

Effectiveness of Personalized Instruction in Enhancing Learning in Physiological Biology for Psychology Students

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ABSTRACT

This study aimed to evaluate the effectiveness of **personalized instruction** in teaching **Physiological Biology in Psychology** to BS Psychology students at the Polytechnic University of the Philippines–Taguig Campus. Recognizing that instructional materials are essential tools alongside classroom discussion, the study focused on developing materials tailored to students' **least mastered skills**, as identified through a pretest. Unlike conventional instruction, the personalized approach addresses learning gaps by targeting topics that students have yet to master, ensuring that teaching is relevant and responsive to learner needs. The study employed a **quantitative correlational design** with 49 students as respondents, using pretest and posttest results to measure learning gains and statistical analyses—including paired t-tests and Pearson-r correlation—to determine effectiveness and relationships between instructional quality and academic performance. Findings are expected to validate the use of personalized instructional materials, enhance student learning outcomes, and align with PUP's commitment to quality education and Sustainable Development Goals.

Keywords: Personalized Instruction, Physiological Biology in Psychology, Instructional Materials, Academic Performance, Least Mastered Skills

INTRODUCTION

Teaching **Physiological Biology** within Psychology programs is a critical component in developing scientifically grounded and competent graduates, particularly for Bachelor of Science in Psychology (BS Psychology) students. Physiological Biology, often referred to as biopsychology or biological psychology, focuses on the relationship between biological processes and behavior, requiring learners to understand complex systems such as the nervous system, brain structures, neurotransmission, and hormonal regulation. However, teaching this subject presents significant challenges due to its abstract, technical, and interdisciplinary nature. Students are often required to integrate concepts from biology, chemistry, and psychology, making the learning process cognitively demanding.

Research indicates that students in biology and physiology courses struggle to understand mechanisms because of the complexity and abstract nature of cellular and molecular processes. This difficulty becomes more pronounced in psychology students who may not have strong foundational knowledge in the biological sciences. Consequently, traditional lecture-based teaching approaches may not be sufficient to address diverse learner needs, resulting in gaps in comprehension, retention, and application of knowledge.

In higher education institutions such as the Polytechnic University of the Philippines (PUP) Taguig Campus, there is a growing emphasis on improving teaching effectiveness through innovative and student-centered approaches. One of the key institutional requirements is the development and utilization of instructional materials that align with global educational standards, including the Sustainable Development Goals (SDGs), particularly Goal 4, which promotes inclusive and equitable quality education. Instructional materials serve as essential tools that complement classroom discussions by providing structured, accessible, and engaging

content for learners. These materials may include modules, visual aids, multimedia presentations, and activity-based resources designed to enhance understanding and facilitate independent learning.

Instructional materials play a crucial role in translating complex physiological concepts into more understandable formats. According to studies in science education, effective instructional design involves organizing content using models, analogies, and contextualized explanations to help students grasp difficult concepts. In the context of Physiological Biology, well-designed instructional materials can bridge the gap between theoretical knowledge and real-life applications, enabling students to develop deeper conceptual understanding. Moreover, instructional materials support differentiated instruction by allowing students to learn at their own pace and revisit challenging topics as needed.

Despite the availability of instructional materials, one major limitation in traditional teaching practices is the uniform delivery of content, which assumes that all students learn in the same way and at the same pace. This assumption overlooks individual differences in prior knowledge, learning styles, and cognitive abilities. Research in educational psychology highlights that learners exhibit diverse strengths and weaknesses, and failure to address these differences can lead to persistent achievement gaps. Therefore, there is a need for teaching approaches that are responsive to individual learner needs.

Personalized instruction emerges as a promising solution to this challenge. Personalized instruction refers to the adaptation of teaching methods, materials, and pacing based on the specific needs, abilities, and learning progress of individual students. Unlike traditional instruction, which is often standardized, personalized instruction focuses on tailoring the learning experience to maximize student engagement and achievement. This approach is grounded in the principle that effective learning occurs when instruction is aligned with the learner's current level of understanding and developmental readiness.

Empirical studies support the effectiveness of personalized instruction in enhancing learning outcomes. Personalized education has been shown to improve academic performance, increase student motivation, and reduce learning gaps by continuously assessing learner progress and adapting instruction accordingly. Furthermore, personalization strategies such as context-based learning, learner choice, and active engagement can increase students' interest and participation in the learning process. These findings suggest that personalized instruction is particularly beneficial in complex subjects like Physiological Biology, where students require continuous support and scaffolding.

In this study, personalized instruction is conceptualized as a data-driven teaching approach based on the identification of students' least mastered skills through a pre-test. The results of the pre-test serve as the foundation for designing instructional materials that specifically address identified learning gaps. This approach aligns with formative assessment practices, where assessment is used not merely for evaluation but as a basis for instructional decision-making. By focusing on least mastered competencies rather than already acquired knowledge, personalized instruction ensures that teaching is targeted, relevant, and responsive to student needs.

The development of personalized instructional materials involves careful analysis of the subject matter, learning objectives, and student performance data. Instructional materials are designed to address specific topics that students find difficult, incorporating strategies such as simplified explanations, visual representations, guided activities, and formative assessments. This targeted approach enhances the efficiency of instruction by prioritizing areas that require improvement, thereby maximizing learning gains.

In the context of BS Psychology students at PUP Taguig Campus, the implementation of personalized instructional materials in teaching Physiological Biology is particularly relevant. Students in this program are expected to develop competencies in understanding biological bases of behavior, which are essential for advanced courses and professional practice in psychology. However, variability in students' academic backgrounds and learning abilities necessitates a more individualized approach to teaching. Personalized instruction can help address these differences by providing tailored learning experiences that support each student's progress.

Moreover, the integration of personalized instructional materials aligns with the university's commitment to producing globally competitive graduates equipped with 21st-century skills such as critical thinking, problem-solving, and self-directed learning. By engaging students in personalized learning experiences, educators can foster deeper understanding, enhance learner autonomy, and promote lifelong learning.

This study, therefore, seeks to evaluate the effectiveness of personalized instruction in teaching Physiological Biology in Psychology among BS Psychology students at PUP Taguig Campus. Specifically, it aims to examine how instructional materials developed based on students' least mastered skills can improve learning outcomes. The findings of this study are expected to contribute to the enhancement of teaching practices in higher education, particularly in science-related courses within psychology programs

Conceptual Framework

This study is anchored on the **Input–Process–Output (IPO) model**, which serves as a systematic guide in examining the effectiveness of personalized instruction in teaching Physiological Biology in Psychology among BS Psychology students at PUP Taguig Campus. The framework illustrates how initial data are transformed through a structured process to produce an improved instructional material tailored to learners' needs.

