EFFECT OF ENRICHED CONVENTIONAL STRATEGY USING POLYA METHOD ON PERFORMANCE IN DIGESTIVE SYSTEM AMONG SENIOR SECONDARY SCHOOL STUDENTS IN IKEJA, LAGOS STATE

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Abstract

This study investigated the effect of enriched conventional strategy using Polya method on senior secondary school students' performance in digestive system concept in Ikeja. A quasi-experimental pre-test/post-test control group design was employed. Out of 1285 students, a total of 120 SSII biology students were sampled from two schools using multistage sampling. The experimental group was taught using the enriched conventional strategy based on Polya's problem-solving steps, while the control group received regular lecture-based instruction. The Digestive System Performance Test (DSPT) was used to collect data, with a KR-20 reliability coefficient of 0.84. Data collected was analyzed using descriptive statistics (mean, standard deviation) and inferential statistics (independent samples t-test). Results showed that students taught with the enriched conventional Polya method performed significantly better than those taught with conventional lecture method ($t(118) = 5.92$, $p < .05$). The study concluded that using Polya's method to enrich conventional strategy enhances problem-solving and understanding of the concept of digestive system and recommended its integration into biology instruction.

Keywords: *Enriched conventional strategy, Polya method, digestive system, students' performance, biology education.*

Introduction

Biology is a core subject in senior secondary schools in Nigeria, with topics such as the digestive system being essential for understanding human physiology, nutrition, and health sciences. Despite its importance, students' performance in biology, particularly in concepts requiring analytical and problem-solving skills, remains unsatisfactory (Adeniran & Oluwafemi, 2023; Nnorom & Okeke, 2022). The digestive system is often taught through conventional lecture methods that focus on rote

memorization of organs, functions, and processes, with limited opportunities for active problem-solving or critical engagement. Consequently, learners may memorize facts but fail to understand functional relationships or apply concepts to real-life scenarios.

The enriched conventional strategy, combined with Polya's problem-solving model, presents a potential solution. Polya (1957) proposed a structured four-step approach: understanding the problem, devising a plan, carrying out the plan, and reviewing the solution. Applying these four-step approach in biology instruction encourages students to engage actively with content, analyze processes, and develop problem-solving strategies. Previous researches indicate that problem-solving approach improve academic achievement and cognitive skills in science subjects (Mayer, 2021; Clark & Paivio, 2020).

In the context of Nigerian classrooms, integrating Polya's problem-solving model into conventional strategy could address persistent low achievement in biology, particularly in complex topics like the digestive system. Therefore, this study investigated the effect of enriched conventional strategy using Polya method on students' performance in digestive system among senior secondary school students in Ikeja- Lagos Oyarole, (2025) enriched conventional strategy involves combining traditional teaching (lecture, discussion) with active learning strategies that enhance understanding when integrated with Polya's problem-solving method, students are guided to: comprehend biological problems, plan approaches, apply knowledge, and critically evaluate solutions. In teaching the digestive system, this may include tasks such as diagram labeling, tracing the path of food, analyzing enzymatic actions, or solving scenario-based questions on digestion.

Research indicates that combining conventional strategy with structured polya problem-solving strategies improves both knowledge retention and analytical skills (Faruk et al., 2022). Students exposed to problem-solving approaches can connect theoretical concepts to practical applications, leading to enhanced comprehension and higher achievement in biology, Polya's four-step model guides learners systematically through problem-solving. Applying this to biology enables students to break down complex systems like digestion into manageable steps, fostering comprehension and analytical reasoning. (Piaget, 1972).

Constructivism, as proposed by Piaget (1972), emphasizes that learners actively construct knowledge through interaction with their environment. Constructivism emphasizes learning through active engagement and building knowledge from experience. Using Polya's method encourages students to construct understanding by actively analyzing digestive processes rather than passively receiving information. Some Studies have demonstrated the effectiveness of problem-solving approaches in biology. Faruk et al. (2022) reported improved genetics performance with structured problem-solving instruction. Similarly, Oladipupo et al. (2025) found that students taught cell biology using guided problem-solving demonstrated higher achievement. Within Nigeria,

Ibrahim and Mohammed (2023) reported that integrating problem-solving methods into conventional instruction improved comprehension and performance in physiological topics.

