

Scienergy: A Mobile-Based Laboratory Manual on the Affective and Cognitive Learning Outcomes

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Abstract—This study examines the effects of Scienergy, a mobile-based laboratory manual on students' affective and cognitive learning outcomes in Biochemistry. It evaluates the level of assessment on Scienergy's components and features, examines affective and cognitive learning outcomes, and investigates the relationship between utilization of Scienergy and affective learning outcomes. Also, this study determines the effect of Scienergy on student's cognitive learning outcomes. A quantitative experimental design was employed with eighty-two (82) Psychology students during the second semester of 2025–2026. Researcher-developed instruments, validated by five experts, were used in the study. Data analysis involved weighted mean and standard deviation for evaluating Scienergy and affective learning outcomes. For inferential statistics, the study used Pearson correlation for the affective outcomes, and t-test for cognitive outcomes. Students rated the components and features of Scienergy very high which indicate that the application can help in enhancing learning outcomes. In terms of affective learning outcomes, the results also reveal very high level of assessment which implies that Scienergy help in enhancing affective learning outcomes. Students also achieve outstanding performance in written and practical tests. The findings show a significant relationship between utilization of Scienergy and affective learning outcomes, thus the hypothesis is rejected. However, since the hypothesis for cognitive learning outcomes is accepted, scores in written and practical tests are not significantly influenced by Scienergy's features and components, except usability as the only feature that positively affected practical test performance. The results imply that Scienergy is a well-structured, accessible, functional, and visually appropriate mobile-based laboratory manual that can support affective learning. However, it may not directly improve cognitive outcomes indicating that other factors may influence students' performance. Therefore, Scienergy can be used by the students to enhance affective learning outcomes but not in the cognitive aspect. Future researchers must conduct further studies to improve the application's effectiveness, especially in cognitive learning outcomes.

Keywords— Mobile-Based Laboratory Manual, Scienergy, Affective Learning Outcomes, Cognitive Learning Outcomes, Biochemistry.

I. INTRODUCTION

The process of teaching and learning has evolved considerably in the shifting landscape of education in the 21st century. This involves acquisition of high-quality knowledge and learning experiences. Aranda and Zamora (2016) mentioned that the students are the center of learning in which the teachers consider the needs and characteristics of the students and must meticulously tailor their strategies to align with each student's learning preference. This means a transition from conventional memorization techniques to a holistic approach that encourages creativity, enhances problem-solving abilities, and

promotes critical thinking. For instance, disciplines such as Science, requiring integrating hands-on experimentation, collaborative problem-solving, along with interactive technologies. These collectively foster an environment conducive for dynamic interactive learning experiences, thus, it is necessary to implement innovative learning strategies such as learning to cater the needs of the students.

Mobile learning, as one of the effective approaches, supports this need and has been proven by various studies in the review of Pedraja-Rejas et al. (2024). Since most students today have internet access, mobile learning has become an efficient and convenient strategy in learning. Mobile learning offers innovative alternatives to traditional instruction, including e-learning modalities (Osorio & Aliazas, 2022). It allows students to learn at their own speed and schedule, providing flexibility and autonomy. Bonk and Lee (2017) also emphasized that greater learner freedom in exploring educational opportunities enhances their creativity and potential contributions to society.

Various literatures emphasized that mobile and e-learning improve student outcomes. For instance, Chikileva et al. (2023), and Hamdan and Amorri (2022) highlighted the positive impact of these strategies on academic performance and engagement. Similarly, electronic modules (e-modules), as an example of mobile learning tools, have been shown to promote independent and effective learning, while also increasing students' interest and interactivity in the learning process (Sumaryati et al., 2022). Their functionality, ease of navigation, operational simplicity, and accessibility make them highly practical for classroom use. In science education, mobile-based applications can address the shortage of instructional materials, improve learners' competence, enhance teaching quality, and promote flexible, self-paced learning (Osorio and Aliazas, 2022).

Therefore, this study aimed to develop a mobile-based learning tool such as laboratory manual in Biochemistry and evaluate its effectiveness in enhancing students' cognitive and affective learning outcomes. It also sought to contribute to the formulation of innovative instructional strategies and their integration into science education, providing valuable support for both teachers and students.

1.1 Statement of the Problem

Problem/s which were addressed by the research

This study aimed to examine the effects of Scienergy as a Mobile-Based Laboratory Manual on the affective and

cognitive learning outcomes in Biochemistry among second-year Psychology students of Laguna University.

Specifically, it sought to answer the following questions:

1. What is the level of assessment on the components of Scienergy, a mobile-based laboratory manual, in terms of:
 - 1.1 Pre-Lab Discussion;
 - 1.2 Laboratory Procedures;
 - 1.3 Glossary;
 - 1.4 Exercises; and
 - 1.5 Post-Lab Discussion?
2. What is the level of assessment on the features of Scienergy, a mobile-based laboratory manual, in terms of:
 - 2.1 Accessibility;
 - 2.2 Functionality;
 - 2.3 Usability; and
 - 2.4 User Interface?
3. What is the status of student's affective learning outcomes in terms of:
 - 3.1 Student Interest;
 - 3.2 Student Motivation;
 - 3.3 Perceived Competence;
 - 3.4 Classroom Involvement; and
 - 3.5 Learning Attitude?
4. What is the level of student's cognitive learning outcomes in terms of:
 - 4.1 Written Test; and
 - 4.2 Practical Test?
5. Is there a significant relationship between utilizing Scienergy, a mobile-based laboratory manual and student's affective learning outcomes? and
6. Is there a significant effect between utilizing Scienergy, a mobile-based laboratory manual and student's cognitive learning outcomes?

