differences were observed between high-ability students and both low- and medium-ability students. This result suggests that LAP was effective in narrowing the performance gap between low- and medium-ability students by providing structured, self-paced, and engaging learning activities. The lack of significant difference between these two groups indicates that LAP supported lower-ability learners to perform at levels comparable to their medium-ability peers.

The superior performance of high-ability students in the experimental group may be attributed to the flexible and learner-centred nature of LAP, which allows such students to explore content more deeply, learn independently, and apply higher-order thinking skills. Thus, while LAP promotes equity in learning, it also enables high-ability students to maximize their academic potential. When experimental and control groups were compared, the results showed that students taught using LAP significantly

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outperformed students taught using conventional methods, particularly at the medium and high ability levels. Experimental high-ability students performed significantly better than all control ability groups.

LAPs are educational resources designed to support students' learning through a sequence of independent exercises that enable personalised and interactive instruction. They are frequently used to improve student engagement and comprehension in combination with other teaching strategies like lectures or debates. The usefulness of LAPs has been the subject of several research in a variety of fields, including language acquisition, science, and mathematics (Horton, 2012; McCann & Johannessen, 2015; Rakes & Casey, 2015).

It's probable that the usage of LAPs in the current study affected high-ability students more than low-ability students, which is why there was a large performance difference between the two groups. This might be caused by a number of things, including the difficulty of the LAPs, the degree of background information needed to do the tasks, or variations in learning preferences or motivation across individuals.

In conclusion, Learning Activity Packages significantly improve students' academic performance compared to conventional teaching methods also reduces performance disparities between low- and medium-ability students and High-ability students benefit greatly from LAP due to its flexibility and learner-centered design. Conventional teaching methods tend to maintain or widen ability-based performance gaps. These findings confirm that LAP is an effective instructional strategy for improving academic performance across varying ability levels and should be encouraged in classroom practice.

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CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.0 Overview

The study's summary is provided in this last chapter of the report, along with an overview of the key results, conclusions derived from the data analysis, and suggestions for future research and practice. A succinct and thorough description of the research's findings is given in the summary of findings section. A thorough explanation of the statistical studies carried out to bolster the results is given in this part, along with a summary of the key findings. The key ideas covered in chapter four are briefly summarised in the conclusion section. Lastly, the recommendations section offers ideas for more study based on the results.

5.1 Summary of the Study

Examining the effect of the Learning Activity Package (LAP) on students' academic performance in digestive and circulatory systems was the purpose of this study. Academic performance, the dependent variable, was examined in connection to a few independent factors, such as the learning activity package and the lecture style of instruction. The study's objectives were to; Examine the difference between the academic performances of students taught digestive and circulatory system using the LAP and those taught using a conventional method, evaluate the effect of the learning activity package on academic performance of male and female students in the digestive and circulatory system, assess the effect of the LAP on the academic performances of students of different ability groups in digestive and circulatory system. The analysis of data was guided by three research questions viz: What is the difference between the academic performances of students taught digestive and circulatory system using the

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LAP and those taught using a conventional method? What is the effect of learning activity package on the academic performance of male and female students taught the digestive and circulatory system? And what is the effect of the LAP on the academic performances of students of different ability groups taught digestive and circulatory system and those taught using conventional method?

Three null hypotheses: Ho1: There is no statistically significant difference between the mean scores of students taught digestive and circulatory system using the LAP and those exposed to a conventional method – were tested at 0.05 level of significance (alpha). ; Ho2: There is no statistically significant difference between the mean scores of male and female students exposed to the LAP approach instructional and Ho3: There is no statistically significant difference between the mean scores of students belonging to different ability groups, taught digestive and circulatory system using the LAP and conventional method.

The study adopted the quasi-experimental design of the pre-test and post-test non-equivalent group design. The experimental and control groups were selected from two separate coeducational senior high schools in the Volta Region – Ghana. The target population of the study comprised all coeducational government run senior high schools in the Volta Region – Ghana. Students enrolled in Integrated Science programs at Anlo Senior High School and Zion College Senior High School at the time of the study made up the accessible population.

