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Development and Validation of Teaching and Learning Module Based on Addie Model for Year 4 Plant Topic

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Abstract

Experiment activity is an important tool in learning process, especially experiment that are made based on student needs and characteristics. One of common problems to apply experiment in teaching and learning session is lack of complete laboratory in school. This study aims to produce and determine the feasibility of teaching and learning module for plant topic for fourth grade primary school students. The research method was used R&D (Research and Development) using ADDIE model. The ADDIE model consists of analysis, design, development, implementation, evaluation. Based on the results of research (1), the teaching and learning module for year 4 students plants topic is produced. (2) The overall agreement percentage obtained from the experts is 90.44%. From the result, the content validity analysis of the ADDIE-based teaching and learning module by 6 experts shows a good score with an average expert agreement percentage of 88%. (3) The alpha Cronbach was obtained from the reliability valued at 0.897. The results of the feasibility questionnaire analysis show very good values of 90.44%. Thus, the teaching and learning based on ADDIE module for year 4 students plants topic is suitable for use as a learning medium for primary school students.

Keyword: Modul Development, Addie Model Maksimum, Empat, Perkataan, Sahaja.

Introduction

Elementary school science is a core subject that is taught using the Standard School Science Curriculum or *Kurikulum Standart Sekolah Rendah* after this will mention as KSSR to grade 1 and 2 students starting in 2011. This core subject is one of the mandatory subjects that students need to take in the Lower Secondary Assessment (UPSR), which has been abolished by the Malaysian Ministry of Education (KPM) starting in 2020. However, according to Ahmad & Abdullah (2020), it is important for elementary school students to master this subject because it serves as the foundation for their future studies in secondary school, even though they do not need to take the UPSR.

Although the UPSR has been abolished, the curriculum that has been set and used by teachers in schools must still be taught until the end, and teachers are responsible for ensuring that students master all the syllabi contained in the KSSR without any deviation (

Ahmad & Iksan, 2021). The KSSR introduced by KPM is in line with the National Education Philosophy (NEP), which states that continuous efforts are made to develop the individual's potential in a holistic and integrated manner to create a balanced and harmonious person in terms of intellectual, spiritual, emotional and physical aspects based on belief and obedience to God (Daud, 2019). The KSSR also supports the Science Education Philosophy (SEP), which focuses on the development of competitive, dynamic, agile, and resilient individuals (Daud, 2019).

To achieve the NEP and SEP, changes in the teaching and learning system are important to focus on, even without the UPSR to assess students through exams. In terms of the development of teaching and learning methods in schools in Malaysia, according to Abu & Saleh (2020), effective teaching means that teachers are able to diversify teaching methods by actively involving students in teaching and learning sessions, and allowing student-centered learning to take place by implementing teaching techniques that expose students to real-world materials. Therefore, teachers are fully responsible for implementing active teaching and learning (Najib et al., 2020).

The education system in Malaysia teaches science in primary schools through guided inquiry activities contained in the syllabus. However, teachers face limitations in terms of time and resources, which makes it difficult for them to conduct inquiry-based experiments in the classroom. Additionally, some teachers believe that such activities can only be conducted in schools with complete laboratory facilities and materials. Hence, this study aims to develop a teaching and learning module based on the ADDIE model for science education in year 4 of primary schools that provides suitable PdP activities for teachers and students even without complete laboratory facilities. The PdP activities contained in this module are aligned with the syllabus content established by KPM.

The lack of a complete laboratory facility will limit teachers in creating effective Science lessons (Adhikari et al., 2020). The limitations that teachers face when delivering effective teaching is that they struggle to carry out activities that involve active student involvement if they are at a school with insufficient complete science laboratory facilities. According to (Nurbaizura et al., 2020), a suitable environment and facilities at the school to carry out activities that center on students being actively involved, such as conducting experiments or other activities that force students to explore using their senses and communicate with peers in sharing information and constructing new knowledge with teacher monitoring to achieve effective Science lessons. This clearly makes it difficult for teachers to provide more effective Science lessons and facilitate students' understanding through activities and interactions during science class, especially if teachers face problems with a lack of complete and proper laboratory facilities like schools in rural areas and remote areas.