II. METHODOLOGY

A quantitative experimental design was employed with eighty-two (82) Psychology students during the second semester of 2025–2026. Researcher-developed instruments, validated by five experts, were used in the study. Data analysis involved weighted mean and standard deviation for evaluating Scienergy and affective learning outcomes. For inferential statistics, the study used Pearson correlation for the affective outcomes, and t-test for cognitive outcomes.

III. RESULTS AND DISCUSSION

This part presents the results of the study by systematically analyzing the evaluation of Scienergy, the mobile-based laboratory manual, in terms of its components and features. The assessment of Scienergy's components and features provides insight into how effectively the manual supports the instructional process.

It also examined the students' learning outcomes in cognitive and affective domains to identify the impact of using a mobile-based laboratory manual in Biochemistry on these variables.

Level of Assessment on the Components of Scienergy

The level of assessment on the components of Scienergy. It contains well-structured components such as pre-lab discussion, laboratory procedures, glossary, exercises and post-lab discussion.

Table 1 presents the evaluation of Scienergy in terms of its pre-laboratory discussion component. The table contains the specific statements together with their mean scores, standard deviations, and descriptive remarks. The students strongly agree that the pre-lab discussions of Scienergy are aligned with the Biochemistry outcomes. The mean ($M=4.88$, and $SD=0.36$) indicates very high level in terms of Prelab Discussion. In addition, students strongly agree that pre-lab discussions explain key Biochemistry concepts before performing the experiment. While the mean for this statement is the lowest ($M=4.76$ and $SD=0.51$) among the indicators, it still indicates a very high level of assessment.

Table 1. Level of Assessment on Scienergy as a Mobile-Based Laboratory Manual in terms of Components with regards to Pre-Lab Discussion

Statement	Mean	SD	Remarks
Scienergy has pre-lab discussion that...			
...are aligned with the Biochemistry course outcomes.	4.88	0.36	Strongly Agree
...help me understand the purpose of the laboratory activity.	4.85	0.39	Strongly Agree
...explain key Biochemistry concepts before performing the experiment.	4.76	0.51	Strongly Agree
...promote understanding of key Biochemistry concepts through real-world examples.	4.82	0.47	Strongly Agree
...encourage critical thinking and readiness by connecting key concepts to possible outcomes and applications.	4.78	0.45	Strongly Agree
Weighted Mean	4.82		
SD	0.44		
Verbal Interpretation	Very High		

The pre-lab discussion assessment achieved a weighted mean score of 4.82, accompanied by a standard deviation of 0.44. This result was categorized as very high among the respondents. This implies that pre-lab discussion results to fostering deeper understanding in the laboratory activities.

Table 2 shows the level of assessment of Scienergy's components in term of laboratory procedure. The students strongly agree that laboratory procedures provide the complete and organized list of required materials and equipment. The mean ($M=4.85$, and $SD=0.36$) indicates a very high level of assessment of Scienergy regarding laboratory procedures. Additionally, students strongly concur with the statements "the instructions in laboratory procedures are clearly articulated and easy to follow" and "the content aids me in understanding the purpose of each step," with both receiving a mean score of 4.79 and a standard deviation of 0.46.

The level of assessment on the pre-lab discussion achieved a weighted mean score of 4.82, with a standard deviation of 0.43, which was described as very high among the students. This implies that the laboratory procedures in the Scienergy attained its goal in providing well-organized safety notes, materials and laboratory instructions to accurately perform the laboratory experiment.

Table 2. Level of Assessment on Scienergy as a Mobile-Based Laboratory Manual in terms of Components with regards to Laboratory Procedures

Statement	Mean	SD	Remarks
The Laboratory procedure component of Scienergy has...			
...clear and appropriate safety notes for conducting the laboratory activity.	4.84	0.43	Strongly Agree
...complete and organized list of required materials and equipment	4.85	0.36	Strongly Agree
...instructions that are clearly written and easy to follow during the laboratory activity.	4.79	0.46	Strongly Agree
...step-by-step instructions that support accurate performance of the experiment.	4.80	0.43	Strongly Agree
...contents that help me understand what each step is intended to accomplish.	4.79	0.46	Strongly Agree
Weighted Mean	4.82		
SD	0.43		
Verbal Interpretation	Very High		

Table 3 shows the assessment of Scienergy in terms of glossary. Also, it includes the statements, mean, standard deviation and remarks.