Eighty-eight individuals (46 men and 42 females) from two intact classes that were conveniently chosen from two senior high schools made up the research sample. The experimental group consisted of 45 students recruited from Anlo Senior High School. Whereas the control group consisted of 43 students chosen from Zion College Senior

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High School, The Achievement Test [AT] was created, evaluated, and employed as a data gathering tool. Students' data were gathered, and inferential statistics such as the t-test and the Analysis of Variance (ANOVA) were used for analysis.

5.2 Main Findings

Some intriguing conclusions were drawn from the study's data analysis. An overview of some of the main conclusions drawn from this investigation is provided in this section. The experimental group's mean score (33.07) was greater than the control group's (25.05), according to the statistics. Additionally, the statistical significance of the difference in mean scores between the two groups is indicated by the t-test analysis. This implies that it is unlikely that the observed variation in mean scores between the two groups happened by accident demonstrating that the experimental group's scores were not just higher but also that there was a practically significant difference between the two groups' results.

Also, the data analyses revealed that there is a statistically significant difference between the mean scores of males and females on the post-test, with females performing better on average. The analysis provides information on the mean scores and standard deviations of male and female students on a post-test. The mean score of male students was 33.77, while that of female students was 34.83. This suggests that, on average, female students performed better on the post-test compared to their male counterparts but the effect was very small.

However, the effect size of 0.13 suggests that the difference between the mean scores of males and females is low in magnitude, even though the difference between the mean scores of males and females is statistically significant, its practical implication is low hence may not be seen.

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Additionally with the mean scores of 42.62, 32.16, and 28.93 for the high, average, and low ability groups, respectively, the study showed that the experimental group did better on the post-test than the control group. In contrast, the control group's mean scores for the high, average, and low ability groups were 32.12, 24.27, and 19.94, respectively. These variations were statistically significant, indicating that the experimental group's performance better on the post-Achievement Test as a result of the intervention rather than chance.

Both the experimental and control groups' learning across all ability categories, however, seemed to have benefited from the intervention when comparing the pre-test and post-test outcomes. The pre-test mean scores for the experimental group were 25.15 for the high ability group, 17.20 for the average ability group, and 10.47 for the low ability group. Their respective scores rose to 42.62, 32.1, and 28.93 on the post-test. This suggests that the intervention improved learning for students of all skill levels, with the low-ability group seeing very noticeable improvements. This implies that the intervention worked especially well for students who performed poorly.

5.3 Conclusion

In summary, the research revealed that the learning activity package outperformed the conventional method in raising students' academic performances in digestive and circulatory systems. It was shown that LAP worked for all ability levels, although the low-ability group showed the biggest increase. In terms of gender, female student outperformed the male students but the effect size was small. This confirm that LAP not only enhances students understanding of subject content but also serves as a practical tool for achieving gender equity in academic performances.

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Although the overall findings of the study indicated that the Learning Activity Package (LAP) had a positive effect on students' academic performances in the digestive and circulatory systems, some unexpected findings and deviations were observed.

One notable anomaly was that a small number of students in the LAP group showed minimal or no improvement in post-test scores despite active participation in the learning activities. This outcome was unexpected, given the learner-centred nature of the LAP. A possible explanation may be individual differences in learning styles, as some students may require more direct teacher guidance than the self-directed approach emphasized in the LAP. Additionally, factors such as poor reading ability, low motivation, or irregular attendance could have affected their performance.

All things considered, these results imply that the learning activity package could be a useful teaching resource for biology teachers looking to improve their students' academic performance. The study's findings support the effect of learning activity package and suggest that students can gain from more dynamic and interesting teaching techniques.

5.4 Educational Implications of the Findings

For educators and educational institutions, the study's conclusions have a number of significant educational ramifications.