This study requires investigation to examine how to integrate readily available materials that teachers can acquire using the ADDIE model to build appropriate modules aligned with educational objectives. The study also aims to design constructivist and active learning approaches in building learning modules that allow teachers and students to conduct experiments even in the absence of complete laboratory facilities at school, with the help and guidance of teachers, utilizing materials that are easily available based on the students' environment at school and at home to fulfill the syllabus requirements set by the KPM. As a

result of this study, the KPM can provide an effective module for teachers and students with more impactful lesson using materials and resources that are easily accessible by teachers and students in their daily lives without requiring complete and perfect laboratory facilities. The objective of this study is to develop a teaching and learning module based on the ADDIE model for year 4 plant topics and to test the validity, usability, and reliability of the module. This study does not test the effectiveness of the module on student performance. It is hoped that the developed module will provide ideas for teachers in building more meaningful Science lesson.

Methodology

This study uses the ADDIE model as a module development design model to develop a teaching and learning module on the topic of plants for year 4. There are 5 phases within the ADDIE module development design model used in this study, namely the analysis phase, design phase, development phase, implementation phase, and evaluation phase.

In the analysis phase, a study was conducted on 42 science teachers in the state of Penang using a needs analysis questionnaire to determine if there is a need to develop a teaching and learning module based on the ADDIE model. The needs analysis questionnaire will also review which topic should be the main topic in the ADDIE-based teaching and learning module.

The design phase is the phase where the needs analysis questionnaire administered in the previous analysis phase is analysed to determine the development needs of the module and also the topics that need to be the main topic in the ADDIE-based teaching and learning module.

In the development phase, the ADDIE-based teaching and learning module is constructed based on the main components analysis resulting from the needs analysis questionnaire administered in the previous analysis phase.

To test the content validity, usability, and reliability of the developed module, 6 experts and 42 expert teachers were involved in the evaluation of the module using a validity, usability, and reliability questionnaire. This evaluation took place in the implementation phase. The content validity questionnaire was given to 6 experts to evaluate the developed module, while the reliability and usability questionnaire was administered to 42 science teachers in the state of Penang to evaluate the reliability and usability of the module.

The last phase is the evaluation phase, where the validity, reliability, and usability questionnaires administered earlier are analysed, and the findings will answer the research questions established.

Research Findings

Phase 1 ADDIE (Analysis)

In this phase, the needs for teaching and learning modules based on the ADDIE model are assessed using a review method to identify the needs for the development of teaching and learning modules for Year 4 students and what topics are suitable for use in the developed module. Respondents involved in identifying the development needs of this module consist of science teachers in Pulau Pinang. To further strengthen the survey instrument for testing

these needs, language and content validity are tested based on the assessment of experts in relevant contexts. This language and content validity is a rational validity approach, where the study administered is to look at the rational needs of the study only (Abu Hassan et al., 2021). A pilot study of 15 science teachers was conducted to ensure that the survey used measures what it intended to measure and the results are presented in Table 1 below. The selection of sample respondents involved is based on the teachers' experience in teaching science in primary schools.

Table 1
The Cronbach's alpha value for each element of the survey questionnaire on needs.

No	Elements	Alpha Cronbach	Items
1	Module development requirements	0.858	1
2	Contents of year 4 syllabus topics	0.847	10
3	Aspects of module content	0.838	8
4	Aspects of module activity	0.837	8
5	Assessment aspects of the module	0.838	5
6	Aspects of the material in the module	0.858	3
	Overall	0.848	57

Phase 2 ADDIE (Design)

The results of the needs assessment questionnaire aimed at identifying the need for a teaching and learning module based on the ADDIE model, and reviewing which topics should be the main focus of the teaching and learning module administered to 42 science teachers in Penang Island, are shown in the figure and table below.