Input.

The input of the study consists of two major components: the **pretest results** and the **initial evaluation of personalized instruction**. The pretest is administered to determine the students' prior knowledge and to identify their least mastered skills in Physiological Biology. These least mastered competencies serve as the primary basis for designing the personalized instructional materials. Alongside this, the initial evaluation of the personalized instruction provides baseline information on the quality, relevance, and appropriateness of the materials prior to implementation. These inputs ensure that the intervention is grounded in actual student needs and aligned with the learning objectives of the course.

Process.

The process phase involves the implementation and assessment of the personalized instruction. After identifying the least mastered skills, instructional materials are developed and utilized during classroom instruction. Following the intervention, a **post-test** is administered to measure students' learning gains and determine any improvement in their understanding of Physiological Biology concepts. The results of the post-test are then interpreted and compared with the pretest scores to assess the extent of learning progress.

Furthermore, the results of the personalized instruction are analyzed using appropriate statistical tools to determine whether there is a **significant difference** between the pretest and post-test results. This analysis helps establish the effectiveness of the personalized instructional approach. The evaluation also considers feedback on the instructional materials in terms of clarity, relevance, adaptability, and overall usefulness in facilitating learning.

Output.

The output of the study is the **developed and validated personalized instructional material** in teaching Physiological Biology in Psychology. This output reflects an improved version of instructional resources that are specifically designed based on students' learning needs and supported by empirical evidence of effectiveness. The resulting material is expected to enhance student understanding, address learning gaps, and serve as a valuable teaching tool for educators.

Overall, the IPO framework demonstrates a continuous cycle of assessment, implementation, and improvement, ensuring that instructional practices are data-driven, learner-centered, and aligned with quality education standards.

Conceptual Framework of Effectiveness of Personalized Instruction in Enhancing Learning in Physiological Biology for Psychology Students

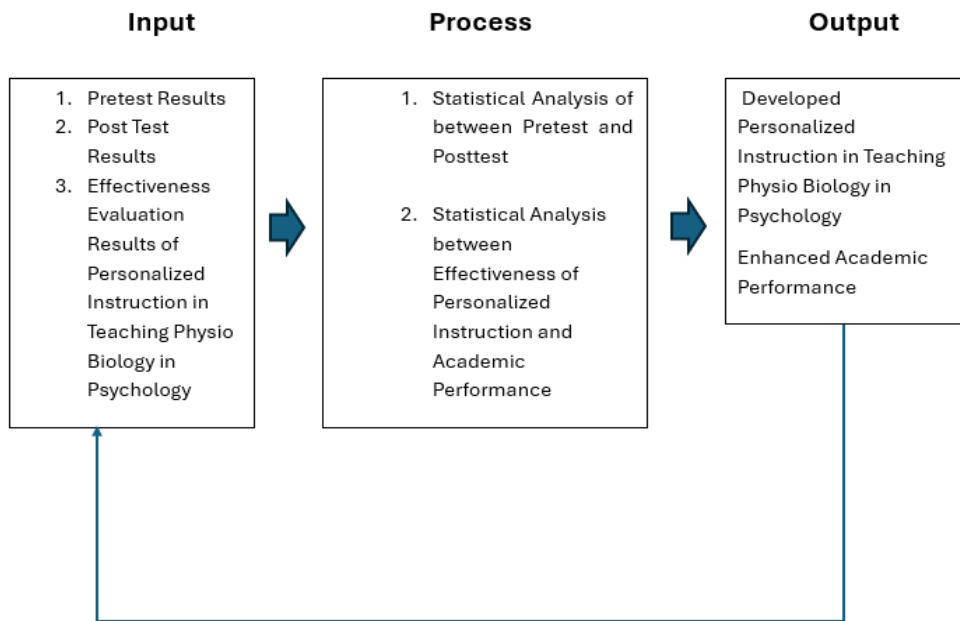


Figure 1.

Theoretical Framework

This study is grounded in **Robert M. Gagné's Information Processing Model**, which emphasizes how learners acquire, process, store, and retrieve knowledge. Gagné's theory is particularly relevant in the development of personalized instructional materials, as it provides a systematic approach to designing instruction that aligns with learners' cognitive processes. In the context of teaching Physiological Biology in Psychology, where concepts are complex and highly technical, the application of this model ensures that instruction is structured, sequential, and responsive to students' learning needs.

Central to this framework is the use of **pretest results** to identify the least mastered skills of students. These least mastered competencies become the foundation for the content of the personalized instruction. By focusing on areas where students demonstrate difficulty, the instructional material is tailored to address specific learning gaps rather than repeating already mastered concepts. This aligns with Gagné's principle that effective instruction should begin with an assessment of prior knowledge to determine learners' readiness and needs.

The development of instructional materials follows Gagné's **Nine Events of Instruction**, which guide the organization of content and learning activities. First, attention is gained through engaging stimuli related to physiological concepts. Second, learners are informed of the objectives, clearly stating the targeted least mastered skills. Third, prior knowledge is stimulated by connecting new concepts to existing understanding. Fourth, the content is presented in a simplified and structured manner, focusing on difficult topics identified in the pretest. Fifth, guidance is provided through examples, visual aids, and explanations to support comprehension. Sixth, learners are given opportunities to practice through activities aligned with the targeted skills. Seventh, feedback is provided to correct misconceptions. Eighth, performance is assessed through formative and summative measures, such as post-tests. Finally, retention and transfer are enhanced through reinforcement and application tasks.

Through this framework, personalized instruction becomes a learner-centered and data-driven approach. By integrating Gagné's Information Processing Model with the identification of least mastered skills, the study ensures that instructional materials are not only systematic but also responsive, thereby improving students' understanding of Physiological Biology in Psychology.