First, according to the study, the learning activity package can be effective teaching strategy for raising students' academic performances. To enhance students' learning results, educators can think about including this strategy into their lesson plans.

Second, the study shows that low-ability level benefit most from the learning activity packages. According to this research, teachers should give priority to giving these

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students more help and resources, such scaffolding and focused instruction, in order to guarantee their success.

Lastly, the study emphasises how critical it is to assess teaching strategies in order to determine which one's best support student learning. To guarantee that students receive the best and most efficient instruction possible, educational institutions should support continuous study and assessment of teaching strategies.

5.5 Recommendations for Practise

Several suggestions for enhancing biology learning outcomes for students may be offered in light of the study's findings.

Science teachers of Anlo Senior high school and Zion college senior high senior should consider incorporating the learning activity package as an instructional method in their teaching approach, since LAP has been found to have effect on academic performance of students in digestive and circulatory systems at all ability, particularly for low-ability students than the lecture method.

Science teachers of Anlo senior high school and Zion college senior high school should adopt LAP in science instructions to promote active participation and gender equitable learning outcome.

School management should organize in service training for Science teachers at Anlo senior high school and Zion college senior high school in creation and efficient use of learning activity packages to improve student academic performance in digestive and circulatory system.

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5.6 Recommendations for Further Research

Even though this study has shed light on how well the LAP works affect students' academic performance in digestive and circulatory systems, there are still a number of issues that need more research.

First and foremost, future studies ought to investigate the learning activity package's long-term effectiveness on students' academic performance. To ascertain if the improvements shown in this study are maintained over time, this would need monitoring students' academic performance over a longer time frame.

Second, the learning activity package's possible transferability to other topic areas should be investigated in future studies. This would entail assessing how well this teaching strategy fosters academic achievement in other areas, like chemistry or physics.

Thirdly, further research is required to create treatments that are more inclusive and equitable for all students and to get a deeper understanding of the underlying mechanisms that lead to gender inequalities in the efficacy of LAP.

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APPENDICES

APPENDIX A: ACHIEVEMENT TEST

INSTRUCTION: Answer all the multiple-choice questions by choosing the letter that corresponds to the correct answer, short answer, practical test and essay type test.

1. Chyme is found in one of the following portions of the digestive system of man
(a) mouth (b) ileum (c) duodenum (d) colon

2. Which of these will be absorbed in the ileum ?
(a) maltose (b) fructose (c) sucrose (d) lactose

3. Excess glucose is converted and stored in the liver as
(a) glycogen (b) starch (c) cellulose. (d) glycerol

4. Anaemia is a deficiency of (a) White cells (b)Platelets (C) Transport waste and white blood cells (d) Absorb protein

5. Roughages are digested by bacteria in the colon to produce
(a) vitamin A and C (b) vitamin D and A (c) vitamin B and K (d) vitamin K and E

6. Which of the following organs is responsible for deamination?
(a) kidney (b) Liver (c) Gall bladder (d) Pancreas

7. The function of the erepsin is to convert (a) maltose to glucose (b) peptides to amino acids c)) lactose to glucose d)) fat droplets to fatty acids and glycerol

8. Which of the following is NOT a function of blood (a) Transport of gases (b)Regulation of body temperature (c)Production of enzymes (d) Defense against disease

9. Among the birds what is responsible for grinding the food
(a) gizzard (b) crop (c). cloaca (d) caecum

10. Which of the following organs acts as the pump of the circulatory system? (a)Lungs (b) Liver (c) Heart (d) Kidney

11. The main function of the circulatory system is to (a) digest food (b) transport materials around the body (c) control body movement (d) remove solid waste

12. Which of the following is a cause of constipation? (a) eating at regular interval
(b) not chewing food properly (c) not cooking food (d) not exercising the body

13. Which blood vessel has the thickest wall? (a) Vein (b) Capillary (c) Artery (d)Venule

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14. Which component of blood is responsible for fighting diseases? (a) Red blood cells (b) Platelets (c) Plasma (d) White blood cells