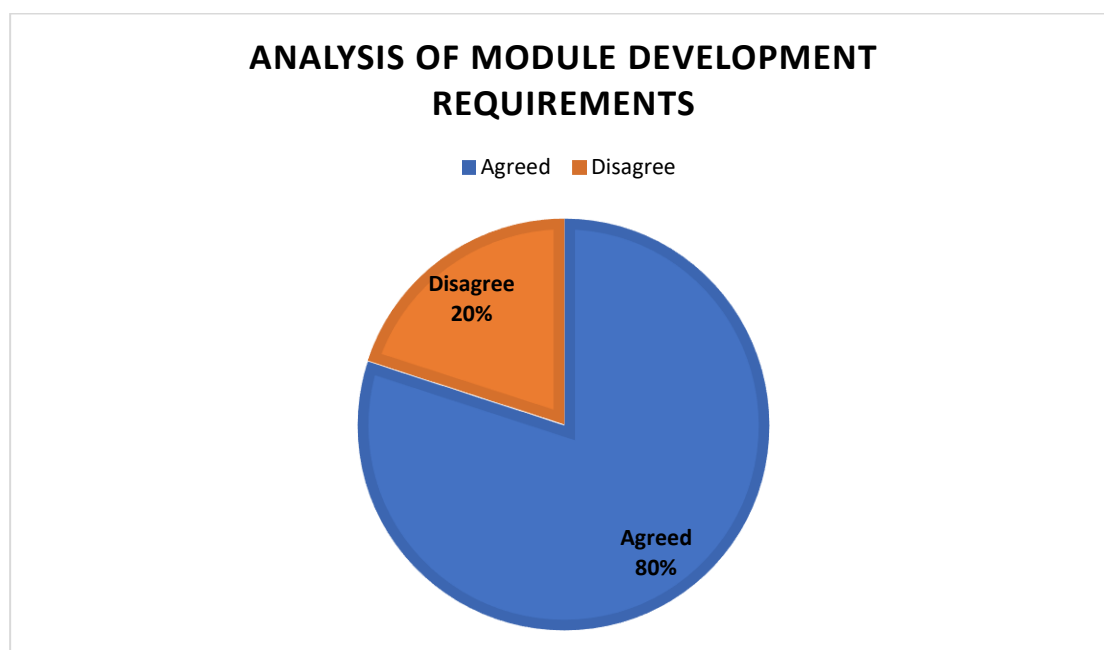


Figure 1
Analysis of teaching and learning module development needs based on the ADDIE model