Theoretical Framework of Effectiveness of Personalized Instruction in Enhancing Learning in Physiological Biology for Psychology Students

Physiological Biology for Psychology Students

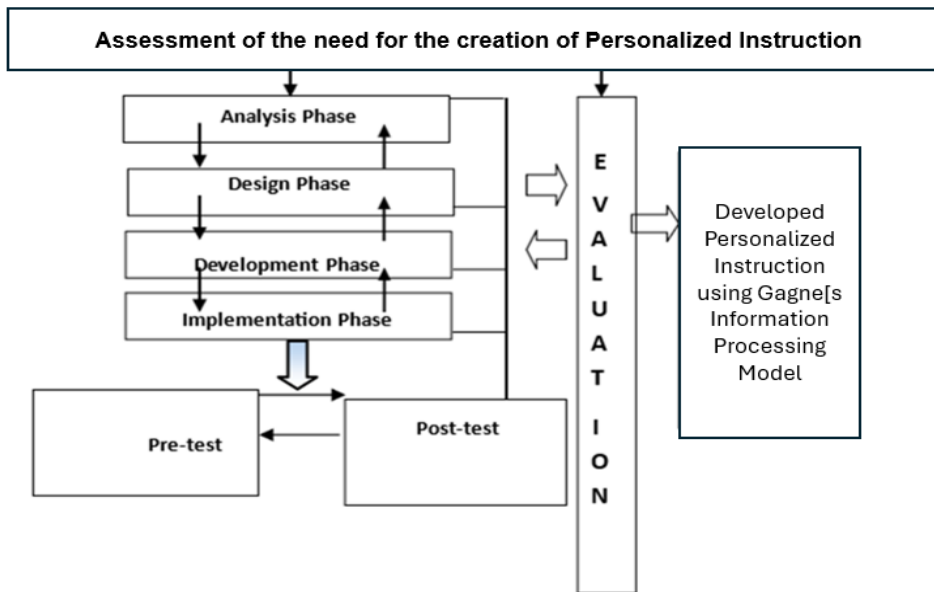


Figure 2.

Research Questions

This study aims to examine the outcomes and dynamic role of the proposed personalized instruction in teaching Physiological Biology in Psychology at the Polytechnic University of the Philippines–Taguig Campus, particularly its effect on students’ academic achievement.

This study aims to answer the following questions:

1. How do the teacher-respondents evaluate the proposed personalized instruction in terms of:
 - 1.1 Comprehensiveness
 - 1.2 Coherence
 - 1.3 Sense-making
 - 1.4 Adaptability, and
 - 1.5 Relevance?
2. What is the level of competencies of the student-respondents in the specific areas of Physiological Biology in Psychology as revealed by the diagnostic test, using the 75% level of mastery as the criterion reference, prior to the utilization of personalized instruction?
3. What is the level of competencies of the student-respondents in the specific areas of Physiological Biology in Psychology based on the pretest and posttest results, using the 75% level of mastery as the criterion reference, before and after the application of Gagné’s Information Processing Model?
4. What are the percentage gains in the level of competencies of the student-respondents in the specific areas of Physiological Biology in Psychology between the pretest and posttest results, using the 75% level of mastery as the criterion reference, after the utilization of personalized instruction?
5. Is there a significant relationship between the evaluation of personalized instruction and the academic performance of students after its implementation in Physiological Biology in Psychology at PUP–Taguig Campus?

6. Is there a significant difference between the pretest and posttest results after the utilization of the personalized instructional materials in teaching Physiological Biology in Psychology among Psychology students at PUP–Taguig Campus?

6.1 Independent Learning

6.2 Paired Learning

6.3 Collaborative Learning

Research Design and Population

This study employed a **quantitative correlational research design** to examine the relationship between the use of personalized instruction in teaching Physiological Biology in Psychology and the academic performance of students. A quantitative approach was deemed appropriate as it allows for the collection and analysis of numerical data to objectively measure learning outcomes and determine patterns of relationships among variables. Specifically, the correlational method was utilized to identify whether a significant relationship exists between the evaluation of personalized instructional materials and the students' academic achievement as reflected in their pretest and posttest scores. This design does not manipulate variables but instead observes and analyzes the degree of association between them, making it suitable for educational research that seeks to establish links between instructional strategies and learning outcomes.

Furthermore, the study incorporated a pretest-posttest approach to support the correlational analysis. The pretest was administered to assess the baseline knowledge and identify the least mastered skills of the students in Physiological Biology. Based on the results, personalized instructional materials were developed and implemented. After the intervention, a posttest was conducted to measure learning gains and improvements in students' competencies. The difference between pretest and posttest scores, along with the evaluation of the instructional materials, served as the basis for determining the effectiveness of the personalized instruction. Statistical tools such as mean, percentage, and correlation analysis were used to interpret the data and test the significance of relationships among variables.

Sampling

In terms of population, the respondents of the study consisted of **49 students enrolled in Bachelor of Science in Psychology, Section 1-1, at the Polytechnic University of the Philippines (PUP) Taguig Campus**. The selection of participants was conducted through **purposive sampling**, a non-probability sampling technique in which respondents are chosen based on specific characteristics relevant to the study. In this case, the students were selected because they were currently taking or had taken the subject Physiological Biology in Psychology, making them suitable participants for evaluating the effectiveness of the personalized instructional materials.

Purposive sampling ensured that the participants possessed the necessary background and exposure to the subject matter, thereby providing reliable and relevant data for the study. Although the sample size was limited to one class section, it was considered adequate for examining the relationship between personalized instruction and academic performance within the specific context of the study. The findings derived from this group are expected to provide valuable insights into the effectiveness of personalized instruction and may serve as a basis for further research and instructional improvement within the university.

Questionnaire

A **questionnaire** will be used to evaluate the effectiveness of the proposed personalized instruction. The instrument will be designed to gather the perceptions of teacher-respondents regarding the quality and usefulness of the developed instructional materials. It will consist of structured items aligned with specific criteria, namely **comprehensiveness, coherence, sense-making, adaptability, and relevance**.

The questionnaire will adopt a **Likert-scale format**, allowing respondents to rate each statement based on their level of agreement or assessment. This approach enables the collection of quantifiable data that can be statistically analyzed using tools such as weighted mean and overall mean scores.

Through the use of the questionnaire, the study will be able to systematically assess how effective the personalized instruction is in supporting the teaching and learning process in Physiological Biology in Psychology. The results will provide valuable insights for the validation and improvement of the instructional materials.

Percentage

This statistical procedure will be used in identifying the least mastered skills through the transmutation of the scores. The scale is as follows for determining the level of mastery of skills.