Table 3. Level of Assessment on Scienergy as a Mobile-Based Laboratory Manual in terms of Components with regards to Glossary

Statement	Mean	SD	Remarks
The glossary of the Scienergy helps me...			
...understand definitions of scientific terms through clear and easy-to-follow definitions	4.74	0.52	Strongly Agree
...recall and understand unfamiliar Biochemistry terms.	4.70	0.49	Strongly Agree
...review quickly with concise and student-friendly explanations.	4.76	0.49	Strongly Agree
...study independently by using it as reference during laboratory activities.	4.71	0.51	Strongly Agree
...apply the terms when performing the laboratory activities and writing laboratory outputs.	4.79	0.41	Strongly Agree
Weighted Mean	4.74		
SD	0.48		
Verbal Interpretation	Very High		

The students strongly agrees that the glossary of the Scienergy helps the students apply the scientific terms when performing laboratory activities and writing laboratory outputs. The mean ($M = 4.79$ and $SD = 0.41$) implies a very high level of assessment. it still represents a very high level of assessment.

The overall assessment level of Scienergy regarding the glossary achieved a weighted mean score of 4.74 and a standard deviation of 0.48, which was verbally interpreted as very high among the students. This indicates that the glossary assists students in understanding Biochemistry concepts easily and apply these terms in their outputs.

Table 4 shows the level of assessment of Scienergy in terms of exercises.

The students strongly agrees that practices drill in the exercise component of Scienergy practice drills that help in reviewing key concepts from the lesson. The mean ($M = 4.79$ and $SD = 0.46$) implies a very high level of assessment.

Furthermore, students strongly agrees that exercises component has appropriate activities that measured what they have learned from each module and lead to improving their performance. While both mean is the lowest ($M = 4.72$ and $SD = 0.57$), it still indicates a very high level of assessment.

Table 4. Level of Assessment on Scienergy as a Mobile-Based Laboratory Manual in terms of Components with regards to Exercises

Statement	Mean	SD	Remarks
Within the mobile-based laboratory manual, the Exercises have...			
...laboratory worksheets that promote critical thinking and application of concepts.	4.77	0.45	Strongly Agree
...practice drills that help me review key concepts from the lesson.	4.79	0.46	Strongly Agree
...practice drills that improve my performance.	4.72	0.57	Strongly Agree
...components that provide appropriate activities that measure what I have learned from each module.	4.72	0.57	Strongly Agree
...laboratory worksheets that effectively assess my understanding of the laboratory activity.	4.78	0.47	Strongly Agree
Weighted Mean	4.76		
SD	0.51		
Verbal Interpretation	Very High		

The level of assessment of Scienergy in terms of exercises attained a weighted mean score of 4.76 with a standard deviation of 0.51 and was verbally interpreted as very high among the respondents. This implies that the exercises in the Scienergy allows them to enhance their critical thinking and performance by providing worksheets and practice drills to measure their understanding of Biochemistry concepts.

Table 5 shows the level of assessment of Scienergy in terms of post lab discussion. It also shows the statements, mean, standard deviation and remarks. The students strongly agrees that the post lab discussion makes their learning experience more interactive. The mean ($M = 4.84$ and $SD = 0.4$) implies a high level of assessment.

Additionally, students strongly agree that post lab discussion encourages students to ask questions and participate in discussion about laboratory concepts. While the mean is the lowest among the indicators ($M = 4.74$ and $SD = 0.52$), it still indicates a high level of assessment of Scienergy in terms of post lab discussion.

Table 5. Level of Assessment on Scienergy as a Mobile-Based Laboratory Manual in terms of Components with regards to Post-Lab Discussion

Statement	Mean	SD	Remarks
The Post-Lab Discussion of Scienergy...			
...allows exchange of ideas among students.	4.78	0.50	Strongly Agree
...encourages me to ask questions and participate in discussions about laboratory concepts.	4.74	0.52	Strongly Agree
...helps me reflect on what I have learned from the activity.	4.82	0.47	Strongly Agree
...allows me to connect the experiment results to real-life applications.	4.80	0.48	Strongly Agree
...makes my learning experience more interactive.	4.84	0.40	Strongly Agree
Weighted Mean	4.80		
SD	0.47		
Verbal Interpretation	Very High		

Overall, the level of assessment of Scienergy in terms of post lab discussion attained a weighted mean score of 4.80 with a standard deviation of 0.47 and was verbally interpreted as highly effective among the respondents. This implies that the post lab discussion allows students to reflect the learning experiences during and after the laboratory activity.

Level of Assessment on the Features of Scienergy

The level of assessment on the features of Scienergy in terms of accessibility, usability, functionality and user interface was treated statistically using mean and standard deviation

Table 6 shows the level of the level of assessment on the features of Scienergy in terms of accessibility. Additionally, it presents the statements, mean, standard deviation and remarks.

Table 6. Level of Assessment on Scienergy as a Mobile-Based Laboratory Manual in terms of Features with regards to Accessibility

Statement	Mean	SD	Remarks
The mobile-based manual...			
...can be accessed on a mobile device using both Wi-Fi and mobile data.	4.82	0.45	Strongly Agree
...run smoothly.	4.29	0.81	Strongly Agree
...have text and buttons that are readable and clear on my screen.	4.80	0.46	Strongly Agree
...have sections that are easy to find from the main menu.	4.77	0.50	Strongly Agree
...allow flexible learning in which I can review modules and activities according to my preferred learning pace.	4.84	0.43	Strongly Agree
Weighted Mean	4.70		
SD	0.58		
Verbal Interpretation	Very High		

The students strongly agree that Scienergy allows flexible learning in which they can review modules and activities according to their preferred learning pace. The mean ($M = 4.84$ and $SD = 0.43$) implies a very high in accessibility. In addition, students agrees that the mobile-based laboratory manual run smoothly. While the mean is slightly lower ($M = 4.29$ and $SD = 0.81$), it still indicates a high in accessibility.