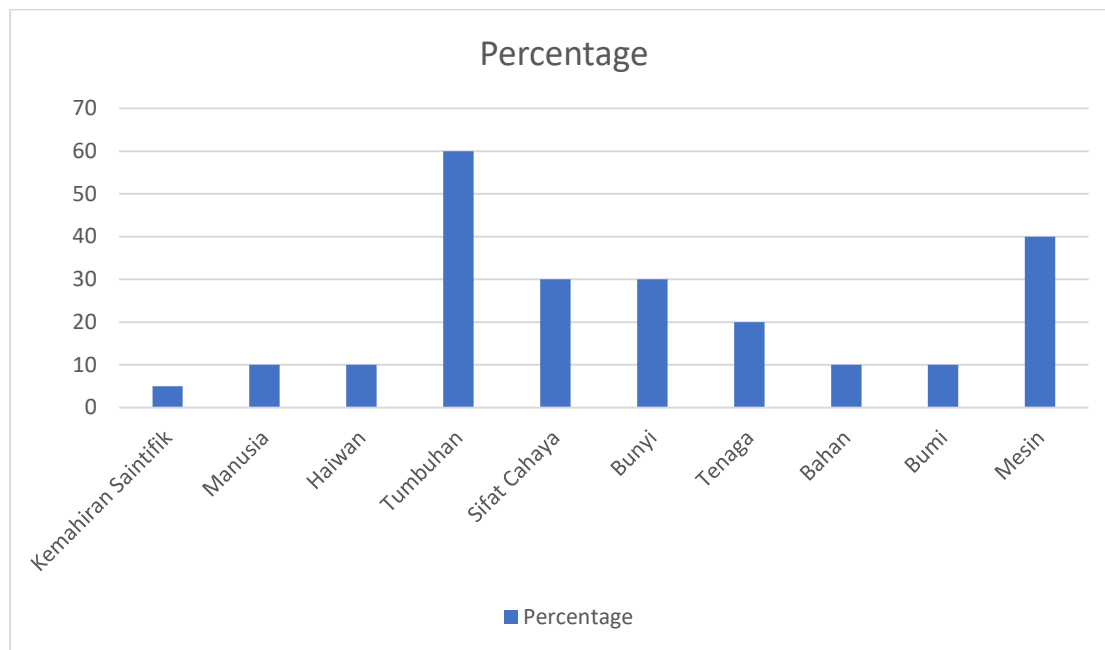


Figure 2
Year 4 Topic Requirements Analysis

Table 2
Module Content Requirements Analysis

No	Items	Percentage
1	There are module development objectives	30
2	There is a module usage guide	60
3	There is a teaching and learning guide (PdP) using active learning methods	80
4	There is a daily lesson plan (RPH)	60
5	There is a suggested time period for each activity in the module	30
6	There are student worksheets	60
7	There are examples/recommendations of materials for each activity	65
8	There are examples of results for each activity	60

Table 3

Module Activity Requirements Analysis

No	Items	Percentage
1	Students conduct experiments while PdP is actively conducted	80
2	Students communicate with friends and teachers during active lesson	75
3	Doing brainstorming activities before doing assignments	70
4	Students collect information in the form of short notes	45
5	Students perform assessment in the form of group or individual presentations	60
6	Students display the results of experiments in videos or pictures	30
7	Students share learning experiences while doing experiments	60
8	Students present and share experimental results during science lesson	65

Table 4

Analysis of Requirements Aspects of Module Assessment

No	Items	Percentage
1	Assessment is not entirely in the form of an examination	65
2	Assessment is done through the observation method	65
3	Assessment is done orally	65
4	Classroom Assessment (PBD) is done individually or in groups	85
5	Assessment in the form of project/experimental work	70

Table 5

Analysis of Material Aspect Requirements in the Module

No	Items	Percentage
1	Electronic media materials that are easy for students to print	80
2	Links from websites over the internet	70
3	Use of interactive media materials	60

Based on the above figure and table, 80% of the teachers agree that the teaching and learning module should be developed using the ADDIE model. The analysis also shows that 60% of the teachers chose the topic of plants for the developed teaching and learning module. Based on the content analysis of the module, 80% of the teachers chose to prioritize the item of teaching and learning guidelines (PdP) using active learning methods. For the analysis of module activity needs, 80% of the teachers chose for students to conduct experiments during active PdP. For the analysis of the assessment aspect of the module, 85% of the teachers chose to include Classroom Assessment (PBD) elements, performed individually or in groups. For the analysis of the material aspect in the module, 80% of the teachers chose to provide easily printable electronic materials for students in the developed teaching and learning module.

Phase 3 ADDIE (Development)

In the development phase of the module based on the ADDIE design model, the teaching and learning module based on the ADDIE model is built based on the main components selected

based on the needs analysis in phase 2 of the design. All of these main components of the module will be used to form a complete teaching and learning module that contains notes, instructions, daily teaching plans, activities, and assessments. The teaching and learning module based on the ADDIE model is built to cover only the topic of plants for year 4 based on the needs analysis. Table 6 below shows the breakdown of the content of the module.

