

## APPLICATION OF MICROSOFT SWAY–BASED DIGITAL LEARNING MEDIA ON ENVIRONMENTAL CHANGE MATERIAL TO ENHANCE SCIENTIFIC LITERACY SKILLS OF GRADE 10 STUDENTS OF SAMPOERNA ACADEMY SURABAYA

### *Penerapan Media Pembelajaran Digital Berbasis Microsoft Sway Pada Materi Perubahan Lingkungan Untuk Meningkatkan Kemampuan Literasi Sains Siswa Kelas X Sma Sampoerna Academy Surabaya*

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#### Abstract

The current curriculum requires students to possess skills to solve real-world problems through learning. Scientific literacy is defined as students' ability to solve problems using reliable information from research. This study was conducted using an international curriculum, namely the Cambridge curriculum, which is implemented at Sampoerna Academy Surabaya and emphasizes the development of students' scientific literacy skills. Therefore, this study aimed to describe the consistency of using Microsoft Sway–based learning media in achieving learning mastery, consistency in improving learning outcomes, and students' responses to the use of Microsoft Sway–based learning media on environmental change material in relation to scientific literacy skills. The study employed a pre-experimental one-group pretest–posttest design. The research sample consisted of 20 tenth-grade students at Sampoerna Academy Surabaya International High School. The instruments used included test questions to measure learning mastery with a minimum mastery standard of 50% and improvement in scores, as well as a response questionnaire to assess students' responses. The collected data were analyzed using descriptive quantitative methods with simple statistics, including averages and percentages. The results showed that all students achieved learning mastery, with an average post-test score of 92.19%. The N-Gain analysis indicated an average score of 0.77, categorized as high improvement. Questionnaire results showed positive student responses with an average of 95.71%. Based on these findings, it can be concluded that Microsoft Sway–based learning media consistently improve students' scientific literacy skills in environmental change material.

**Keywords:** *scientific literacy, Cambridge, Microsoft Sway, environmental change*

#### Abstrak

Kurikulum saat ini menuntut peserta didik memiliki keterampilan menyelesaikan berbagai permasalahan nyata melalui pembelajaran. Literasi sains adalah kemampuan peserta didik untuk menyelesaikan masalah menggunakan berbagai informasi resmi dari berbagai penelitian. Penelitian dilakukandengan kurikulum internasional yaitu Cambridge yang diterapkan pada Sampoerna Academy Surabaya yang menekankan penguasaan kemampuan literasi sains peserta didik. Berdasarkan hal tersebut tujuan penelitian ini adalah untuk mendeskripsikan konsistensi penggunaan media pembelajaran berbasis Microsoft Sway pada ketuntasan pembelajaran, konsistensi pada peningkatan nilai, dan respons peserta didik terhadap penggunaan media pembelajaran berbasis Microsoft Sway pada materi perubahan lingkungan terhadap kemampuan literasi sains. Penelitian yang dilakukan merupakan penelitian Pre Experimental One Group Pretest and Posttest Design. Sampel penelitian adalah 20 peserta didik kelas X pada SMA internasional Sampoerna Academy Surabaya. Instrumen yang digunakan berupa soal tes untuk mengetahui ketuntasan dengan standar ketuntasan 50% dan peningkatan nilai serta angket respons untuk mengetahui respons peserta didik. Data yang didapat dianalisis secara deskriptif kuantitatif denganf statistika sederhana menggunakan rata-rata dan persentase. Hasil tes menunjukkan peserta didik tuntas dalam pembelajaran dengan rata-rata nilai post-test 92,19%. Uji N-Gain menunjukkan rata-rata N-Gain 0,77 dengan kriteria peningkatan tinggi. Hasil angket respons menunjukkan respons positif dengan rata-rata 95,71%. Berdasarkan hasil dapat disimpulkan bahwa penggunaan media pembelajaran berbasis Microsoft Sway pada materi perubahan lingkungan secara konsisten meningkatkan kemampuan literasi sains peserta didik.