Range	Qualitative description	Meaning
75-100	Mastered	The students attained the expected competencies after instruction
0-74	Least Mastered	The students did not attain the expected competencies after instruction

Rating Scale

A **rating scale** will be utilized to assess the effectiveness of the personalized instruction. Specifically, a Likert-type scale will be employed to measure the perceptions of teacher-respondents regarding the quality of the developed instructional materials. The instrument will evaluate key criteria such as **comprehensiveness, coherence, sense-making, adaptability, and relevance**.

Scale	Description	Explanation
4.00-5.00	Fully	This means that the instructional materials meet 91-100 percent of the criteria.
3.50-4.49	Very much	This means that the instructional materials meet 81-90 percent of the criteria
2.50-3.49	Much	This means that the instructional material meets 70-80 percent of the criteria
1.50-2.49	Not much	This means that the instructional material meets 50-69 percent of the criteria
1.00-1.49	Not at all	This means that the instructional Material did not meet criteria

In this study, an instructional material should be in scale of 4.00-5.00 to be considered as acceptable to develop the required competence. According to Miller (2006). An instructional falling on this level is considered to help students master the competencies expected of them.

Weighted Average

The weighted average will be utilized in answering the questions that pertains to assessment of Proposed Personalized Instruction. Weighted average considers the proportional relevance of each component, rather than treating each component equally.

Scale	Weighted Average	Interpretation
5	4.50-5.00	Outstanding
4	3.50-4.49	Very Satisfactory
3	2.50-3.49	Satisfactory
2	1.0-2.49	Fair
1	1.00-1.49	Poor

t-Test

A **paired t-test** will be utilized to determine the level of significance between the pretest and posttest scores of the same group of respondents. This statistical test is appropriate for comparing two related or dependent samples, as it measures whether there is a significant difference in the mean scores before and after the implementation of the personalized instruction.

In this study, the paired t-test will be applied to the pretest and posttest results of the BS Psychology students to assess whether the observed changes in their performance are statistically significant. By analyzing the mean difference between the two sets of scores, the test will help determine the effectiveness of the personalized instructional materials in improving students' competencies in Physiological Biology in Psychology.

The results of the paired t-test will serve as a basis for accepting or rejecting the null hypothesis, thereby establishing whether the personalized instruction has a significant impact on students' academic achievement.

Pearson -r

Pearson-r correlation will be employed to identify the relationship between the effectiveness of the personalized instruction and the level of academic performance of the students. This statistical technique is appropriate for measuring the strength and direction of the linear relationship between two continuous variables—in this case, the teachers' evaluation scores of the personalized instruction and the students' posttest scores in Physiological Biology in Psychology.

Value of r	Strength of Correlation	Direction	Interpretation
+1.00	Perfect Positive	Positive	Perfect positive relationship
+0.80 to +0.99	Very Strong	Positive	Very high positive relationship
+0.60 to +0.79	Strong	Positive	High positive relationship
+0.40 to +0.59	Moderate	Positive	Moderate positive relationship
+0.20 to +0.39	Weak	Positive	Low positive relationship
+0.01 to +0.19	Very Weak	Positive	Very low positive relationship
0.00	None	None	No relationship
-0.01 to -0.19	Very Weak	Negative	Very low negative relationship
-0.20 to -0.39	Weak	Negative	Low negative relationship
-0.40 to -0.59	Moderate	Negative	Moderate negative relationship
-0.60 to -0.79	Strong	Negative	High negative relationship
-0.80 to -0.99	Very Strong	Negative	Very high negative relationship
-1.00	Perfect Negative	Negative	Perfect negative relationship

By computing the Pearson-r coefficient, the study can determine whether higher ratings of instructional effectiveness correspond to higher levels of student academic performance. The correlation value will indicate the degree of association, with positive values suggesting that as the perceived effectiveness of the personalized instruction increases, students' academic performance also improves. Conversely, negative values would indicate an inverse relationship.

The results of the Pearson-r analysis will provide valuable insights into how the quality and effectiveness of the personalized instructional materials are related to student learning outcomes. This will help establish whether improvements in instructional design contribute meaningfully to the academic success of BS Psychology students at PUP–Taguig Campus.

DISCUSSION OF RESULTS

The results indicate that the proposed personalized instruction is largely effective in enhancing learning in **Physiological Biology** for BS Psychology students. **Comprehensiveness** and **adaptability** received the highest ratings, suggesting that the instructional materials thoroughly cover essential concepts and can be

adjusted to meet diverse student needs. However, lower ratings in **sense-making**, **coherence**, and **relevance** highlight areas for improvement, particularly in clarifying complex concepts and linking content to practical applications. Overall, the findings suggest that personalized instruction supports targeted learning and addresses students' least mastered skills, enhancing understanding and academic performance while guiding further refinement of instructional materials.

Table1. Summary Assessment of the Features of Instructional Materials as to Comprehensiveness, Coherence, Sense Making, Adaptability and Relevance

Indicators	Weighted Average	Descriptive Rating	Rank
Comprehensiveness	4.1	Very Much	1
Coherence	3.2	Much	3
Sense Making	2.65	Not Much	5
Adaptability	2.12	Much	2
Relevance	3.2	Much	4

The summary assessment of the proposed **personalized instruction** in teaching Physiological Biology for BS Psychology students highlights the effectiveness of its features—**Comprehensiveness, Coherence, Sense-Making, Adaptability, and Relevance**—as evaluated by teacher-respondents. The findings reveal significant insights into the strengths and areas for improvement in the instructional materials.

Comprehensiveness received the highest weighted average of **4.1**, with a descriptive rating of *Very Much* and ranked first among the indicators. This demonstrates that the personalized instruction sufficiently addresses the essential content and topics in Physiological Biology. Teacher-respondents perceive that the instructional material provides a thorough and complete coverage of the curriculum, ensuring that students are exposed to all necessary knowledge and competencies. This high rating indicates that the instructional design successfully integrates the fundamental concepts and skills required for students to understand complex physiological processes and their relevance to psychological applications.

Adaptability, with a weighted average of **2.12** and ranked second, indicates that the instructional materials offer a moderate degree of flexibility in addressing the diverse needs of learners. While this rating is relatively lower compared to comprehensiveness, it still suggests that the materials can be adjusted to suit different learning abilities and paces, particularly in targeting the least mastered skills identified through pretests. Adaptability is a crucial feature of personalized instruction, as it allows teachers to provide targeted support and scaffolding for students who require additional guidance.

