

ESCALATING STUDENTS' PERFORMANCE IN BIOLOGY SUBJECT THROUGH BIO-WONDERS FLIP

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Abstracts: Digital flipbook is an innovation in 21st century teaching and learning that may replace the long wordy traditional method into fun, engaging, and effective learning experiences. Bio-Wonders Flip offers a comprehensive explanation of the learning material in the form of an interactive flowchart, and simplified diagram enabling the students to master the important keyword and sequential steps easily and effectively. The infographic digital Biology flipbook is expected to increase the student's engagement, capture their attention and interest in Biology subjects as well as improve their performance in examinations. The objectives of this study are to determine the effectiveness of using the Bio-Wonders Flip integrated via Moodle (iTa'LeEm) among biological sciences students and to evaluate the impact of this digital flipbook on students' performance in test examination. This study focused on developing a flipbook module that consisted of 5 Biology chapters, followed by an evaluation of students' performance before (pre-test) and after accessing the flipbook (post-test). The statistical analysis conducted shows a significant improvement in students' performance, understanding and learning experience in Biology subjects. Increased the mean score of pre-test and post-test from 74.40% (B+) to 85.90% (A). In addition, T test analysis has shown that there was a significant reduction of false marks in post test questions with diagrams and visual appearance is consistent, reliable and accepted with $\alpha = 0.83$ for the features in the questionnaire used for data survey. Hence, due to the positive results, this study suggests the use of Bio-Wonders Flip as a learning tool for biological sciences students can enhance their performance in achieving learning outcomes of the Biology II subject in CFS IIUM, Gambang.

Keywords: Digital flipbook; Biology subject; digital literacy; learning experience

1. INTRODUCTION

Biology is a subject that consists of topics with mechanisms and physiological processes that require understanding and memorization. Normal text reading might reduce student's engagement and interest in learning Biology. Addressing this issue, Bio-Wonders Flip was developed to escalate student's performance and interest in learning Biology. Digital flipbook is an innovation in 21st century teaching and learning that may replace the long wordy traditional method into a fun, engaging and effective learning experiences. Bio-Wonders Flip is an interactive digital publication of flipbook that offers comprehensive explanation of learning materials in the form of an interactive flowchart. According to Firdaus et. al., 2024, digital flipbook used in learning Biology cells showed a significant increase in student's learning outcomes and technology literacy. Another research by Abadiyah, 2018 entitled "Development of biology Interactive Digital Flipbook on animal growth and development shown 97.72% of student's responses improved in achieving learning outcomes.

The objectives of this study are to enhance student's engagement in achieving Biology II learning outcomes through Bio-Wonders Flip in iTa'LeEm and to determine the student's preference towards different types of question that used in pre-test and post-test.

2. METHODOLOGY

Steps and Procedures

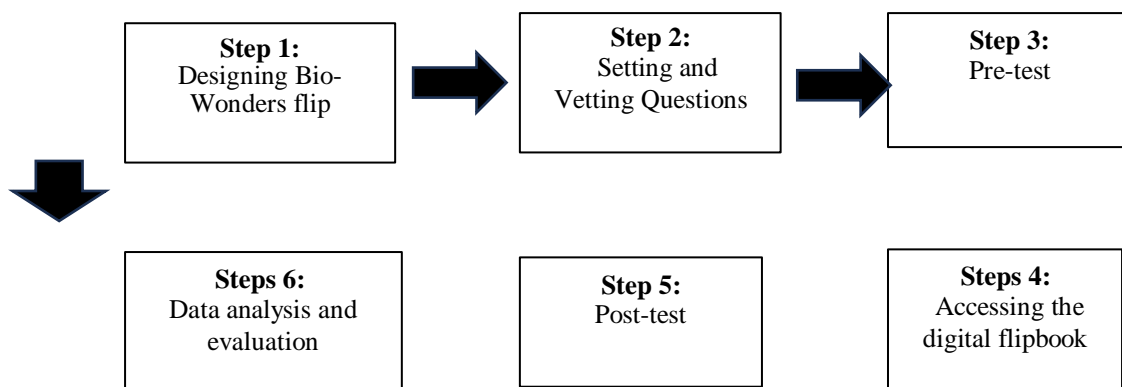


Figure 1: Research Framework

Figure 1 represents the methodological framework in evaluating the effectiveness of Bio-Wonders flip using iTa'LeEm to enhance student's engagement in achieving learning outcomes in Biology II subject among

biological sciences students, CFSIUM. The method used in data collection was adopted from the ADDIE model, 2019 that consists of five stages, namely analyse, design, develop, implement and evaluate.