15. One of these diseases affects the liver (a). anaemia (b) beriri (c) cirrhosis (d) ulcer

16. Which blood vessel allows exchange of materials between blood and body cells? (a) Artery (b) Vein (c) Capillary (d) Aorta

17. In which of the following stomach of ruminants is the food fermented by anaerobic bacteria to break down cellulose? (a) rumen (b) reticulum (c) omasum (d) abomasum

18. Which of the following prevents backflow of blood in the heart? (a) Auricles (b) Ventricles (c) Valves (d) Arteries

19. Which of the following diseases affects the circulatory system? (a) Asthma (b) Cholera (c) Anaemia (d) Tuberculosis

20. Blood vessels that carry blood away from the heart are called (a) veins (b) arteries (c) capillaries (d) venules

21. Haemophilia is ______________________________ [1 mark]

22. Septal defect is also called ______________________ [1 mark]

23. The vena cava brings blood to the ________________ [1 mark]

24. Digestion begins in the _________________________ [1 mark]

25. The enzyme in saliva is _________________________ [1 mark]

26. Peristalsis is __________________________________ [1 mark]

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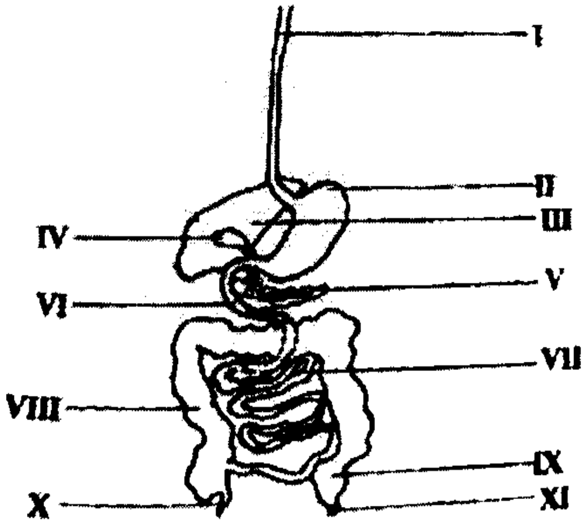
Part 2

Study the diagram below carefully and answer the questions that follow.

27a) Name the parts labelled I to XIV

4marks



II____________________ **III**____________________

IV____________________ **V**____________________

VI____________________ **VII**____________________

VIII____________________ **IX**____________________

(b) i. What is the function of the part labelled II? [1 mark]

ii Name **two** enzymes found in part labelled VII [2 mark]

(c)) i. State any two cause of indigestion in man. [2 marks]

i i) Mention two ways of preventing constipation. [2 marks].

i I) State one characteristics of enzymes [1marks]

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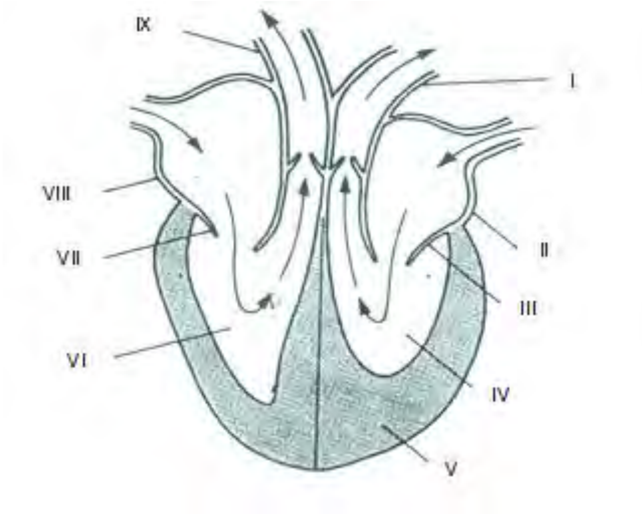
Figure 2 below shows a vital organ in the human