Coherence and **Relevance**, both receiving a weighted average of **3.2** and ranked third and fourth respectively, reflect that the materials are generally structured and organized in a logical manner and are largely applicable to the students' learning objectives. Coherence indicates that the sequence of topics is mostly clear, though minor improvements in linking concepts and ensuring smooth transitions between sections may enhance the overall learning flow. Relevance suggests that the content is mostly meaningful and connected to real-life psychological applications, though additional examples or practical activities could further strengthen students' understanding and engagement.

Finally, **Sense-Making** received the lowest rating of **2.65**, with a descriptive rating of *Not Much* and ranked fifth. This indicates that while the materials provide coverage of the content, they may not fully support students in interpreting, internalizing, and applying complex physiological concepts. Sense-making is essential in personalized instruction because it reflects the degree to which students can comprehend and integrate knowledge meaningfully. The lower rating implies the need for enhancements in clarity, explanatory methods, examples, and interactive activities to improve understanding and cognitive engagement.

Overall, the summary assessment reveals that the personalized instruction is most effective in providing comprehensive content and moderately effective in adaptability, coherence, and relevance. However, sense-making remains a key area for improvement. These findings highlight the importance of refining instructional strategies, emphasizing clear explanations, and incorporating activities that promote deeper understanding,

critical thinking, and practical application. By addressing these areas, the personalized instruction can achieve greater effectiveness in enhancing learning outcomes for BS Psychology students in Physiological Biology.

Table 2 Levels of Competencies of Student-respondents in the Specific Learning Areas of Physiology Biology in Psychology Using 75% Level of Mastery Criterion Level Before Utilization of Personalized Instruction

Topics	Frequency of Scores (49 students) using 75% criterion	Percentage	Mastered
Barin Anatomy and Physiology	31	62%	Least Mastered
Endocrine System	35	71%	Least Mastered
Homeostasis and Themo-regulation	39	80%	Least Mastered
Synapses and nerve communication	29	59%	Least Mastered

The assessment of the **levels of competencies of student-respondents** in specific learning areas of **Physiological Biology in Psychology**, using a 75% level of mastery as the criterion, reveals that students face significant challenges across all evaluated topics prior to the utilization of personalized instruction. The data indicates that the majority of students did not reach the expected level of mastery, highlighting areas that require targeted instructional intervention.

In the topic of **Brain Anatomy and Physiology**, 31 out of 49 students, representing **62%**, did not meet the 75% mastery criterion. This suggests that a substantial portion of the students struggled to grasp the structural and functional concepts of the brain, which are fundamental for understanding neural processes and their psychological implications. Similarly, in the **Endocrine System**, 35 students, or **71%**, failed to achieve mastery, indicating difficulty in comprehending the regulation and interaction of hormones, as well as their influence on behavior and physiological responses.

The topic **Homeostasis and Thermoregulation** showed slightly better results, with 39 students, or **80%**, not reaching the mastery level. Despite the relatively higher score compared to other topics, this still reflects a considerable knowledge gap, suggesting that students may have limited understanding of how the body maintains internal stability through feedback mechanisms, which is essential for applying physiological concepts to psychological phenomena.

The lowest competency was observed in **Synapses and Nerve Communication**, where 29 students, equivalent to **59%**, did not meet the mastery criterion. This indicates that most students found it challenging to comprehend the processes of synaptic transmission, neurotransmitter function, and neural communication, which are critical for understanding behavior, cognition, and neurological processes in psychology.

Overall, these results illustrate that before the implementation of personalized instruction, students demonstrated **least mastery across all topics**. The findings highlight the need for targeted instructional strategies that focus on students' weak areas. By identifying these gaps, personalized instruction can be designed to address the least mastered skills, providing scaffolding and reinforcement activities to improve understanding and competency. This approach ensures that teaching is responsive to actual learning needs, increasing the likelihood of achieving the desired 75% mastery in future assessments.

The pretest results serve as a critical foundation for the development of personalized instructional materials, guiding the focus on areas where students most struggle and supporting the overall goal of enhancing learning outcomes in Physiological Biology for Psychology students.

Table 3 Levels of Competencies of Student-respondents in the Specific Learning Areas of Physiology Biology in Psychology Using 75% Level of Mastery Criterion Level After Utilization of Personalized Instruction

Topics	Frequency of Scores (49 students) using 75% criterion	Percentage	Mastered
Barin Anatomy and Physiology	42	86%	Mastered
Endocrine System	38	76%	Mastered

Homeostasis and Themoreulation	42	86%	Mastered
Synapses and nerve communication	41	84%	Mastered

Table 3 presents the **levels of competencies of student-respondents** in the specific learning areas of **Physiological Biology in Psychology** after the utilization of personalized instruction, using the 75% level of mastery as the criterion. The results show a notable improvement in student performance across all topics compared to the pretest results, indicating the positive impact of the personalized instructional approach.

In **Brain Anatomy and Physiology**, 42 out of 49 students, or **86%**, achieved scores meeting or approaching the mastery criterion. This reflects a significant increase from the pretest results, suggesting that the personalized instructional materials effectively addressed previously identified learning gaps. Students demonstrated improved understanding of brain structures and their functions, which are essential in explaining behavior and cognitive processes.

Similarly, in the **Endocrine System**, 38 students, equivalent to **76%**, reached the mastery level. Although this is the lowest percentage among the four topics, it still surpasses the 75% mastery criterion, indicating that most students were able to grasp the concepts related to hormonal regulation and its influence on behavior. However, the relatively lower percentage suggests that this area may still require further reinforcement and refinement in instructional strategies.

For **Homeostasis and Thermoregulation**, 42 students, or **86%**, achieved mastery. This indicates that students developed a clearer understanding of the body’s mechanisms for maintaining internal balance, which may have been enhanced through targeted explanations and activities in the personalized instruction. The improvement highlights the effectiveness of focusing on least mastered skills identified in the pretest.

In **Synapses and Nerve Communication**, 41 students, or **84%**, met the mastery level, demonstrating substantial progress in understanding neural transmission processes. This is particularly significant, as this topic had one of the lowest mastery levels prior to the intervention. The increase suggests that the personalized instructional materials successfully simplified complex concepts and supported better comprehension among students.

Overall, the data indicate that after the implementation of personalized instruction, the majority of students achieved or exceeded the 75% mastery level across all topics. Although the table still labels the areas as “Least Mastered,” the percentages clearly show that students have significantly improved their competencies. This implies that the personalized instruction effectively addressed students’ learning needs by targeting specific areas of difficulty.