Details of the research framework were detailed out as follows:

Step 1: Designing Bio-Wonders flip

This study has chosen Biology II (BLL0425) as the scope of study. From the Biology II subject, 5 chapters were selected with determined learning outcomes. The total number of determined learning outcomes was delegated among the team members. The concept of Bio-Wonders flip design is based on simplified mechanisms and processes, with colourful, clear, visible figures and fonts. It was created in pdf format and embedded using H5P (HTML5 Package) which later was integrated via Moodle (iTa’LeEm).

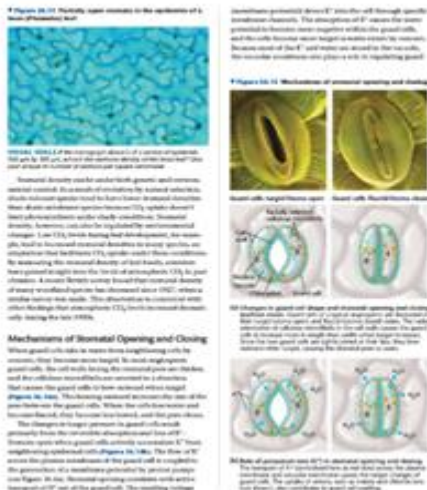


Figure 2.
Notes from the Biology Campbell textbook

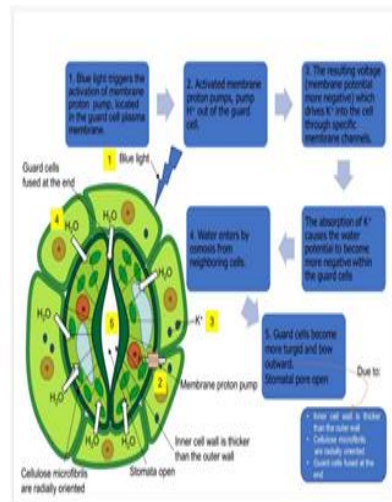


Figure 3.
Notes in PDF Form

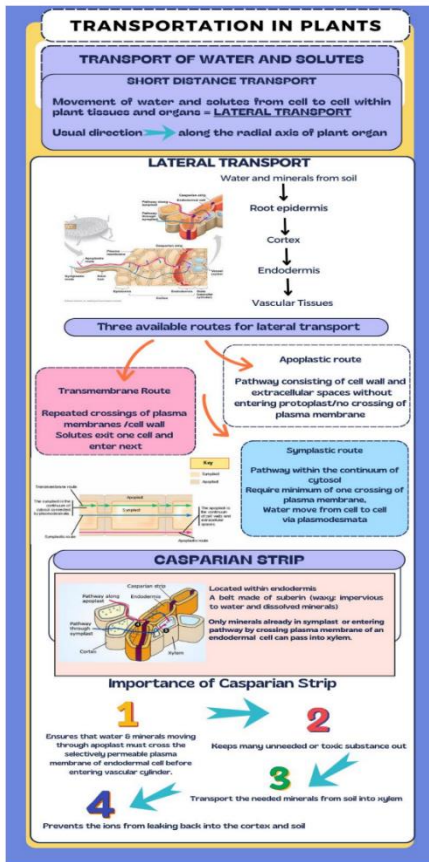


Figure 4.