Objective of the study

1. To examine effect of enriched conventional strategy with Polya method on students' performance in digestive concepts among senior secondary school students.

Research Question

1. What is the difference between meanperformance scores of students taught digestive system using enriched conventional strategy with Polya method and those taught using conventional lecture method?

Hypothesis Testing

$H0_1$: There is no significant difference in performance between students taught using enriched conventional strategy with Polya method and those taught using conventional lecture method.

Methodology

A quasi-experimental pre-test/post-test control group design was used, suitable for intact class studies where random individual assignment is not possible. Population of the study consisted of 1285 SSII Biology students in public secondary schools within Ikeja. A total of 120 students were sampled using multistage sampling. Two schools were purposely selected based on resources and size. One intact class per school was randomly assigned to: 60 students for the experimental group and 60 students for the control group. The Digestive System Performance Test (DSPT), a 30-item multiple-choice instrument, was developed to assess knowledge, application, and problem-solving skills in concept of digestive system. Three experts in Biology Education and Measurement validated the instrument for content clarity, and coverage. The KR-20 reliability coefficient of the DSPT was 0.84, indicating high internal consistency. The study spanned five weeks. Pre-tests were administered in week one. Experimental group received enriched conventional strategy with Polya model; control group received conventional lecture method lecture. Post-tests were conducted in week six to determine the effectiveness of the instruments and the results were subjected to analysis.

Data Analysis

Descriptive statistics (mean, standard deviation) addressed the research question; independent samples t-test tested the hypothesis at 0.05 significance level.

Results

This section presents answers to the research question and test of the corresponding stated hypothesis: What is the difference between mean performance scores of students taught digestive system using enriched conventional strategy with Polya method and those taught using conventional lecture method?

Table 1: Mean and Standard Deviation Statistics of Pretest and Posttest Scores for Students in Experimental and control group

Group	N	Pretest Mean	Pretest SD	Posttest Mean	Posttest SD	Mean Difference
Experimental	60	13.10	2.85	25.75	3.05	12.65
Control	60	12.95	3.02	19.40	3.50	6.45

Table 1 indicates that the experimental and control groups had comparable baseline knowledge, as shown by similar pre-test means of 13.10 and 12.95, respectively. After instruction, the experimental group scored higher (25.75) than the control group (19.40), suggesting that using Polya's problem-solving model with the enriched conventional strategy significantly enhanced understanding and performance in the digestive system.

Table 2: Independent Samples t-test on Posttest Scores

What is the difference between mean performance scores of students taught digestive system using enriched conventional strategy with Polya method and those taught using conventional lecture method?

Variable	Group	N	Mean	SD	t-value	DF	p-value
Posttest Scores	Experimental		25.75	3.05	5.92	118	0.000
	Control		19.40	3.50			

The t-test shows a t-value of 5.92 with a significance level of p = .000, which is below the 0.05 threshold. Therefore, the null hypothesis is rejected. This confirms that the enriched conventional strategy using Polya method significantly improved students' performance compared to conventional lecture instruction.

Discussion of Findings

The findings demonstrate that students taught using enriched conventional strategy using Polya method achieved significantly higher performance than those taught via conventional lecture. These results align with Faruk et al. (2022) and Oladipupo et al. (2025), supporting the efficacy of problem-solving strategies in enhancing comprehension, application, and analytical skills in biology. The method enables students

to actively engage with content, plan solutions, and review understanding, which enhances mastery of complex processes in the digestive system. The results also align with Constructivist theory of Piaget (1972), highlighting that active learning promotes deeper understanding.

Conclusion

Enriched conventional strategy using Polya problem-solving steps is an effective instructional strategy that significantly improves students' performance in the digestive system concept. Incorporating problem-solving elements into conventional instruction fosters critical thinking, problem-solving, and conceptual understanding.

Recommendations

Biology teachers should incorporate Polya's problem-solving model into classroom instruction.

School administrators should provide resources and training for teachers to implement enriched instructional enriched conventional strategy with Polya model.

Curriculum planners should integrate problem-solving strategies into the national biology curriculum.

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