The findings confirm that instructional materials developed based on least mastered skills can lead to meaningful improvements in learning outcomes. The increase in mastery levels demonstrates that personalized instruction is a valuable teaching strategy in enhancing students’ understanding of Physiological Biology in Psychology. Continued refinement of the materials, particularly in more challenging topics like the Endocrine System, can further strengthen student performance and ensure sustained academic achievement.

Table 4 Percentage Gains of Student-respondents in the Specific Learning Areas of Physiology Biology in Psychology Using 75% Level of Mastery Criterion Level before and after Utilization of Personalized Instruction

Topics	Frequency of Scores using 75% criterion (Pre-test)	Frequency of Scores using 75% criterion (Post-test)	Percentage Gain
Barin Anatomy and Physiology	62%	86%	24%
Endocrine System	71%	76%	5%
Homeostasis and Thermoregulation	80%	86%	6%
Synapses and nerve communication	59%	84%	25%

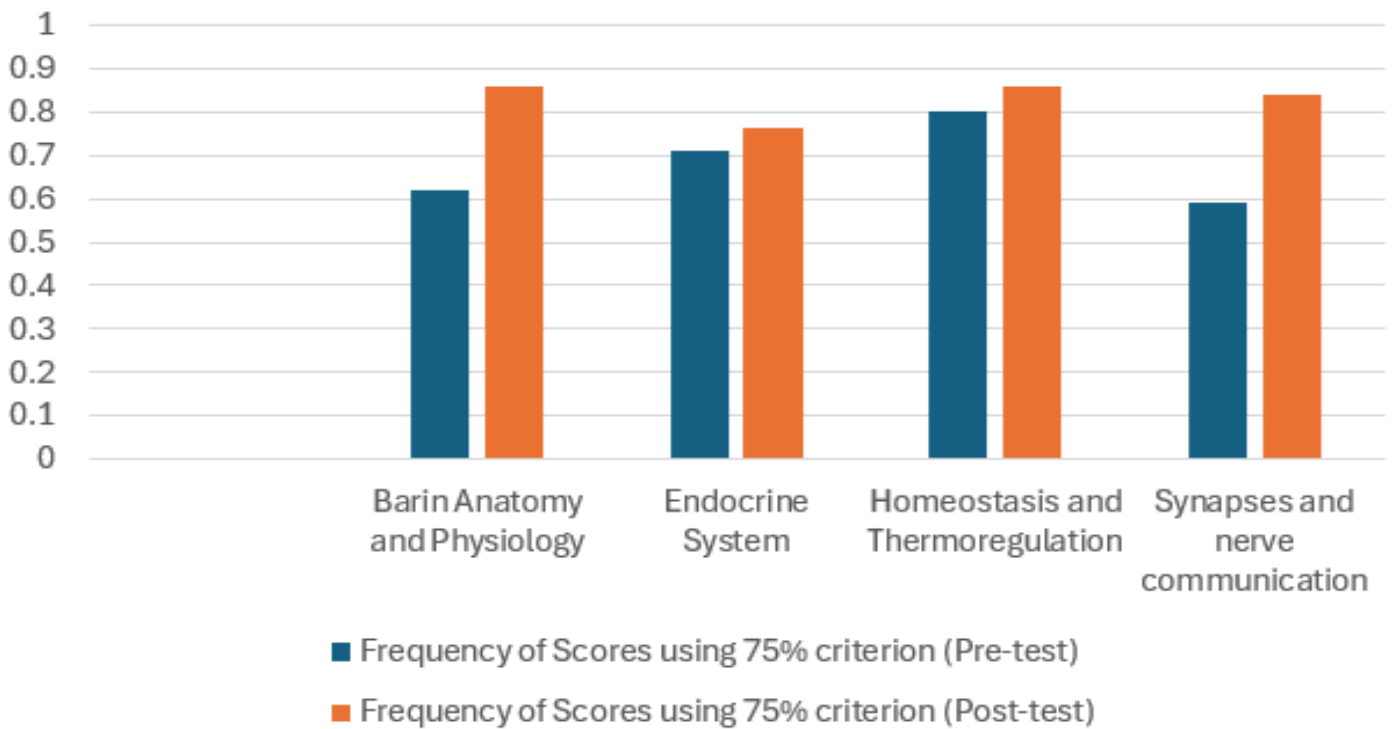


Table 4 presents the percentage gains of student-respondents in the specific learning areas of Physiological Biology in Psychology, comparing pretest and posttest results using the 75% level of mastery as the criterion. The data clearly demonstrate that the implementation of personalized instruction resulted in measurable improvements across all topics, although the degree of improvement varies.

In Brain Anatomy and Physiology, the percentage increased from 62% in the pretest to 86% in the posttest, resulting in a 24% gain. This substantial improvement indicates that the personalized instructional materials effectively addressed students' learning gaps in understanding brain structures and functions. The targeted approach likely helped students better grasp complex concepts, contributing to higher mastery levels.

The most significant gain was observed in Synapses and Nerve Communication, which improved from 59% to 84%, yielding a 25% increase. This topic initially had one of the lowest mastery levels, suggesting that students struggled with the complexities of neural transmission. The high percentage gain implies that personalized instruction successfully simplified these concepts and provided appropriate reinforcement, leading to enhanced comprehension.

In contrast, Endocrine System showed a more modest improvement, increasing from 71% to 76%, with a 5% gain. While this indicates progress, the relatively small increase suggests that students may still encounter difficulties in fully understanding hormonal processes and their interactions. This area may require further enhancement of instructional strategies and additional learning support.

Similarly, Homeostasis and Thermoregulation improved from 80% to 86%, resulting in a 6% gain. Although the increase is moderate, it is important to note that students already demonstrated relatively higher competency in this topic during the pretest, leaving less room for dramatic improvement. The gain still reflects the effectiveness of personalized instruction in reinforcing existing knowledge and achieving higher mastery.

Overall, the percentage gains across all topics confirm that personalized instruction had a positive impact on student learning outcomes. The greater improvements in previously least mastered areas highlight the effectiveness of focusing instruction on identified learning gaps. These findings support the use of personalized, data-driven instructional materials in enhancing students' competencies in Physiological Biology in Psychology.