Table 6
Breakdown Table of Module Content Based on Year

Year	Content	Content Breakdown
4	4 Year Plant Life Process	1. Daily lesson plans (1) and (2) 2. List of materials and apparatus 3. Activity instructions for students 4. Activity instructions for teachers 5. Assessment exercise

Phase 4 ADDIE (Implementation)

During the implementation phase, the completed module will be analyzed to determine the validity, reliability and usability of the teaching and learning module based on the ADDIE model developed. The developed module will also be referred to six expert teachers to determine the suitability of the module in terms of validity, reliability, and usability. The survey forms are as follows:

1. Content validity survey form (Appendix C)
2. Reliability and usability survey form (Appendix D)

All of these survey forms were adapted from the study (Khalid et al., 2019). Details on the elements and items contained in the two survey forms and where they were adapted from based on literature sources can be clearly seen based on Table 7 details below.

Table 7

Questionnaire elements of validity, reliability and usability based on literature sources

No	Element	Items	Literature
1	Module Content Validity Questionnaire		(Khalid et al., 2019)
	1. 1. Validity of Module Content	5	
2	Module Trust and Usability Questionnaire		(Khalid et al., 2019)
	1. Demographic Information	2	
	2. Trust Module	11	
	3. Usability of the Module	45	

Based on the survey form developed, a pilot study was conducted to test its validity, reliability and usability to obtain Cohen's Kappa and Cronbach's Alpha values. Validity can be defined as the suitability, accuracy, usefulness and usability of an instrument being evaluated according to Khalid et al (2019) which cites (Fraenkel and Wallen, 1996). In the context of this study, the pilot study was administered to 15 science teachers in elementary schools in the state of Penang Island.

Table 8

Analysis of a Pilot Study of Module Validity, Reliability and Usability Questionnaire

No	Element	Cohen`s Kappa Value
1	Module Content Validity Questionnaire	
	2. 1. Validity of Module Content	0.83
2	Module Trust and Usability Questionnaire	
	4. Demographic Information	0.82
	5. Trust Module	0.76
	6. Usability of the Module	0.72
	Overall	0.78

Table 9

Cronbach's alpha value for each element of the validity, trust and usability questionnaire of the module

No	Element	Items	Alpha Cronbach Value
1	Module Content Validity Questionnaire		
	3. 1. Validity of Module Content	5	0.847
2	Module Trust and Usability Questionnaire		
	7. Demographic Information	2	0.820
	8. Trust Module	11	0.838
	9. Usability of the Module	45	0.898
	Overall		0.850

Phase 5 ADDIE (Evaluation)

As stated in the implementation phase, the completed module will be analyzed to determine the validity, reliability, and usability of the teaching and learning module based on the ADDIE model developed. The developed module will also be referred to six expert teachers to determine the suitability of the module in terms of content validity. Table 10 below shows the overall content validity results for each expert with each expert's agreement percentage indicating an agreement rate of over 80%.

Table 10

Achievement of Module Content Validity Based on Overall Percentage of Experts

Experts	Total Experts Score	Percentage of Agreement	Expert View
P1	20	80%	Good
P2	23	92%	Good
P3	23	92%	Good
P4	24	96%	Good
P5	23	92%	Good
P6	20	80%	Good
	Overall Average Percent	88%	

Table 11 below will detail the expert findings analysis for each item in the content validity survey form based on the expert agreement.

Table 11

Achievement of Item-Based Module Content Validity

No	Items	Total Experts Score	Percentage	Experts View
1	The content of the Active Teaching Module for the topic of plant level 2 meets the target group.	17	85%	Good
2	The content of the Active Teaching Module for the topic of plant level 2 can be implemented perfectly.	18	90%	Good
3	The content of the Active Teaching Module for level 2 plant topics corresponds to the allotted time.	18	90%	Good
4	The content of the Active Teaching Module for the topic of plant level 2 can increase students' interest in the lesson.	18	90%	Good
5	The Active Learning Module content for level 2 plant topics can help students relate the topics learned to everyday life.	17	85%	Good
	Overall Average Percent		88%	

The ADDIE model-based teaching and learning module is also evaluated for its usability to determine the expert agreement percentage. The module usability survey form contains 5 main sections. The number of items based on the main components of the module usability survey form is explained based on Table 12 below.