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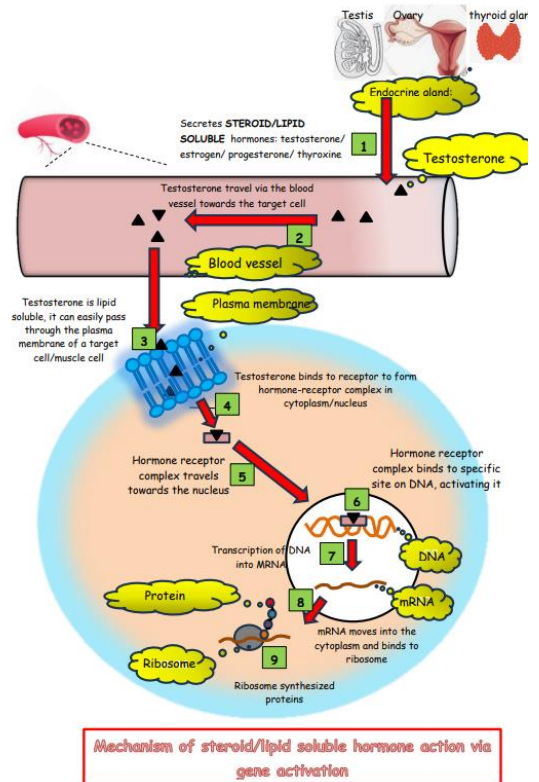


Figure 5.
Notes in PDF Form

Mechanism of synaptic transmission

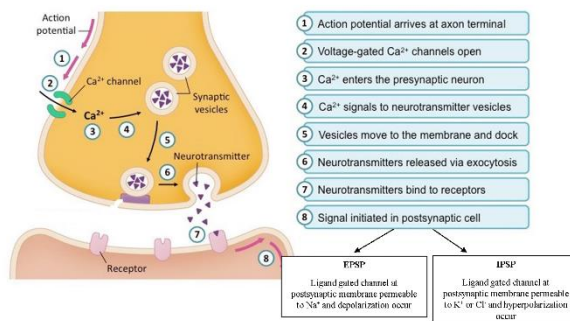


Figure 6.
Notes in PDF Form

Step 2: Setting and Vetting Questions

60 MCQ questions were prepared for both the pre-test and post-test by the team members. Those questions were created using the Google form format and vetted before questions were distributed to the targeted students.

Step 3: Pre-test

The vetted questions were distributed to the Biological Sciences students. The data collected and recorded from their score, represented as pre-test data.

Step 4: Accessing the Bio-Wonders flip

The iTa'LeEm (moodle) link was shared to the students to have an access on the flipbook.

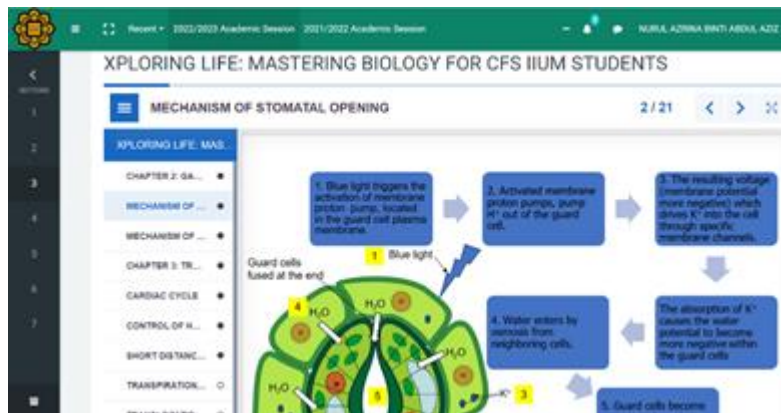


Figure 7.