**Kata kunci:** *literasi sains, Cambridge, Microsoft Sway, perubahan lingkungan*



## INTRODUCTION

Education is a very important aspect in ensuring the development of a country. Through education, the young generation of a nation can be nurtured to continue the legacy of previous generations in accordance with the development of the times. The development of education not only improves the quality of a nation's human resources, but also strengthens social and economic power (Trinh, 2023). One way for a country to ensure that the level of education continues to develop is by implementing an agreed-upon curriculum such as the Merdeka Curriculum.

The current curriculum requires students to have skills in solving problems critically by applying learning that does not only focus on theoretical knowledge through subjects, but also knowledge obtained through co-curricular and extracurricular activities (Kemendikbudristek, 2022). In addition to the national curriculum, there are other curricula that complement its implementation, such as the Cambridge curriculum, which is commonly used in international standard schools such as Sampoerna Academy Surabaya.

Sampoerna Academy Surabaya is an international school that uses English as the language of instruction and applies the Cambridge curriculum as the basis of its learning activities. The Cambridge curriculum adapts to local culture while producing outputs that are internationally recognized and is flexible in nature, with a focus on developing students' abilities in building their careers (Cambridge University Press & Assessment, 2025). Differences in curricula and the diversity of students' backgrounds result in learning mechanisms that differ from those of schools in general. At Sampoerna Academy, biology learning activities are designed by subject teachers based on several recommendations provided in Cambridge textbooks. The recommended activities and guidelines are expected to facilitate learning and help students more easily achieve learning objectives. However, along with current technological developments, some learning objectives are often overlooked. One of the problems encountered is the large number of students who rely on artificial intelligence to complete assignments or participate in learning activities.

The low interest of students in seeking information and being involved in learning is caused by less engaging learning activities, as well as the ease of using AI. As a result, many students obtain answers without understanding the process or the sources of the information, and they are unable to conduct direct analysis by observing real conditions and facts in the environment. The application of scientific literacy skills based on existing indicators requires students to seek official information from reliable sources and to conduct experiments independently, thereby preventing the direct use of AI to obtain answers.

Scientific literacy is the ability of students to solve a problem by using various official information from scientific research to provide solutions (Cambridge University Press, 2025). Scientific literacy is important to be developed because it trains students to utilize various sources of information and data to produce solutions to a problem. Scientific literacy has four main indicators, namely mastery of concepts, data recording, result validation, and drawing conclusions. The fulfillment of all these indicators helps students obtain broader and more accurate information through scientific articles and other reliable scientific sources in solving a problem. Scientific literacy can improve thinking skills that can be used to face various problems (Pratiwi, 2019). Although it is one of the skills that must be mastered in the Cambridge curriculum and has been embedded in the learning framework, learning activities that focus on scientific literacy have still not been implemented at Sampoerna Academy Surabaya. One material that is suitable for the application of scientific literacy at Sampoerna Academy Surabaya is environmental change. Environmental change material generally uses real-world problems as learning content, which are difficult to solve without strong scientific literacy skills (Kelp *et al.*, 2023).

Biology is one of the main fields in the science curriculum at phases E and F at the senior high school level. Biology is essentially the science that studies life (Ashraf & Sarfraz, 2016). Life in this context refers to organisms and their interactions with the environment. As a fundamental science that studies life, it is important for students to understand living organisms and their environment so that biology can become a foundation for the development of science. Environmental pollution is one of the more abstract biological concepts because it does not have a single fixed form and requires an understanding of various aspects such as environmental conditions, types of pollution, impacts on living organisms, and drawing conclusions from these factors (Hanafi *et al.*, 2021). Mastery of environmental change material is still relatively low among senior high school students. Based on national examination data, 61% of students throughout Indonesia answered ecology questions correctly, but only 38.68% answered correctly questions related to "predicting the impact of human activities in a certain area on environmental balance/environmental conditions" (Kemendikbud, 2019). This occurs because learning generally uses simple and common examples, such as river pollution, to represent environmental change, even though many cases involve different conditions.