Study the figure carefully and answer the questions that follow



28.a) Name the parts labelled **I- IX** **[4.5marks]**

I.______________________________ II________________________________

III.____________________________ IV___________________________________

V.______________________________ VI______________________________________

VII.____________________________ VIII______________________________________

IX.__________________________________

29) a). Name the organ shown in figure 3 above [1mark]

____

(b) Where exactly in the human body is the organ figure 2 located [1mark]

____

(c) State the main function of the organ in figure 2 [1mark]

____

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(d) Name two diseases of the organ in figure 3 [2marks]

____

____

(e) Define the term circulatory system [2marks]

____

____

____

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APPENDIX B

S/N	Pre-Test EXPT	Pre-Test CTRL		Post Test EXPT	Post Test CTRL
1	20	18		29	37
2	25	11		30	30
3	28	10		45	32
4	14	9		30	28
5	19	12		28	20
6	13	27		33	30
7	15	14		32	28
8	27	22		43	28
9	15	12		29	16
10	9	21		26	25
11	28	23		42	31
12	19	28		33	31
13	18	21		34	29
14	22	8		40	15
15	12	22		35	30
16	17	17		23	22
17	29	17		15	14
18	18	10		23	16
19	12	11		30	19
20	6	30		20	37
21	17	14		27	13
22	14	9		25	19
23	18	22		29	17
24	21	19		36	24
25	19	23		24	29
26	5	8		25	14
27	30	29		37	33
28	21	34		26	45
29	13	15		32	23
30	28	12		44	32
31	17	15		39	19
32	22	20		45	19
33	16	25		29	25
34	16	13		31	14
35	21	19		34	25
36	24	33		33	20
37	20	23		39	41
38	17	9		36	16
39	16	24		36	32
40	22	9		43	26
41	29	14		39	25

42	15	26		16	19
43	09	15		18	33
44	30			48	
45	10			21	

Experimental Group Pre-Test				**Control Group Pre-Test**		
Low ability	Medium ability	High ability		Low ability	Medium ability	High ability
10	18	27		12	18	33
12	19	30		9	17	30
9	18	28		14	22	24
9	22	29		12	17	29
15	17	27		11	19	25
12	20	28		13	21	34
15	17	29		8	20	28
5	19	28		14	21	26
13	22	25		9	19	27
13	17	28		14	22	29
14	16	30		10	19	25
6	16	24		15	23	
14	16	23		15	22	
15	20			10	22	
13	19			8	23	
	21			9		
	22			15		

Experimental Group Post-Test				**Control Group Post-Test**		
Low ability	Medium ability	High ability		Low ability	Medium ability	High ability
21	29	43		20	35	24
25	28	37		28	22	37
18	34	45		28	17	41
26	40	44		16	14	33
32	27	46		30	24	25
30	29	44		14	25	45
29	39	17		15	19	31
25	33	44		14	29	19
33	45	30		13	25	32
32	36	48		19	30	26
30	29	33		25	16	25
20	31	17		32	31	
25	39	22		19	30	

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29	24			33	28	
33	34			16	29	
	43			14		
	34			26		

Experimental group Post test	
Female	Male
34	35
29	23
27	31
29	33
23	42
30	31
25	48
26	29
34	35
38	38
29	40
30	29
33	27
32	29
39	19
39	17
45	39
42	34
43	45
32	44
43	44
47	27
42	

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APPENDIX D: LAP

Title: Understanding the digestive System

Overview:

In this learning activity package, you will explore the topic of the digestive system, including the main parts of alimentary canal and their roles, the processes of food digestion, and constipation and indigestion.

Learning Objectives:

After completing this activity, you should be able to:

Identify the major parts of the digestive system and their functions.

Describe the process of digestion in human.

Explain constipation and indigestion and their causes.

Materials:

Printable worksheets

Interactive diagrams and videos

Articles and resources

Duration:

2-4 hours

Activities:

Introduction to the human digestive System:

Watch an introductory video that explains the concepts of the digestive system, including the part and the functions of the mouth, oesophagus, stomach, duodenum,

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ileum, colon, rectum, and anus. Use an interactive diagram to explore the structure of the digestive system.