PDF Embed in H5P and Integrate in Moodle (iTa'LeEm)
<https://italeemc.iium.edu.my/>

Step 5: Post-test

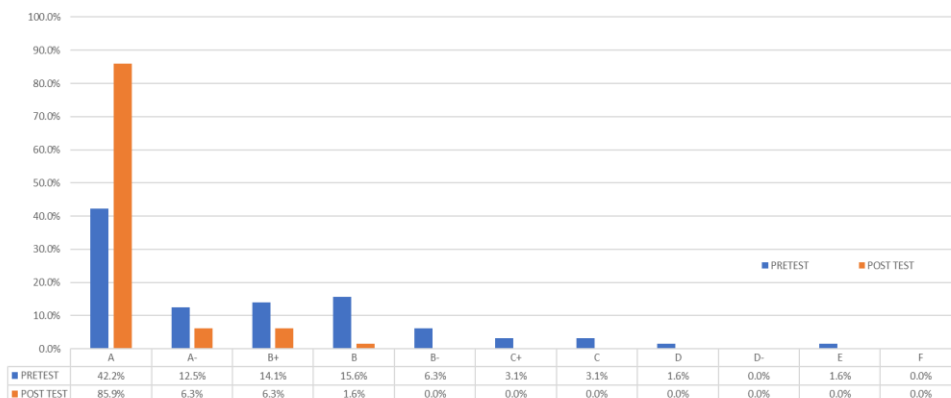
Following their completion of the observation and studies on the Bio-Wonder flip, the students were given the same set of questions as a post-test. The post-test scores were gathered and documented to be analysed.

Step 6: Data analysis and evaluation

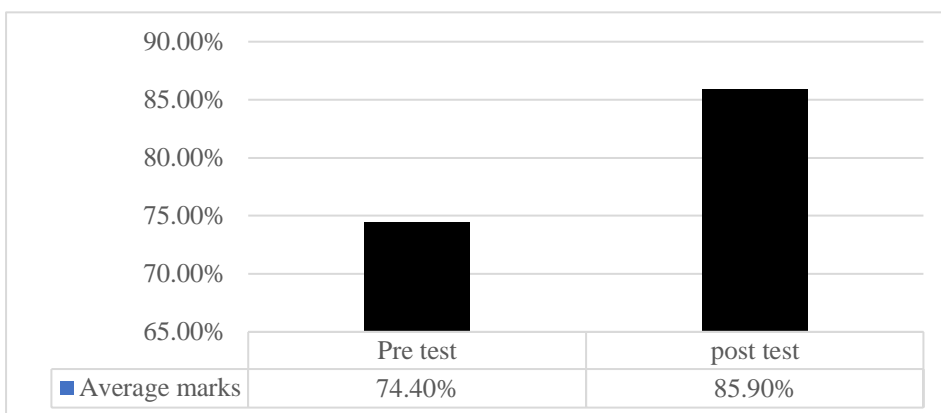
Descriptive analysis was conducted using the data results from pre-test and post-test. The results were calculated and compared by analysing the grade scored from pre - test to post-test to determine students' performance and understanding, in Biology II subject. Besides that, statistical analysis was conducted to determine the difference between means of pre and post-test before and after using the Bio - Wonders flip. Statistical analysis also was conducted to compare the score difference between pre-test and post-test of MCQ questions with figure and MCQ with text. Further statistical analysis using Cronbach alpha test was conducted to measure the reliability of the assessment used in pre and post-test and intended visual appearance of the Bio-Wonders flip.

3. RESULTS AND DISCUSSIONS

As illustrated in **Graph 1**, there was a great improvement in overall grades for post-test over pre-test. The students who scored grade A, increased by 43.7%, from pre-test to post-test. Results showed there was no failure for the post-test. However, in the pre-test, 3.2% of students failed. From 3.2%, 1.6% scored D and 1.6% scored E. The lowest grade for pre-test was E and B for post-test. Based on the bar graph in **Graph 2**, there was an increase in the mean score of pre-test and post-test from 74.4% to 85.9%. This finding somehow supports the study by Oladejo, Maruff A., *et al.* (2011), who stated that students who were taught with the improvised instructional material achieved statistically significantly higher test scores compared to those who were taught with standard instructional material and conventional methods. This is because the flip chart can increase learning participation, since the presented material is more interesting when compared to learning using only textbooks (Rosita, R. 2017). In addition, the utilisation of an electronic module such as a digital flipbook can significantly increase the memory and comprehension level of the students in understanding the different concepts in science. According to both Abdu-Raheem, B. O. (2014), and Isola, O. M. (2010), E-modules aid explanations and make the learning of the subject matter understandable and motivating to students during the teaching and learning process.