Table 12

Key Components of Usability Questionnaires

No	Main component	Items
1	Part A : Format	12
2	Part B: Contents	11
3	Part C : Objective Accessibility	6
4	Part D : Feasibility of PdP Process	10
5	Part E : Satisfaction	6

This reliability survey form is evaluated by experts to determine its usability agreement percentage. Table 13 below will detail the average agreement percentage of experts based on each main component of the usability survey form obtained, along with the overall average agreement percentage of experts for the active teaching module survey form developed.

Table 13

Percent Expert Agreement for Usability Questionnaires

No	Main component	Percentage of Agreement
1	Part A : Format	93.9%
2	Part B: Contents	91.1%
3	Part C : Objective Accessibility	90.5%
4	Part D : Feasibility of PdP Process	89%
5	Part E : Satisfaction	87.7%
	Average Percent Agreement	90.44%

According to Table 13 above, the overall agreement percentage obtained from the experts is 90.44%, and this value is considered very good and satisfactory according to (Khalid et al., 2019). All of the main components evaluated in the usability survey form have a percentage of 90% or above. This clearly indicates that the ADDIE-based teaching and learning module developed has high usability.

Discussion*Content Validity of the Teaching and Learning Module Based on the ADDIE Model*

The results of the content validity analysis of the ADDIE-based teaching and learning module by 6 experts shows a good score with an average expert agreement percentage of 88%, which is a good value. The language used in the module is good and suitable for the language level and is easily understood. Additionally, the developed module is very compatible with the target group. The results of the content validity analysis of the ADDIE-based teaching and learning module are consistent and in line with the study by Khalid et al (2019) that developed a STEM-based teaching module and obtained high content validity scores. Although the module developed by Khalid et al (2019) is for mathematics subjects, the goal of the study is the same, which is to develop a module for the BBM purpose in PdP.

The findings of this study are also consistent with other studies such as the study by Ranuharja et al (2021) that developed an Interactive Learning Media module based on the ADDIE model and also showed high content validity results with a minimum percentage of 89.09%. Further, the study by Chuseri et al (2021) that developed a mathematics module based on High Order Thinking Skills that also used the ADDIE module development design model showed that the developed module is effective in improving student achievement. Moreover, the study carried out by Wicaksana et al (2020) also used the ADDIE model as a module development design model to produce an e-comic development module to increase students' interest in learning about the preparation for the independence of Indonesia. His findings showed that the average expert agreement percentage for content validity was high, which was 78.85%.

In conclusion, the teaching and learning module based on the ADDIE model for grade 4 plants topic is a relevant study based on the results of the analyzed data and the average validity score of the teaching and learning module content, which is 88%, is a good and acceptable value. Furthermore, it successfully answers the research question regarding the suitability of the teaching and learning module in terms of content validity. The good average percentage score indicates that the ADDIE model used to develop this module is suitable to be used as a guide for building and developing modules with high validity. However, this

developed module needs to be tested by science teachers for reliability and usability. Therefore, a detailed explanation and discussion on the reliability and usability findings of the module will be presented in the sub-topic below.

Reliability of the Teaching and Learning Module Based on the ADDIE Model

Therefore, the next research question to be answered in this study is whether the teaching and learning module based on the ADDIE model developed for the Year 4 plant topic is suitable in terms of the reliability aspect of the module. The reliability of a module can be measured using a reliability questionnaire developed based on the research objectives to evaluate to what extent the users can follow the module (Khalid et al., 2019; Wahyugi & Fatmariza, 2021).