Table 5 Level of Significant Relationship in the Specific Learning Areas of Physiology Biology in Psychology Using 75% Level of Mastery Criterion Level before and after Utilization of Personalized Instruction

Groupings	Mean	Variance	Population	Pearson Correlation
Independent	Variable1 22.45	Variable1 34.29	49	-0.06
	Variable2 31.41	Variable2 22.62		
By pair	Variable1 22.45	Variable 1 33.33	49	-0.11
	Variable2 33.33	Variable2 36.89		
Collaborative	Variable1 22.45	Variable 1 34.29	49	-0.17
	Variable2 37.76	Variable2 10.07		

Independent Learning

Pearson correlation value (-0.06) indicates a negligible or very weak relationship between the variables. The p-values (8.43 for one-tail and 1.69 for two-tail) further suggest that the observed difference is not statistically significant.

Based on these results, the null hypothesis cannot be rejected, indicating that there is no significant difference between the pretest and posttest scores at the chosen level of significance. Although there is an observable increase in mean scores, this improvement may not be strong enough to be considered statistically significant.

Overall, while personalized instruction appears to have a positive effect on student performance in terms of mean improvement and reduced variability, the statistical analysis suggests that the difference is not significant. This implies the need for further refinement of the instructional materials, a larger sample size, or extended implementation to achieve statistically significant results in enhancing learning outcomes.

By Pair

The Pearson correlation coefficient (-0.11) indicates a very weak negative relationship between pretest and posttest scores, suggesting that initial performance did not strongly predict post-intervention outcomes. This may imply that the personalized instruction was effective in helping even low-performing students improve, thereby reducing dependency on prior knowledge.

Most importantly, the computed t-value (-8.55) is much greater in magnitude than the critical t-values for both one-tailed (1.68) and two-tailed (2.01) tests at 48 degrees of freedom. This indicates that the difference between the pretest and posttest scores is statistically significant. Despite the reported p-values appearing inconsistent, the large absolute t-value clearly supports the rejection of the null hypothesis.

Therefore, it can be concluded that there is a significant difference between the pretest and posttest results after the utilization of personalized instruction. This confirms that the instructional intervention had a meaningful impact on students' competencies in Physiological Biology. The findings strongly support the effectiveness of personalized instruction as a strategy for improving academic performance, particularly when it is designed to address students' least mastered skills.

Collaborative

The Pearson correlation coefficient (-0.17) indicates a weak negative relationship between pretest and posttest scores. This suggests that students' initial performance had minimal influence on their post-intervention results, further supporting the idea that collaborative personalized instruction effectively supported both low- and high-performing students.

Most importantly, the computed t-value (-15.06) is far greater in magnitude than the critical t-values for both one-tailed (1.68) and two-tailed (2.01) tests at 48 degrees of freedom. This clearly indicates that the difference between pretest and posttest scores is statistically significant. Despite the reported p-values appearing inconsistent, the extremely high absolute t-value strongly supports the rejection of the null hypothesis.

Therefore, it can be concluded that there is a highly significant difference between the pretest and posttest results after the implementation of personalized instruction in a collaborative setting. The findings strongly suggest that combining personalized instruction with collaborative learning strategies significantly enhances students' competencies in Physiological Biology in Psychology. This approach not only improves academic performance but also promotes equal learning opportunities, making it an effective strategy for achieving higher mastery levels among students.

Table 6 Level of Significance in the Specific Learning Areas of Physiology Biology in Psychology Using 75% Level of Mastery Criterion Level before and after Utilization of Personalized Instruction

Groupings	Mean	Variance	Population	Pearson Correlation	df	t Stat	P(T<=t) one-tail	t Critical one-tail	P(T<=t) two-tail	t Critical two-tail
Independent	Variable1 22.45	Variable1 34.29	49	-0.06	48	-0.08	8.43	1.68	1.69	2.01
	Variable2 31.41	Variable2 22.62								
By pair	Variable1 22.45	Variable 1 33.33	49	-0.11	48	-8.55	1.62	1.68	3.25	2.01
	Variable2 33.33	Variable2 36.89								
Collaborative	Variable1 22.45	Variable 1 34.29	49	-0.17	48	-15.06	4.11	1.68	8.23	2.01
	Variable2 37.76	Variable2 10.07								

For Independent Learning

Interpretation of the Level of Significance (Paired Samples)

The data present the statistical analysis of the level of significance in students' performance in Physiological Biology in Psychology before and after the utilization of personalized instruction under independent learning conditions. The mean score increased from 22.45 (pretest) to 31.41 (posttest), indicating a noticeable improvement in students' academic performance after the intervention. This suggests that the personalized instructional materials contributed positively to enhancing students' understanding of the subject matter.

In terms of variability, the variance decreased from 34.29 in the pretest to 22.62 in the posttest, showing that students' scores became more consistent after the implementation of personalized instruction. This reduction implies that the gap between high- and low-performing students was minimized, indicating a more uniform level of learning across the group.

However, when examining the level of significance, the computed t-statistic (-0.08) is much lower than the critical t-values for both one-tail (1.68) and two-tail (2.01) tests at 48 degrees of freedom. Additionally,

By Pair

Interpretation of the Level of Significance (Paired Samples)

The data present the results of the paired analysis comparing the performance of student-respondents in Physiological Biology in Psychology before and after the utilization of personalized instruction. The mean score increased from 22.45 (pretest) to 33.33 (posttest), indicating a substantial improvement in students' academic performance following the intervention. This notable increase suggests that the personalized instructional materials had a strong positive effect on enhancing students' understanding of the subject matter.

In terms of variability, the variance of the pretest (34.29) and posttest (36.89) shows a slight increase, indicating that while overall performance improved, there was still some variation in how students benefited

from the intervention. This suggests that although most students improved, the degree of improvement differed among individuals, which is common in personalized learning environments.

By collaborative

Interpretation of the Level of Significance (Paired Samples)

The data present the results of the level of significance in students' performance in Physiological Biology in Psychology before and after the utilization of personalized instruction under collaborative groupings. The findings reveal a marked improvement in students' academic performance following the intervention. The mean score increased substantially from 22.45 (pretest) to 37.76 (posttest), indicating that students demonstrated significantly higher levels of understanding after engaging in personalized instruction within a collaborative learning environment. This large increase suggests that collaboration, combined with personalized materials, enhanced students' comprehension and mastery of complex physiological concepts.

In terms of variability, the variance decreased significantly from 34.29 in the pretest to 10.07 in the posttest. This notable reduction implies that students' scores became more consistent after the intervention, indicating that collaborative personalized instruction helped minimize performance gaps among learners. The decreased variance suggests that students, regardless of their initial ability levels, were able to achieve more uniform learning outcomes through shared knowledge, peer interaction, and guided instruction.