The level of assessment of Scienergy in term of accessibility attained a weighted mean score of 4.70 with a standard deviation of 0.58 and was verbally interpreted as very high among the respondents. The accessibility of the application helps in attaining autonomy since Scienergy is easy to navigate and user-friendly.

Table 7 presents the assessment regarding the functionality features of Scienergy. It also includes the statements, mean, standard deviation, and remarks. Students strongly believe that the components and features of Scienergy improve the laboratory learning experience. The mean ($M = 4.79$ and $SD = 0.44$) indicates a very high level of functionality.

Furthermore, students affirm that the buttons and links within the application operate correctly. This means that the application is functioning effectively. Although the mean is slightly lower ($M = 4.56$ and $SD = 0.67$) compared to other indicators, it still reflects a very high level of functionality. The functionality attained a weighted mean score of 4.68 with a standard deviation of 0.58 and was verbally interpreted as very high among the respondents. This implies that the functionality of the application enhances the learning experiences.

Table 8 shows the level of the level of assessment on the features of Scienergy in terms of usability. It also presents the statements, mean, standard deviation, and comments.

The students express strong agreement that Scienergy provides clear and easy-to-understand instructions. The mean ($M = 4.80$ and $SD = 0.46$) implies the high level of usability. Additionally, the students strongly concur that the layouts, icons, and menus of Scienergy are well-organized for an effortless interaction. Although this mean is the lowest ($M = 4.73$ and $SD = 0.50$), it still reflects a very high level of usability.

Table 7. Level of Assessment on Scienergy as a Mobile-Based Laboratory Manual in terms of Features with regards to Functionality

Statement	Mean	SD	Remarks
Within the mobile-based manual, it has...			
...buttons and links that function correctly.	4.56	0.67	Strongly Agree
...components and features that work properly.	4.66	0.57	Strongly Agree
...embedded media that display correctly.	4.76	0.49	Strongly Agree
...components and features that enhance the laboratory learning experience.	4.79	0.44	Strongly Agree
...components and features that performs well with minimal bugs, crashes, or interruptions.	4.62	0.68	Strongly Agree
Weighted Mean	4.68		
SD	0.58		
Verbal Interpretation	Very High		

Table 8. Level of Assessment on Scienergy as a Mobile-Based Laboratory Manual in terms of Features with regards to Usability

Statement	Mean	SD	Remarks
The mobile-based manual has ...			
...the components that are easy to navigate.	4.73	0.52	Strongly Agree
...the instructions that are clear and readable.	4.80	0.46	Strongly Agree
...the layout, icons, and menus that are clearly organized for smooth interaction.	4.73	0.50	Strongly Agree
...the design and interface that make the learning experience enjoyable.	4.74	0.56	Strongly Agree
...an overall experience that enhances my learning satisfaction.	4.79	0.49	Strongly Agree
Weighted Mean	4.76		
SD	0.51		
Verbal Interpretation	Very High		

The level of assessment of Scienergy in term of usability attained a weighted mean score of 4.76 with a standard deviation of 0.51 and was verbally interpreted as very high among the respondents. This indicates that the Scienergy attained its intended use in enhancing learning experiences by providing the good quality user experience.

Table 9 shows the level of the level of assessment on the features of Scienergy in terms of user interface. It also shows the statements, mean, standard deviation and remarks.

The students express strong agreement with the statements that Scienergy possesses a "clean and professional appearance that aligns with its educational objective" and offers an "easy-to-navigate layout." The mean score ($M = 4.70$, $SD = 0.44$) indicates a very high rating for the user interface. Furthermore, the students also show strong agreement that the application features a user-friendly layout and design, with fonts, icons, and buttons that are clear and easy to read. Although the mean score is the lowest ($M = 4.76$ and $SD = 0.51$), it still reflects a very high evaluation of the user interface.

Table 9. Level of Assessment on Scienergy as a Mobile-Based Laboratory Manual in terms of Features with regards to User Interface

Statement	Mean	SD	Remarks
Within the mobile-based manual, it has...			
...layout and design that are user-friendly.	4.73	0.52	Strongly Agree
...fonts, icons, and buttons that are clear and readable.	4.80	0.46	Strongly Agree
...layout that is easy to navigate	4.73	0.50	Strongly Agree
...layout and design that enhances the learning content.	4.74	0.56	Strongly Agree
...a clean, professional look that reflects its educational purpose.	4.79	0.49	Strongly Agree
Weighted Mean	4.78		
SD	0.48		
Verbal Interpretation	Very High		

The overall assessment of Scienergy regarding its user interface achieved a weighted mean score of 4.78, with a standard deviation of 0.48, and was interpreted as highly effective by the respondents. This suggests that Scienergy offers a user interface that can enhance the learning experience in Biochemistry.

The Status of Students' Affective Learning Outcomes

The status of students' affective learning outcomes related to student interest, motivation, perceived competence, classroom engagement, and learning attitude was assessed using mean and standard deviation.