Graph 1: Overall Grades for Pre-Test Versus Post-Test



Graph 2: Average Marks for Pre-Test Versus Post-Test

Based on the statistical analysis conducted, the result obtained shows an extremely small p value, $p = 7.72 \times 10^{-13}$ ($p < 0.05$). This indicated that there is a statistically significant difference between mean value of the pre-test and post-test. This means that the observed data provided strong evidence against the null hypothesis. Hence, this suggests that the effect under study likely represents a real relationship rather than just random chance.

The application of Bio-Wonders flip as the learning tool has effectively increased the performance of students Biology II in achieving learning outcomes. Excellent average score in post-test indicates an improvement in student's engagement and understanding toward Biology II topics. As stated by Birgilli

(2002), flipbooks allow students to interact with content that leads to better retention of mastery topics.

Questions with figure					Questions with text				
MCQ No.	Pre-Test	%	Post-Test	%	MCQ No.	Pre-Test	%	Post-Test	%
6	9	14.06	2	3.13	41	7	10.94	8	12.50
9	8	12.50	5	7.81	53	0	0.00	2	3.13
33	19	29.69	11	17.19	18	1	1.56	1	1.56
42	22	34.38	9	14.06	25	13	20.31	13	20.31
45	15	23.44	12	18.75	31	1	1.56	1	1.56
52	21	32.81	13	20.31	34	17	26.56	17	26.56
					50	3	4.69	3	4.69

p: 0.002967
p<0.05
The reduction of false mark in post-test is significant

p: 0.099811
p>0.05
Data is random. The reduction of false mark in post-test is not significant

Table 1: Analysis of pre-test and post-test reduction in false mark

Results in **Table 1**, indicates that the MCQ questions with figures show a significant difference with $p < 0.05$ reduction of false marks in post-test while the reduction of false marks in post-test for MCQ questions with text is not significant with $p > 0.05$. This means that the observed data provided strong evidence against the null hypothesis, as the null hypothesis stated that there is no significant different reduction in false score of MCQ questions with figure and MCQ text questions. This finding somehow shows that students who were taught with the improvised instructional material achieved statistically significantly higher test scores compared to those who were taught with standard instructional material and conventional methods, Oladejo, Maruff A., *et al.* (2011).

The next analysis is focused on data collected from the questionnaire as shown in **Figure 8**. The figure illustrated the five items used in rating of visual appearance of Bio-Wonders flip. Cronbach's alpha statistical analysis was conducted with value calculated $\alpha = 0.83$. This indicated a good internal consistency of the survey item, and the survey is measuring the intended visual appearance of the Bio-Wonders flip.

How would you rate the visual appearance of the flipbook?
Explanation/keywords in flowcharts are clear and easy to read.
The figures or images used are simple and attractive.
The color composition used in flowcharts are suitable.
Explanation/keywords in flowcharts are clear and precise.
The number of information represent in one page is appropriate.

Figure 8: Items used in survey for visual appearance (VA) of the Bio-Wonders flip

Furthermore, based on **Figure 9**, the highest percentage of strongly agreed falls under item VA 2 and VA 5 with a score of 70.8%. Nevertheless, item VA 3 can be improved in future, by having a standardize size of font of the Bio-Wonders flip and supported with audio recording embedded in it. According to Diana, N., Fauziah, F., & Sukhor, F. (2023), Visual elements, accuracy of sentence used, simple to operate have been determined as an effective and efficient principles in designing flipbook at higher education level. In addition, Sastri, Y., Suryawati, E., & Hatta, M. (2020), also stated that the flipcharts colours and images are able to make the learning process in control, interesting, and fun. Hence, it motivates students to learn and focus.