Complete a worksheet that describes the structure and function of the human digestive system, including the enzymes and their functions.

Human digestive system and their part

Read an article that explains the process of food digestion, including the role of various organs and enzymes. Use an interactive diagram to explore the different role of the enzymes involved.

Human digestive system:

Complete a worksheet that describes the processes of food digestion.

Culminating Activity:

Take the quiz to assess the understanding of the topic. Write a reflection on what you learned and how you can apply this knowledge to maintain a healthy lifestyle.

Assessment:

Completion of worksheets and interactive activities

Quiz on the topic

Reflection on what was learned

Title: Understanding Circulation in the Human Body

Overview:

In this learning activity package, you will explore the topic of circulation in the human body, including the structure and function of the cardiovascular system, the

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mechanisms of blood circulation, and the importance of maintaining healthy circulation.

Learning Objectives:

At the end of this activity, you should be able to:

Identify the major components of the cardiovascular system and their functions.

Describe the mechanisms of blood circulation, including the roles of the heart, blood vessels, and blood.

Explain the importance of maintaining healthy circulation and how lifestyle factors can affect it.

Materials:

Printable worksheets

Interactive diagrams and videos

articles and resources

Duration:

2-4 hours

Activities:

Introduction to Circulation: Watch an introductory video that explains the basic concepts of circulation in the human body, including the functions of the heart, blood vessels, and blood. Use an interactive diagram to explore the structure of the cardiovascular system.

Blood Flow and Pressure:

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Complete a worksheet that describes the mechanisms of blood flow and pressure in the cardiovascular system. Use the resources provided to learn about the different types of blood vessels and their functions.

Heart and Circulation Disorders:

Read an article that explains the common disorders of the cardiovascular system, including heart disease, hypertension, and stroke. Use an interactive diagram to explore the effects of these disorders on circulation.

Healthy Circulation:

Complete a worksheet that describes the lifestyle factors that can affect circulation, including exercise, diet, and smoking. Use your resource to learn about the benefits of cardiovascular exercise and healthy eating habits.

Culminating Activity:

Take the quiz on page 3 of this package to assess your understanding of the topic.

Write a reflection on what you learned and how you can apply this knowledge to maintain healthy circulation in your own life.

Assessment:

Completion of worksheets and interactive activities

Quiz on the topic

Reflection on what was learned

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Observation Checklist on the Effect of LAP on Students' Academic Performance in Digestive and Circulatory Systems

Class: ____________Subject: Integrated Science

Topic: Digestive System / Circulatory System

Date: ____________Observer: ____________

Teacher: _________Duration: ____________

Rating Scale:

4 = Very High 3 = High 2 = Low 1 = Very Low

Section A: Lesson Preparation and Use of LAP

1. Lesson objectives are clearly stated and learner-centred ☐ ☐ ☐ ☐

2. LAP activities are well planned and relevant to the topic ☐ ☐ ☐ ☐

3. Teaching and learning materials (charts, models, specimens) are available

☐ ☐ ☐ ☐

4. Activities reflect real-life examples of digestion and circulation

☐ ☐ ☐ ☐

Section B: Student Engagement and Participation

5. Students actively participate in group or pair activities ☐ ☐ ☐ ☐

6. Students ask relevant questions during activities ☐ ☐ ☐ ☐

7. Students collaborate effectively during LAP tasks ☐ ☐ ☐ ☐

8. Students show interest and enthusiasm during the lesson ☐ ☐ ☐ ☐

Section C: Understanding of Digestive and Circulatory Systems

9. Students correctly identify parts of the digestive system ☐ ☐ ☐ ☐

10. Students explain functions of digestive organs ☐ ☐ ☐ ☐

11. Students correctly identify parts of the circulatory system ☐ ☐ ☐ ☐

12. Students explain the functions of the heart and blood vessels ☐ ☐ ☐ ☐

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13. Students relate digestion and circulation to human health ☐ ☐ ☐ ☐