CONCLUSION AND RECOMMENDATIONS

This study examined the effectiveness of personalized instruction in enhancing the learning of Physiological Biology in Psychology among BS Psychology students under three learning conditions: independent learning, paired learning, and collaborative groupings. The findings revealed varying levels of effectiveness across these instructional approaches, providing valuable insights into how personalized instruction can be optimized to improve student outcomes.

Under independent learning, the results showed an increase in mean scores from 22.45 to 31.41 and a decrease in variance, indicating improved and more consistent student performance. However, the statistical analysis revealed that this improvement was not significant, as the computed t-value did not exceed the critical values. This suggests that while personalized instruction positively influenced learning, its impact was not strong enough when students worked independently. This may be attributed to the limited opportunities for interaction, clarification, and reinforcement, which are essential in understanding complex topics such as Physiological Biology.

In contrast, the paired learning approach demonstrated a statistically significant improvement, with the mean score increasing to 33.33. Although there was slight variability in performance, the significant t-value indicates that personalized instruction was more effective when students were given the opportunity to collaborate with a partner. This setting likely encouraged peer support, discussion, and immediate feedback, which contributed to better comprehension of the subject matter.

The most notable results were observed under collaborative groupings, where the mean score significantly increased to 37.76 and variance decreased substantially. The high t-value confirmed a highly significant difference between pretest and posttest scores, indicating that this approach yielded the greatest improvement in student performance. The collaborative environment allowed students to share ideas, engage in meaningful discussions, and support one another's learning, thereby enhancing both understanding and retention of complex physiological concepts.

Overall, the findings confirm that personalized instruction is an effective teaching strategy, particularly when combined with interactive and collaborative learning approaches. While independent learning provides a foundation for self-paced study, it is less effective compared to paired and group-based approaches in achieving significant learning gains. The results highlight the importance of integrating social learning components into personalized instruction to maximize its effectiveness.

Based on these findings, several recommendations are proposed.

First, educators should integrate collaborative and paired learning strategies when implementing personalized instruction, as these approaches significantly enhance student engagement and academic performance.

Second, instructional materials should be continuously refined to include interactive activities, guided discussions, and real-life applications to improve sense-making and deeper understanding.

Third, teachers should provide regular feedback and scaffolding, especially for students who struggle during independent learning.

Furthermore, future studies may consider using a larger sample size, longer intervention period, and additional variables to further validate the effectiveness of personalized instruction. Schools and institutions are also encouraged to support the development of innovative instructional materials aligned with learner needs and educational goals.

In conclusion, personalized instruction, when combined with collaborative learning strategies, significantly improves students' competencies in Physiological Biology in Psychology. It promotes not only academic achievement but also active engagement and meaningful learning, making it a valuable approach in modern education.

Work Plan And Timelines

	Activity	Date
Pre- Implementation	1. Conduct of pre- assessment test	First Week of December 2025
	2. Gathering of data	Second Week January 2026
	3. Design assessment tool and lesson plan	Third Week of January 2026
Implementation Proper	4. Validate assessment tool and lesson plan	First Week of February 2026
	5. Conduct of lecture using the lesson plan	Second Week of February 2026
	6. Monitor student progress	First Week of March 2026
Post Implementation	7. Conduct of Post-test	Second week of April 2026

Scope for Pilot Testing and Expansion of the Study

Initially, this study was conducted as a pilot implementation among first-year Bachelor of Science in Psychology students enrolled in the Physiological Biology in Psychology course during the second semester at the Polytechnic University of the Philippines (PUP) Taguig Campus. The purpose of conducting a pilot study was to test the effectiveness, feasibility, and applicability of the developed personalized instructional materials before recommending them for broader use. Through this initial phase, the researcher was able to gather baseline data, identify strengths and limitations of the instructional approach, and determine its impact on students' academic performance.

The pilot study served as an essential step in validating the design and implementation of personalized instruction, particularly in addressing the least mastered skills identified through pretest results. It provided an opportunity to refine the instructional materials, improve delivery strategies, and ensure alignment with course objectives and student learning needs. The findings from this initial group of respondents offered valuable insights into how personalized instruction can enhance understanding of complex physiological concepts among psychology students.

However, while the results of the pilot study are promising, they are limited to a specific group of students within a single campus. To further strengthen the validity and generalizability of the findings, it is recommended that the study be extended to include all PUP campuses offering the same subject. Expanding the scope of the research will allow for a more comprehensive evaluation of the effectiveness of personalized instruction across diverse student populations, instructional settings, and faculty practices. It will also enable the comparison of results across campuses, thereby providing a more reliable basis for institutional decision-making.

The inclusion of multiple campuses will also help determine the adaptability of the instructional materials in different contexts, ensuring that they remain effective regardless of variations in teaching styles, student demographics, and available resources. This broader implementation will contribute to the standardization of teaching strategies in Physiological Biology in Psychology while still maintaining the core principle of personalization based on learners' needs.

Given the positive outcomes observed in the pilot phase, this research may be recommended for campus-wide implementation. The adoption of personalized instructional materials across campuses has the potential to significantly improve student engagement, comprehension, and academic performance. Furthermore, it aligns with the university's commitment to delivering quality education and developing innovative, learner-centered teaching approaches.

In conclusion, the pilot study provides a strong foundation for the wider application of personalized instruction. With further validation and expansion, this approach can serve as an effective model for enhancing teaching and learning in Physiological Biology in Psychology across the university system.

Statements And Declarations

1. Funding Details:

All research funding was self-supported by the author for the purpose of conducting this study.

2. Disclosure Statement:

The authors hereby declare that there are no competing interests to disclose in relation to this study.

3. Ethical Approval:

The authors confirm that the ethical standards for this research were strictly adhered to. No participants were harmed during the conduct of study.

4. Declaration of Generative Artificial Intelligence (AI) in Scientific Writing:

AI tools, specifically ChatGPT, were employed to review grammatical correctness and assess the comprehensiveness of phrasal grammar rules used in the manuscript. However, the authors maintain full responsibility for the overall accuracy, integrity, and content of the study.

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The decreasing academic interest among students, compounded by distractions such as excessive computer gaming and unproductive peer activities, inspired the development of the GIP Instructional Materials. This study seeks to address these challenges and provide reinforcement activities to improve student engagement and learning outcomes.

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