Table 10 presents the status of the respondents' affective learning outcomes concerning student interest.

Table 10. Status of Student's Affective Learning Outcomes refers to Student Interest

Statement	Mean	SD	Remarks
When using the mobile-based laboratory manual, I...			
...find learning Biochemistry more enjoyable and interactive	4.76	0.49	Strongly Agree
...become more curious to explore and understand biochemical concepts through the app..	4.72	0.53	Strongly Agree
...take the Biochemistry topics more engaging and relatable to real-life situations.	4.74	0.47	Strongly Agree
...spend extra time exploring the lessons because I find them interesting and enjoyable	4.68	0.54	Strongly Agree
...become curious to discover new connections between Biochemistry concepts.	4.72	0.53	Strongly Agree
Weighted Mean	4.72		
SD	0.51		
Verbal Interpretation	Very High		

The students express strong agreement that the use of the mobile-based laboratory manual makes learning Biochemistry more enjoyable and interactive. The mean ($M=4.76$ and $SD=0.49$) indicates a very high level of student interest. Additionally, the students strongly agree that they allocate extra time to explore the lesson, as Biochemistry has become interesting and enjoyable. Although the mean is slightly lower ($M=4.68$ and $SD=0.54$), it still reflects a very high level of student interest.

The student interest indicator achieved a weighted mean score of 4.72, with a standard deviation of 0.51, which was verbally interpreted as very high among the respondents. This

indicates that the students became interested in learning Biochemistry since they discover the connections between scientific concepts and real-life situations when using Scienergy.

Table 11 presents the status of the respondents' affective learning outcomes in terms of student motivation. It also shows the statements, mean, standard deviation and remarks.

Table 11. Status of Student's Affective Learning Outcomes refers to Student Motivation

Statement	Mean	SD	Remarks
Using the mobile-based laboratory manual, I/ I can...			
...exert more effort in understanding Biochemistry.	4.68	0.52	Strongly Agree
...feel motivated to complete laboratory tasks without the teacher's prior direction.	4.62	0.58	Strongly Agree
...feel a sense of accomplishment when I finish the activities.	4.77	0.45	Strongly Agree
...recognize my strengths and areas for improvement.	4.77	0.48	Strongly Agree
...set learning goals and challenge myself to achieve them	4.78	0.47	Strongly Agree
Weighted Mean	4.72		
SD	0.50		
Verbal Interpretation	Very High		

The students express strong agreement that Scienergy encourages them to establish learning goals and pushes them to achieve those goals. The mean ($M=4.78$ and $SD=0.47$) indicates a very high level of student motivation. Additionally, the students strongly agree that they feel driven to finish the laboratory tasks independently, without requiring prior guidance from the teacher when utilizing the application. Although the mean is slightly lower ($M=4.62$ and $SD=0.58$) than other indicators, it still reflects a very high level of student motivation.

The status of students' affective learning outcomes in terms of student motivation attained a weighted mean score of 4.72 with a standard deviation of 0.50 and was verbally interpreted as very high among the respondents. This indicates that the students are motivated to finish the laboratory tasks since they feel the sense of accomplishment in understanding the Biochemistry concepts and completing the laboratory activity.

Table 12 presents the status of the respondents' affective learning outcomes in terms of perceived competence.

The students strongly agrees that Scienergy improves their laboratory skills effectively. The mean ($M=4.70$ and $SD = 0.51$) implies a very high level in perceived competence. Furthermore, the students strongly agree that they are confident in performing laboratory experiments, completing the activities independently and answering problems in Biochemistry. While the means are slightly lower than other indicators ($M = 4.61$ and $SD= 0.58$), it still indicates a very high level in student motivation

The perceived competence received a weighted mean score of 4.64 and a standard deviation of 0.56, which was interpreted verbally as very high among students. This indicates that the students viewed themselves as competent in Biochemistry, since they feel that they are capable of

accomplishing tasks independently and improve their skills effectively with the use of Scienergy.

Table 12. Status of Student's Affective Learning Outcomes refers to Perceived Competence

Statement	Mean	SD	Remarks
When using the mobile-based laboratory manual, I am...			
...more confident in performing Biochemistry experiments.	4.68	0.52	Strongly Agree
...capable of completing Biochemistry activities independently	4.62	0.58	Strongly Agree
...able to understand Biochemistry concepts better, which increases my confidence.	4.77	0.45	Strongly Agree
...confident that I can solve problems and answer questions.	4.77	0.48	Strongly Agree
...improving my laboratory skills effectively	4.78	0.47	Strongly Agree
Weighted Mean	4.64		
SD	0.56		
Verbal Interpretation	Very High		

Table 13 presents the status of the respondents' affective learning outcomes in terms of classroom involvement. It also shows the statements, mean, standard deviation and remarks. The students strongly agree that Scienergy makes them to participate in laboratory tasks. The mean ($M=4.74$ and $SD = 0.59$) implies a very high level.

Furthermore, the students strongly agree that they become more active in Biochemistry discussion when using Scienergy. While the mean is slightly lower than other indicators ($M = 4.59$ and $SD= 0.59$), it still indicates a very high level in classroom involvement.