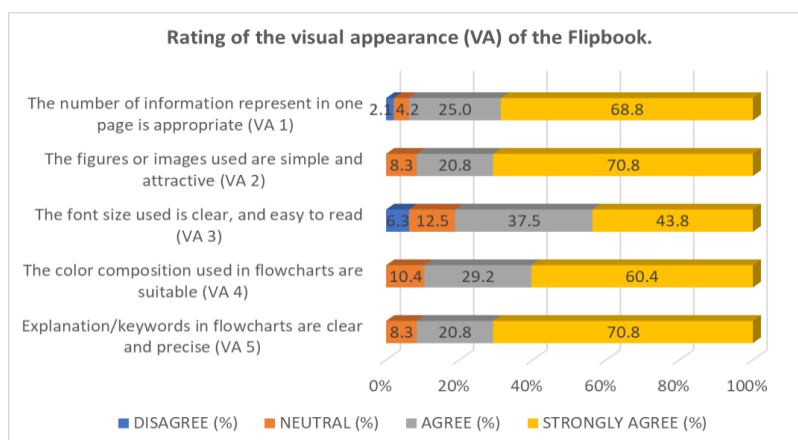


Figure 9: Results of Student's Responses Regarding Visual Appearance of the Bio-Wonders flip

Figure 10 represents the four items used in the survey regarding the rating of assessment conducted before and after using the Bio-Wonder flip. This research adopted a minimum value of 0.6 of Cronbach's alpha value and the maximum value of 0.9 (Tavakoland & Dennick, (2011)). This study finding of Cronbach's

alpha statistical analysis value = 0.78 indicates the survey about the assessment conducted has good reliability. All the four items are well correlated, providing consistent response.

How would you rate the assessment conducted before and after using the flipbook?
The figures are required to be part of the questions.
Most of the questions reflect a higher order thinking.
The number of questions are enough to cover all topics.
The flowchart in flipbook help me to answer the questions.

Figure 10: Items in survey regarding the assessment conducted before and after using the Bio-Wonders flip

Based on **Figure 11**, the highest percentage of strongly agreed falls under item AC 1 and with a score of 69.39%. This indicates that the diagrams with symbols and arrows in flowchart to show the flow of steps in a process are able to guide the students to answer the questions effectively.

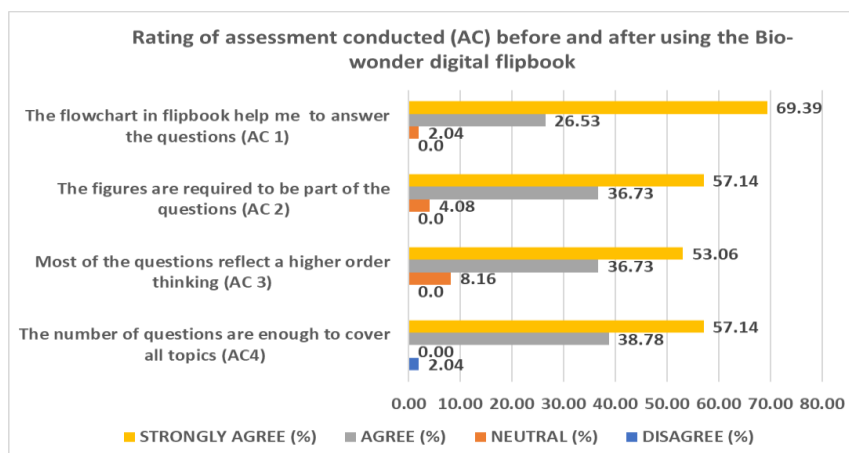


Figure 11: Results of Student's Responses Regarding Assessment conducted before and after using the Bio-Wonder flip

4. CONCLUSIONS

This study concluded that the use of Bio-wonder digital flipbook as learning materials can enhance performance in Biology II subject among Biological Sciences students. When aligned with learning outcomes, digital flipbooks can foster creativity, motivation and good learning experiences among students. Digital flipbooks (Bio-Wonders flip) help to create chances for life-long

learning which is crucial for attaining sustainable development by fostering inclusive and equitable high-quality education.

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