Section D: Academic Performance Indicators

14. Students correctly answer oral questions ☐ ☐ ☐ ☐

15. Students perform well in class exercises during LAP ☐ ☐ ☐ ☐

16. Students apply knowledge to solve problems ☐ ☐ ☐ ☐

17. Majority of students complete tasks accurately ☐ ☐ ☐ ☐

Section E: Overall Effect of LAP

21. LAP improves students' understanding of the topic ☐ ☐ ☐ ☐

22. LAP enhances students' academic performance ☐ ☐ ☐ ☐

General Comments by Observer

....

....

Observer's Recommendation

....

....

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SPSS OUTPUTS

Group Statistics

	GROUP	N	Mean	Std. Deviation	Std. Error Mean
SCORES	POST_TEST	45	31.8222	8.08278	1.20491
	PRE_TEST	45	18.5778	6.40131	.95425

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
SCORES	Equal variances assumed	2.494	.118	8.617	88	.000	13.24444	1.53701	10.18996	16.29893
	Equal variances not assumed			8.617	83.612	.000	13.24444	1.53701	10.18772	16.30117

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T-Test

Group Statistics

	GROUP	N	Mean	Std. Deviation	Std. Error Mean
SCORES	EXP	45	33.07	7.87	1.20491
	CTRL	43	25.05	7.26	1.19596

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
SCORES	Equal variances assumed	.000	.985	3.934	86	.000	6.68269	1.69886	3.30546	10.05991
	Equal variances not assumed			3.936	85.979	.000	6.68269	1.69768	3.30779	10.05758

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Oneway

ANOVA

SCORES

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4471.38	5	894.27	34.96	.001
Within Groups	2097.28	82	25.58		
Total	6568.63	87			

ANOVA

SCORES

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1581.460	2	790.730	25.683	.000
Within Groups	1293.118	42	30.789		
Total	2874.578	44			

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Multiple Comparisons

Dependent Variable:SCORES

	(I) GROUP	(J) GROUP	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Tukey HSD	LA	AA	-6.87500	4.38666	.271	-17.5324	3.7824
		HA	-19.41429*	4.03410	.000	-29.2151	-9.6135
	AA	LA	6.87500	4.38666	.271	-3.7824	17.5324
		HA	-12.53929*	2.17445	.000	-17.8221	-7.2565
	HA	LA	19.41429*	4.03410	.000	9.6135	29.2151
		AA	12.53929*	2.17445	.000	7.2565	17.8221
Scheffe	LA	AA	-6.87500	4.38666	.303	-18.0070	4.2570
		HA	-19.41429*	4.03410	.000	-29.6516	-9.1770
	AA	LA	6.87500	4.38666	.303	-4.2570	18.0070
		HA	-12.53929*	2.17445	.000	-18.0574	-7.0212
	HA	LA	19.41429*	4.03410	.000	9.1770	29.6516
		AA	12.53929*	2.17445	.000	7.0212	18.0574
LSD	LA	AA	-6.87500	4.38666	.125	-15.7276	1.9776
		HA	-19.41429*	4.03410	.000	-27.5554	-11.2731
	AA	LA	6.87500	4.38666	.125	-1.9776	15.7276
		HA	-12.53929*	2.17445	.000	-16.9275	-8.1511
	HA	LA	19.41429*	4.03410	.000	11.2731	27.5554
		AA	12.53929*	2.17445	.000	8.1511	16.9275

*. The mean difference is significant at the 0.05 level.

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Homogeneous Subsets

SCORES

	GROUP	N	Subset for alpha = 0.05	
			1	2
Tukey HSD[a]	LA	17	15.5000	
	AA	15	22.3750	
	HA	13		34.9143
	Sig.		.158	1.000
Scheffe[a]	LA	17	15.5000	
	AA	15	22.3750	
	HA	13		34.9143
	Sig.		.184	1.000