Table 13. Status of Student's Affective Learning Outcomes refers to Classroom Involvement

Statement	Mean	SD	Remarks
Using the mobile-based laboratory manual, I am			
...more active in Biochemistry discussions.	4.59	0.59	Strongly Agree
...willing to participate in laboratory tasks	4.74	0.49	Strongly Agree
...more attentive and engaged in class	4.65	0.55	Strongly Agree
...more comfortable sharing my ideas	4.67	0.52	Strongly Agree
...involved in relating classroom discussions to hands-on laboratory work.	4.68	0.52	Strongly Agree
Weighted Mean	4.67		
SD	0.53		
Verbal Interpretation	Very High		

The status of students' affective learning outcomes in terms of perceived classroom involvement achieved a weighted mean score of 4.67, accompanied by a standard deviation of 0.53, and were verbally rated as very high among the respondents. This means that the students are engaged in the laboratory discussions and activities, as Scienergy enables them to exchange ideas and connect them to hands-on experiences.

Table 14 presents the status of the respondents' affective learning outcomes in terms of learning attitude.

The students strongly agree that Scienergy helps them to see the value of this application as learning tool in improving

their understanding in Biochemistry effectively. The mean ($M=4.78$ and $SD = 0.45$) implies a very high level in learning attitude.

Table 14. Status of Student's Affective Learning Outcomes refers to Learning Attitude

Statement	Mean	SD	Remarks
The mobile-based laboratory manual helps me to...			
...see the value that this type of learning tool is effective in improving my understanding of Biochemistry	4.78	0.45	Strongly Agree
...become more appreciative of Biochemistry lessons	4.74	0.49	Strongly Agree
...become more open to exploring scientific topics.	4.74	0.47	Strongly Agree
...feel that laboratory activities are less intimidating and more enjoyable.	4.74	0.49	Strongly Agree
...see Biochemistry as a more relevant and interesting course in my degree program	4.76	0.46	Strongly Agree
Weighted Mean	4.75		
SD	0.47		
Verbal Interpretation	Very High		

Furthermore, the students strongly agree to the statements that Scienergy helps them to become more appreciative of Biochemistry lessons, open to exploring scientific topics and "feel that laboratory activities are less intimidating and more enjoyable." While the mean is slightly lower than other indicators ($M = 4.74$ and $SD= 0.49$), it still indicates a very high level in learning attitude.

The status of students' affective learning outcomes in terms of learning attitude attained a weighted mean score of 4.75 with a standard deviation of 0.47 and was verbally interpreted as very high among the respondents. This indicates that the students show positive attitude towards learning Biochemistry when using Scienergy.

The Status of Cognitive Learning Outcomes

The status of learning outcomes related to written and practical tests was analyzed statistically using frequency, percentage, mean, and standard deviation. Table 15 shows the cognitive learning outcomes based on the students' scores on the written test, along with the frequencies, percentages, and remarks.

Table 15. Status of Students' Cognitive Learning Outcomes in terms of Written Test

Raw Score	Frequency (f)	Percentage (%)	Descriptive Equivalent
41-50	62	75.61	Outstanding
31-40	14	17.07	Very Satisfactory
21-30	6	7.32	Satisfactory
11-20	0	0	Fair
0-10	0	0	Needs Improvement
Total	82	100	
Mean		43.76	
SD		6.76	
VI		Outstanding	

Among the 82 respondents, the score range of 41-50 had the highest occurrence, with 62 respondents, representing 75.61% of the total group. This was followed by the 31-40 score range, which had 14 respondents, making up 17.07% of the overall sample. Only six respondents earned scores

between 21-30. Additionally, no respondents achieved scores in the other ranges, accounting for 0.00% of the total population surveyed.

Given that most students demonstrated excellent performance on the Biochemistry written test, with a mean score of 43.76 (SD=6.76), this indicates the positive impact of Scienergy on students' academic success, particularly reflected in their written test results.

Table 16 presents the cognitive learning outcomes in terms of practical test. The students were assessed using rubrics with the following criteria: Safety and Laboratory Behavior, Critical Thinking, Application, and Experimental Techniques. In Practical Test 1, 51 out of 82 students scored between 33 and 40, accounting for 62.20% of all respondents. Thirty-one students scored between 25 and 32, representing 37.80% of the total respondents. In contrast, there were no students who received any scores outside of those ranges, resulting in 0.00% of the total sample population.

Table 16. Status of Students' Cognitive Learning Outcomes in terms of Practical Test

Scores	PT 1		PT 2		PT 3		PT 4		Descriptive Equivalent
	F	%	F	%	F	%	F	%	
33-40	51	62.20	62	75.60	32	39.02	49	59.76	Outstanding (O)
25-32	31	37.80	20	24.39	50	60.98	33	40.24	Very Satisfactory (VS)
17-24	0	0.00	0	0.00	0	0.00	0	0.00	Satisfactory (S)
9-16	0	0.00	0	0.00	0	0.00	0	0.00	Fair (F)
0-8	0	0.00	0	0.00	0	0.00	0	0.00	Needs Improvement (NI)
Total	82	100.00	82	100.00	82	100.00	82	100.00	
Mean	35.12		36.21		33.21		34.83		
SD	3.40		3.57		2.86		3.31		
VI	O		O		O		O		

The majority of students demonstrated outstanding performance in Practical Test 1. This indicate that the students are able to perform the procedure and identify the characteristics of organic compounds correctly.