The reliability of a module is measured using a reliability questionnaire to find the Cronbach's alpha value. In this study, the SPSS software was used to find the Cronbach's alpha value. The results of the analysis showed a Cronbach's alpha value of 0.897. A Cronbach's alpha value of 0.897 is very good according to (Khalid et al., 2019) where the accepted alpha value is above >0.700 . This indicates that the developed active teaching and learning module has a high level of reliability and therefore successfully answers the research question of whether the teaching and learning module based on the ADDIE model is suitable in terms of the reliability aspect.

Looking at other studies such as (Abu & Saleh, 2020) who built a teaching module for Al-Quran using the ADDIE model, their findings showed that the reliability of the developed module was also high and acceptable with a Cronbach's alpha value of 0.838. This result is in line with (Khalid et al., 2019). In their study, the reliability value obtained was 0.967, which is a very good value.

In conclusion, the study carried out in developing a teaching and learning module based on the ADDIE model is relevant as the developed module is trustworthy and can be concluded as a good module to be used. After that, the ADDIE-based teaching and learning module is evaluated again, this time by assessing its usability. The discussion of these findings will be discussed in the next subtopic.

Usability of the teaching and learning module based on the ADDIE model

The next objective in this study is to measure the compatibility of the teaching and learning module based on the ADDIE model in terms of the feasibility aspect of the module. The instrument used to measure the issue of this study is a feasibility questionnaire module consisting of 5 main aspects. These 5 aspects are aspect format, content, ability to achieve objectives, feasibility of teaching and learning process, and satisfaction aspect. A pilot study was conducted on the feasibility questionnaire form before it was given to teachers to obtain actual study values.

This feasibility questionnaire study was conducted in the state of Penang, involving 42 respondents consisting of teachers who teach science subjects in primary schools. The results of the feasibility questionnaire analysis show very good values, with an average percentage agreement for all aspects at 90.44%. The details of the percentage agreement based on the evaluated aspects can be referred to table above. In conclusion, the results of the analysis

obtained show that the teaching and learning module based on the ADDIE model built on the ADDIE model is good and suitable.

Conclusion

In conclusion, the study found that the teaching and learning module based on the ADDIE model developed for fourth-year primary school students has received approval and endorsement from experts and can be used in classroom teaching and learning sessions. It is hoped that the findings of this study will meet the needs of various parties such as the Malaysian Ministry of Education, teachers, and students to help them learn using a module based on more effective active learning in teaching and learning sessions. These findings can also assist teachers and educational management in learning how to develop teaching and learning modules in a better and more systematic manner.

Contribution

Most of the respondents involved in this study stated that this module is good, interesting, and easy to understand. The ADDIE teaching and learning module for the fourth-grade topic on plants can also be used as a reference by teachers in their efforts to implement teaching and learning processes in the classroom. Additionally, the use of this module can help teachers save time in preparation before teaching and learning because it is equipped with daily lesson plans, notes, exercises, and assessment tests for the teachers' use during class. The use of this module indirectly helps students improve their understanding and generate interest in the subject of science. This developed module can also serve as a guide for teachers, schools, District Education Offices (DEO), State Education Departments (SED), and the Ministry of Education (MOE) in planning the development of modules for other topics. Constructing modules for diverse topics can help schools train students and teachers to be more creative, thereby increasing student and teacher motivation.

In conclusion, the development of this ADDIE teaching and learning module has been well-received by all parties involved and has had a positive impact on improving the quality of teaching and learning produced by teachers. The implication of developing this module is that it can enhance teachers' pedagogical knowledge, which is expected to improve their existing teaching practices, raise awareness and knowledge of science teachers, enabling them to be more creative and critical in planning and implementing teaching and learning processes, thereby increasing students' interest in the subject being taught. It is hoped that through the development of this ADDIE teaching and learning module, it provides a clear understanding of the module development process and its advantages to serve as a reference for teachers, schools, District Education Offices (DEO), State Education Departments (SED), and the Ministry of Education (MOE).

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