Biology learning must be carried out systematically so that the material can be delivered effectively to students. However, a systematic learning flow alone is not sufficient to improve students' understanding. Students' learning motivation is needed so that they can more easily absorb the material. Appropriate learning methods and suitable learning media can increase students' learning motivation (Azizah & Alberida, 2021). Learning media can be packaged digitally with the addition of graphics and made interactive by utilizing the latest technology to increase students' interest in learning.

Microsoft Sway is one of Microsoft's products that can be used as a digital learning medium. Microsoft Sway has animation features and a more visually attractive display for readers, such as flipbook-style animations, non-monotonous layouts, and flexibility in image placement. These various features do not reduce its ability to convey information efficiently. Users can freely adjust the display format so that the information appears formal and easy to read without changing its original structure.

Research on the use of a Microsoft Sway-based "learning package" shows high user interest due to the well-structured material organization (Jacklin *et al.*, 2025). Other research also shows that the use of Microsoft Sway for a concept map (mind mapping) learning model results in improved learning outcomes after the post-test (Prasetyowati & Setyasto, 2023). Well-designed Microsoft Sway learning media can encourage students to seek factual information in accordance with the principles of scientific literacy. Features such as Bio-Think and Bio-Link utilize Microsoft Sway to fulfill scientific literacy indicators in the form of mastery of concepts and validation of results. Features that guide experimental activities, such as Bio-activity, can fulfill the indicators of data recording and drawing conclusions. The results of these studies indicate the potential of using Microsoft Sway for international school students such as those at Sampoerna Academy Surabaya, although there has been no research that specifically focuses on international students.

Meeting the need to improve scientific literacy skills through the use of Microsoft Sway can be developed into learning media that are feasible to use (Azaly & Fitrihadijati, 2021). The media design is focused on being attractive and interactive for students while simultaneously stimulating them to practice scientific literacy skills. The media have been validated and are ready to be used with a validation score of 84.79% (Azaly & Fitrihadijati, 2021). Based on these validation results, further research can be conducted to determine whether the media can have a positive effect on improving students' scientific literacy skills. The researchers carried out innovations by adjusting the language in the media created by Azaly & Fitrihadijati (2021) to suit the characteristics of international school students. Innovations in practical activities were also carried out by modifying them into experiments on substances that can degrade oil in water, which were aligned with the Cambridge curriculum implemented at Sampoerna Academy. In addition, a teaching module was also prepared to complement the developed learning media so that students can solve a problem through activities (experiments) that are aligned with scientific literacy indicators. A complete set of instruments with newly developed questions was also designed to be in accordance with the implemented research.

Based on these considerations, this study was conducted to describe the consistency of the implementation of Microsoft Sway-based digital learning media in learning mastery, the improvement of scientific literacy skills, and responses to the use of Microsoft Sway-based digital learning media among Grade X international senior high school students.

## METHODS

The type of research conducted was a Pre-Experimental design with quantitative descriptive analysis. The Pre-Experimental design used employed a test instrument in the form of a One Group Pre-test and Post-test Design as shown in **Table 1**. The pre-test was used to determine the initial condition of the sample before the treatment was given, then compared with the post-test results to identify differences, particularly improvements after learning using Microsoft Sway-based learning media was conducted. The collected data were then analyzed statistically to determine whether the treatment consistently produced changes in the obtained results (Leedy & Ormrod, 2015).

**Table 1.** Research Design Scheme S

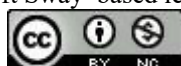
<i>Pre-test</i>	<i>Treatment</i>	<i>Post-test</i>
<i>Obs</i>	<i>Tx</i>	<i>Obs</i>

Source: (Leedy & Ormrod, 2015)

### Notes:

Obs : Observation for pre-test and post-test data measurement

Tx : The treatment was carried out using Microsoft Sway-based learning media.



The research and data collection were conducted at the international school Sampoerna Academy Surabaya, Grand Pakuwon branch, for the senior high school level in the odd semester of the 2025/2026 academic year. The research sample consisted of two classes with 10 Grade X senior high school students in each class, selected using a Simple Random Sampling technique. The data collected were pre-test and post-test results with eight essay questions in each test. In addition to the tests, students' responses to the media used were also obtained using a response questionnaire.