Sixty-two students obtain scores ranging from 33-40, comprising the 75.60% of the total respondents, in the Practical Test 2. Twenty students receive scores from 25-32, making up the 24.39% of the total respondents. In contrast, there were no students who received any scores outside of those ranges, resulting in 0.00% of the total sample population. The majority of students demonstrated outstanding performance in Practical Test 2. This indicate that the students are able to demonstrate proper laboratory techniques in detecting proteins and denaturation process.

In the Practical Test 3, 32 out of 82 students obtains scores ranging from 33-40, comprising the 39.02% of the total respondents. 50 students received scores from 25-32, making up the 60.98% of the total respondents. Also, there were no students who received any scores outside of those ranges, resulting in 0.00% of the total sample population. The majority of the students obtained outstanding performance Practical Test 3. This indicate that the students are able to

apply the appropriate qualitative tests to identify carbohydrates and lipids.

Lastly, 59.76% of the students scored between 33 and 40 in Practical Test 4, with a total of 49 students achieving this range. Meanwhile, 33 out of 82 students scored between 25 and 32, representing 40.24% of the overall sample. On the other hand, no students scored in the other ranges, accounting for 0.00% of the total sample population. The majority of students demonstrated outstanding performance in Practical Test 4. The findings imply that students are able to apply their understanding of lipid chemistry through saponification process.

Overall, the status of students' performance in Practical Test 1 to 4 are remarked as outstanding. This outstanding result indicates that Scienergy as mobile-based laboratory manual helps to developing their practical skills in Biochemistry.

Test of Significant Relationship Between Scienergy and Affective Learning Outcomes

To test the significant relationship, utilizing Scienergy and students' affective learning outcomes. are treated statistically using the Pearson Product-Moment Correlation. Table 17 presents the statistical relationship between students' affective learning outcomes and the components and features of Scienergy using the Pearson Product-Moment Correlation Coefficient (Pearson-r).

The results revealed that all components of Scienergy have significant positive relationships with students' affective learning outcomes. Pre-lab discussions showed moderate correlations across except learning attitude ($r = 0.455$, $p = 0.000$) with low to moderate results but still significant. Since all p-values are less than 0.05, pre-lab discussion is significantly related to all affective learning outcomes which indicate their role in preparing and engaging students The findings support the idea that structured learning materials can stimulate students' interest in science.

For laboratory procedures, the results reveal moderate positive significant relationship on affective learning outcomes in terms of student interest ($r = 0.611$, $p = 0.000$) and learning attitude ($r = 0.602$, $p = 0.000$), motivation ($r = 0.586$, $p = 0.000$), perceived competence ($r = 0.493$, $p = 0.000$) and classroom involvement ($r = 0.494$, $p = 0.000$). These findings indicate that the structured components of the mobile-based laboratory manual contribute to sustaining students' enthusiasm, persistence, and willingness to participate in laboratory activities.

The glossary emerged as the strongest component, showing a strong positive and significant relationship with student interest ($r = 0.769$, $p = 0.000$), motivation ($r = 0.800$, $p = 0.000$), perceived competence ($r = 0.753$, $p = 0.000$), classroom involvement ($r = 0.764$, $p = 0.000$), and learning attitude ($r = 0.711$, $p = 0.000$). These results indicate that the glossary can strongly influence affective learning outcomes. In line with this, Baker et al. (2025) explained that resources like glossaries improve students' understanding of scientific terminology, which can positively influence their confidence and attitude toward science learning. When the learning

environment is supportive, interactive, and aligned with students' needs, learners tend to develop a more positive disposition toward the subject.

Table 17. Significant Relationship between the Utilization of Scienergy as a Mobile-Based Laboratory Manual and the Student's Affective Learning Outcomes Science

Scienergy as a Mobile-Based Laboratory Manual		Student's Affective Learning Outcomes				
		Student Interest	Student Motivation	Perceived Competence	Classroom Involvement	Learning Attitude
Pre-Lab Discussion	Pearson Correlation	0.550*	0.539*	0.523*	0.516*	0.455*
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000
	N	82	82	82	82	82
Laboratory Procedures	Pearson Correlation	0.611*	0.586*	0.493*	0.494*	0.602*
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000
	N	82	82	82	82	82
Glossary	Pearson Correlation	0.769*	0.800*	0.753*	0.764*	0.711*
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000
	N	82	82	82	82	82
Exercises	Pearson Correlation	0.686*	0.733*	0.724*	0.748*	0.671*
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000
	N	82	82	82	82	82
Post-Lab Discussion	Pearson Correlation	0.690*	0.716*	0.638*	0.691*	0.663*
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000
	N	82	82	82	82	82
Accessibility	Pearson Correlation	0.690*	0.747*	0.598*	0.670*	0.685*
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000
	N	82	82	82	82	82
Functionality	Pearson Correlation	0.548*	0.656*	0.543*	0.629*	0.694*
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000
	N	82	82	82	82	82
Usability	Pearson Correlation	0.729*	0.853*	0.680*	0.690*	0.733*
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000
	N	82	82	82	82	82
User Interface	Pearson Correlation	0.756*	0.837*	0.711*	0.715*	0.832*
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000
	N	82	82	82	82	82

The indicator Exercises, also show strong to moderate relationships, particularly in motivation ($r = 0.733$, $p = 0.000$), perceived competence ($r = 0.724$, $p = 0.000$), and classroom involvement ($r = 0.748$, $p = 0.000$). It emphasized their role in reinforcing skills and engagement.