Students' scientific literacy skills were obtained through pre-test and post-test scores. Before the treatment was given, a pre-test was conducted with individual assessment using the following formula.

$$percentage = \frac{Score\ obtained}{Maximum\ score} \times 100\%$$

These results will be compared with the post-test scores to determine whether there is an improvement in post-test results. The final results will be compared with the school's mastery criterion of 50%, with score criteria in accordance with Table 2. The learning media will be declared applicable in learning if the students' final results exceed the school's mastery criterion.

**Table 2.** Test score criteria.

Score Interval	Criteria
85% – 100%	Very High
75% – 84%	High
60% – 74%	Moderate
40% – 59%	Low
0% – 39%	Very Low

Source: (Sugiarti *et al.*, 2023)

After an improvement is confirmed, the pre-test and post-test results will be further analyzed using the N-Gain test with the following formula:

$$N - Gain = \frac{Post - test\ score - Pre - test\ score}{Maximum\ Score - Pre - test\ score}$$

The results of the N-Gain test will be interpreted to determine the level of score improvement into the low, moderate, and high categories using **Table 3**.

**Table 3.** N-Gain category

Intervals	Category
$g > 0,7$	High
$0,7 \geq g \geq 0,3$	Moderate
$g < 0,3$	Low

Source: (Nuryani *et al.*, 2022)

Students' responses will be obtained using a questionnaire, with the scores for students' statements following the scoring in **Table 4**.

**Table 4.** Guttman criteria scale



Statement	Score
Yes	1
No	0

The overall questionnaire results will be averaged and a percentage value will be obtained using the following formula.

$$percentage = \frac{Score\ obtained}{Maximum\ score} \times 100\%$$

The percentage results will be interpreted into the level of students' responses using **Table 5**.

**Table 5. Kriteria Respons Peserta Didik**

Score Interval	Criteria
85% – 100%	Very High
75% – 84%	High
60% – 74%	Moderate
40% – 59%	Low
0% – 39%	Very Low

Source: (Sugiarti *et al.*, 2023)

The implementation of Microsoft Sway-based learning media will be considered positive and applicable if the students' response score is greater than 75%.

## RESULTS AND DISCUSSION

The results of the study on the implementation of Microsoft Sway-based learning media on environmental change material for Grade X international senior high school students include the consistency of learning media use in learning mastery, as reflected in test scores and improvements in scientific literacy skills measured by N-Gain, as well as students' responses assessed through a response questionnaire. Students' test mastery is presented in **Table 6**. for the pre-test and **Table 7**. for the post-test.

**Table 6. Students' Pre-test Mastery**

No.	10 A		10 B	
	Percentage (%)	Criteria	Percentage (%)	Criteria
1	75,00	Complete	93,75	Complete
2	78,13	Complete	78,13	Complete
3	65,63	Complete	75,00	Complete
4	56,25	Complete	65,63	Complete
5	62,50	Complete	71,88	Complete
6	59,38	Complete	75,00	Complete
7	84,38	Complete	40,63	Not Complete
8	78,13	Complete	93,75	Tuntas
9	75,00	Complete	50,00	Not Complete
10	46,88	Not Complete	68,75	Complete
Mean	68,13	Complete	71,25	Complete



**Table 7.** Students' Post-test Mastery

No.	10 A		10 B	
	Percentage (%)	Criteria	Percentage (%)	Percentage (%)
1	96,88	Complete	100,00	Complete
2	93,75	Complete	93,75	Complete
3	96,88	Complete	90,63	Complete
4	87,50	Complete	96,88	Complete
5	87,50	Complete	87,50	Complete
6	87,50	Complete	93,75	Complete
7	96,88	Complete	81,25	Complete
8	96,88	Complete	100,00	Complete
9	90,63	Complete	81,25	Complete
10	90,63	Complete	93,75	Complete
Mean	92,50	Complete	91,88	Complete

Based on the test results in **Table 6** and **Table 7**, all students were able to complete the post-test conducted after learning using Microsoft Sway–based learning media. The tables show that the average mastery in the pre-test phase was 68.13% for Class 10A and 71.25% for Class 10B. Meanwhile, in the post-test phase, it was 92.50% for Class 10A and 91.88% for Class 10B, indicating an increase in the percentage of mastery after using Microsoft Sway–based learning media. In addition, there was a change in the number of students achieving mastery, where 3 out of 20 students did not achieve mastery in the pre-test. This differs from the post-test, where all students in both classes achieved mastery. The fulfillment of mastery by all students in the post-test indicates that the treatment in the form of learning using Microsoft Sway–based learning media was able to have a positive impact on students' learning mastery.

After achieving students' mastery, an N-Gain test was conducted on the results in **Table 8**.

**Table 8.** Students' N-Gain Results

No.	10 A		10 B	
	N-Gain	Criteria	N-Gain	Criteria
1	0,88	High	1,00	High
2	0,71	High	0,71	High
3	0,91	High	0,63	Moderate
4	0,71	High	0,91	High
5	0,67	Moderate	0,56	Moderate
6	0,69	Moderate	0,75	High
7	0,80	High	0,68	Moderate
8	0,86	High	1,00	High
9	0,63	Moderate	0,63	Moderate
10	0,82	High	0,80	High



No.	10 A		10 B	
	N-Gain	Criteria	N-Gain	Criteria
Mean	0,76	High	0,72	High
Overall N-Gain	0,77			
Overall Criteria	High			

In **Table 8**, further score improvement measured using the N-Gain test shows the lowest N-Gain value of 0.56, while the highest N-Gain is 1.00. Class 10A showed an N-Gain value of 0.76, and Class 10B showed an N-Gain value of 0.72, both falling into the high category. The overall average N-Gain of all students is classified as high based on the criteria in **Table 3**, with a value of 0.77.

Overall, there is a clear increase in students’ scores after learning using Microsoft Sway–based learning media. The use of the media and its features to facilitate the delivery of concepts from environmental change material, along with the teacher’s role in guiding media use and practical activities, contributes to the improvement of students’ scientific literacy skills after learning. This improvement is reflected in all individual scores increasing in the post-test and the absence of students failing in the post-test compared to the pre-test in **Table 6**. The average pre-test mastery score of 69.69% was lower than the post-test mastery of 92.19%. The media was designed to enhance scientific literacy skills through its design and features, which convey environmental change concepts without overly dense material by utilizing images and embedded activities. This reduction in cognitive load helps students better understand the concepts presented (Baxter *et al.*, 2025).

In addition to the design, activities within the Microsoft Sway–based learning media also help improve students’ scientific literacy skills. Practical activities not only help students apply the learned concepts in real situations but also train their data recording skills. Practicum activities in learning can help students master both data recording and conceptual understanding (Kleib *et al.*, 2021).

Microsoft Sway–based media is also designed to train students’ skills in result validation. All data provided for exercises within the media are real-world problems that have been documented and discussed in scientific sources. Using real-world data greatly helps students practice scientific literacy skills in understanding complex topics and improving literacy (Anderson *et al.*, 2020). Students can utilize various media and reliable scientific articles to find explanations for the data presented or results obtained from practical activities.

The final skill influencing the improvement of students’ scientific literacy is drawing conclusions, which is integrated into the learning media through practical activities. Students who are not accustomed to this skill may produce only simple conclusions and fail to answer the given problems (Pols *et al.*, 2021). With features that support this ability in Microsoft Sway–based learning media, students can develop their scientific literacy skills more effectively.

Differences in ability mean that some individuals may not achieve the same mastery as others within the same timeframe. To address potential bias in the data due to this, the N-Gain test was conducted to clearly show the changes achieved regardless of students’ initial scores (Sirianansopa, 2024). The N-Gain results for all students are presented in **Table 8**. The N-Gain test results show that, on average, students experienced high score improvements. Although some students experienced different levels of mastery improvement, all students successfully achieved mastery in the post-test, with an average N-Gain value of 0.77 classified as high. This provides strong evidence that the learning media used had a positive impact on students’ scientific literacy skills.