Lastly, post-lab discussions exhibited moderate to strong relationships with student interest ($r = 0.690$, $p = 0.000$), motivation ($r = 0.716$, $p = 0.000$), perceived competence ($r = 0.638$, $p = 0.000$), classroom involvement ($r = 0.691$, $p = 0.000$), and learning attitude ($r = 0.663$, $p = 0.000$). All the p-values are less than 0.05, thus, the relationship between post-lab discussion and affective learning outcomes are significant.

These findings indicate that the organized and engaging components promote student involvement in discussions and laboratory activities.

When it comes to features of Scienergy, the results reveal that all the components of the Scienergy have significant relationship on affective learning outcomes. Accessibility and usability demonstrated strong relationships, particularly with motivation ($r = 0.747$ and 0.853 , respectively) and all p-values are less than 0.05, thus, accessibility and usability have significant relationship with all indicators of affective learning outcomes. The results imply that accessibility and usability of Scienergy fosters positive affective learning outcomes that encourage students to actively engage in learning tasks and sustain their motivation during laboratory activities.

Functionality shows moderate positive relationships across all indicators. These findings indicate that the functionality of the mobile-based laboratory manual contribute to stimulating students' curiosity and engagement in learning laboratory concepts.

Test of Significant Effect of Utilizing Scienergy on Cognitive Learning Outcomes

To evaluate the significant impact of using Scienergy on cognitive learning Outcomes, both written and practical test results were analyzed statistically through t-test.

Table 18 presents the calculated t-value (t-cal), p-value, the total number of observations, and the critical t-value (t-crit) or constant.

Table 18. Significant Effect between the Utilization of Scienergy as a Mobile-Based Laboratory Manual on the Students' Cognitive Learning Outcomes

Utilization of Scienergy as a Mobile-Based Laboratory Manual		Students' Performance in Science	
		Written Test	Practical Test
Pre-Lab Discussion	t-value	-0.274	0.802
	Sig. (2-tailed)	0.785	0.425
	N	82	82
Laboratory Procedures	t-value	-0.591	1.139
	Sig. (2-tailed)	0.556	0.258
	N	82	82
Glossary	t-value	-0.812	1.060
	Sig. (2-tailed)	0.419	0.292
	N	82	82
Exercises	t-value	-1.266	1.475
	Sig. (2-tailed)	0.209	0.144
	N	82	82
Post-Lab Discussion	t-value	-0.375	1.953
	Sig. (2-tailed)	0.709	0.054
	N	82	82
Accessibility	t-value	-0.885	1.926
	Sig. (2-tailed)	0.379	0.058
	N	82	82
Functionality	t-value	-0.915	1.225
	Sig. (2-tailed)	0.363	0.224
	N	82	82
Usability	t-value	-1.311	2.197*
	Sig. (2-tailed)	0.194	0.031
	N	82	82
User Interface	t-value	-1.021	1.758
	Sig. (2-tailed)	0.310	0.082
	N	82	82

Constant=1.99

In the written test, the results show that the features and components of Scienergy did not significantly affect students' cognitive learning outcomes. All computed p-values greater than 0.05, which means that none of these factors had a significant impact on students' performance in written tests. These findings imply that, although the Scienergy provide opportunities for both independent and group learning experiences, their combined application does not consistently result in meaningful enhancements in cognitive learning outcomes as evaluated through written assessments.

IV. CONCLUSION AND RECOMMENDATIONS

There is a significant relationship between utilizing Scienergy, a mobile-based laboratory manual, and students' affective learning outcomes, thus the null hypothesis is rejected. This indicates that the use of Scienergy contributes to fostering interest, positive attitudes, motivation, and engagement toward laboratory learning.

There is no significant effect between utilizing Scienergy, a mobile-based laboratory manual, and students' cognitive learning outcomes, hence the null hypothesis is accepted. This indicates that the use of the application alone did not significantly influence students' cognitive learning outcomes in both written and practical laboratory tests. However, an exception was observed in terms of usability, which showed a significant effect on students' practical test performance. This implies that the usability of the application plays an important role in helping students effectively carry out laboratory tasks and enhanced practical skills.

Based on the results, the following are the recommendations:

Teachers may integrate Scienergy as a supplementary tool in laboratory instruction to enhance students' affective learning outcomes.

Teachers may combine the use of Scienergy with other instructional approaches. They may provide scaffolded instruction and continuous feedback when using Scienergy, ensuring that students not only navigate the application

effectively but also apply scientific concepts during practical tasks.

Future researchers may perform further studies on the other factors that influence cognitive learning outcomes, such as students' prior knowledge, laboratory experience, and assessment methods, to provide a more holistic understanding of learning in laboratory settings.

Future researchers may consider longitudinal studies or mixed-method approaches to evaluate how sustained use of Scienergy impacts both affective and cognitive learning outcomes over time.

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