Students’ responses were obtained from a response questionnaire completed at the end of the learning process. The results of the response questionnaire are presented in **Table 9**.

**Table 9.** Students’ Responses to the Learning Media

No.	Statement	Yes (%)	No (%)
1	The learning media has clear learning objectives.	100	0
2	The learning media has sufficient time allocation for use.	90	10
3	The learning media provides clear usage instructions.	85	15
4	The learning media includes activity steps that are easy to carry out.	100	0
5	The exercises for finding information sources in this media are easy to use.	95	5



No.	Statement	Yes (%)	No (%)
6	The exercises for formulating problems in the media are easy to use.	100	0
7	The exercises for applying the scientific method in the media are easy to use.	100	0
8	The exercises for data collection in the media are easy to use.	90	10
9	The exercises for data analysis and creating scientific conclusion in the media are easy to use.	90	10
10	The features in the learning media are easy to use.	100	0
11	The learning media helps in understanding the material concepts.	95	5
12	The learning media has an attractive appearance for use.	95	5
13	The learning media uses language that is easy to understand.	100	0
14	The learning media uses clear images that facilitate understanding.	100	0
Percentage		95,71	4,29
Criteria		Very High	

Based on Table 9, all statements in the questionnaire received responses above 84%, so all statements were rated very high according to the criteria in Table 5. There were seven statements with 100% positive responses, indicating a strong positive response from students to the learning media used.

The results show that the average positive response from students was 95.71%, classified as high. This demonstrates that the learning media used can be well accepted and effectively utilized by students. The Microsoft Sway-based learning media used had already been validated and deemed feasible for use (Azaly & Fitrihadijati, 2021). However, several innovations were still implemented to ensure the media could be well received by Grade X international senior high school students. In addition to developing instruments, innovations included language adjustments, sourcing more up-to-date facts and data as topics, and creating worksheets and practical activities. These innovations, which brought changes or additions to the media, required re-collecting student responses to evaluate their reactions after the media was updated.

Among all statements, a few received negative responses. The statement regarding usage instructions received 85% positive and 15% negative responses. This may occur because some students have different learning methods and find it difficult to understand the learning activities by reading alone without guidance from the teacher. Using learning media without teacher guidance can make it harder for students who are accustomed to traditional learning (Lembani *et al.*, 2023). Related to this issue, statements about the ease of using data recording exercises and drawing conclusions received 90% positive and 10% negative responses. These difficulties may arise because some students struggle to follow instructions when fully relying on the learning media. To address this issue, teachers can act as facilitators to clarify unclear instructions for students.

Overall, the use of Microsoft Sway-based learning media has a positive impact on students' scientific literacy skills. Test results show improved scores after learning with Microsoft Sway-based media. Score improvements also had an average N-Gain classified as high, proving that the use of Microsoft Sway-based learning media positively affects students' scientific literacy skills. Students' response results also had a high average positive rating, demonstrating that Microsoft Sway-based learning media is well accepted and effectively used by students.

## CLOSING

### Conclusion

Based on the analysis results of the study on the implementation of Microsoft Sway-based digital learning media to improve scientific literacy skills of Grade X international senior high school students, the use of Microsoft learning media consistently met students' learning mastery. All students' post-test scores exceeded the minimum mastery criterion of 50%, with post-test scores reaching 92.19%, classified as very high. The implementation of the media also achieved an N-Gain of 0.77, indicating a high increase in students' scientific literacy skills. The consistency of implementation is also supported by students' responses to the use of the media, which reached 95.71% for the environmental change material. These results indicate that Microsoft Sway-based learning media consistently enhances students' scientific literacy skills.

### Suggestion



Further research on the media used can be conducted with a larger sample size. Studies can also be carried out using other learning models to determine the effect of different learning models on students' scientific literacy skills.

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