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The Development of Observation Module of Astronomy Lecture Based on Sky Portal Application

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Abstract
Astronomy is one of Physics' branches. But, there is a content shift happening in Astronomy where it should be part of Physics, but currently it tends to be part of Geography. Hence, it is needed a module which can support deeper understanding in Astronomy through sky observation. This research aims to develop an Astronomy observation module based on Sky Portal Application which is valid and has a good response. This research used the ADDIE model with the students of Physics Education Study Porgram of Education and Teacher Training Faculty of Mulawarman University batch 2022 being the subject. The data was gathered by using the questionnaire for the validation of material and media, and also questionnaire for the response of the students. The material obtains a percentage of 89,3%, while the media obtains a percentage of 87,7%, which both of them are categorized as valid. Meanwhile, the response of the students obtains a percentage of 88,8% which is categorized as practical. So, from the results of validation and response of the Observation Module of Astronomy Lecture based on Sky Portal Application, this module is valid and can be used in the lecture activity.

Keywords: astronomy, development of module, Sky Portal

INTRODUCTION

Physics is one of science's branch which implementation's can growth child's critical thinking. This critical thinking ability can be developed by using a lot of natural phenomena as an implementation of Physics (Erviani et al., 2016). Physics also demands the students to be able to have problem solving with daily problems which have correlation with Physics. The students who are capable to solve the problems will have meaningful experience which can make the student more active in the classroom activity. That fact shows that the problem solving ability is one of essential skills that needs to be developed in a physics classroom (Ayudha & Setyasih, 2021). In order to reach that, in learning physics, students need experiments which are based on the questions what, why, and how the natural phenomena happen (Rahman et al., 2015).

The universe is an integrated part of the science world, and astronomy is the branch of science which learns about it (Saputra, 2018). However, there is not as much attention as the other subjects compared to astronomy since the education in Indonesia is inadequate in facilitating the knowledge in astronomy (Hikmatiar et al., 2023). As the result, there is a tendency where a lot of physics teacher is not really into astronomy, as astronomy is seen as a completely different subject than physics. There's also a shifting of this subject from Physics to Geography (Pujani & Rapi, 2013).

Nowadays, the technology has been developing rapidly. With this technology, there are a lot of innovation in many aspects of human life, especially in education, which can help our daily activity (Maritsa et al., 2021). In Astronomy, which is usually related to outer space objects and outer space phenomena which are really hard to be observed, there has been some innovation that can help to do the observation such as simulation application (Acut & Latonio, 2021).

The implementation of learning activity through the Stellarium application (sky simulation application) can help in improving learning activity and cognitive ability of students (Habibi et al., 2014). The utility of Stellarium in the Sky Object Coordinate's material can help several aspects of the students significantly, such as the interpretation, giving examples, and summariing. Also, the students' digital literacy is on a really good level after using the Stellarium application (Maulana & Masturi, 2023).

Hence, research in this topic is essential, but so far there has not been a lot of research developing

module or learning media based on application for Astronomy lesson or lecture. So, this paper will explain about the process of development of observation module of Astronomy lecture based on Sky Portal application, the validation, and also the response from the students.

METHOD

This research is a development reesearch which adpoted research and development (RnD) from Borg & Gall (1989), and ADDIE which is common to be used in educational area to make a valid product (Aldoobie, 2015). Even though there are 5 phases in the ADDIE process, this research only went through three phases which are the analyze, design, and development. The subject in this research was the 6th semester students of Physics Education Study Program which were taking the Astronomy lecture. The data were collected through the validation questionnaire from validators and also the response questionnaire from students. Data then analyzed using the likert scale from 1-4, just like Table 1.

Table 1. Likert Scale for the Questionnaire

Answer	Score
Strongly Agree	4
Agree	3
Disagree	2
Strongly Disagree	1

The obtained scores then were transformed into percentage with the following formula, adopted from Akbar (2013).

$$P = \frac{\sum x}{\sum x\, i} \times 100\% \qquad 1$$

Where P is the percentage of validation, ∑x is the total score of the validator, and ∑xi is the maximum score.

After that, the percentage then was translated into the level of validation in Tabel 2.

Tabel 2. The Criteria of Product Validation According to Validators' Percentage

Percentage	Level of Validation
90% ≤x< 100%	Strongly valid
80% ≤x< 90%	Valid enough
65% ≤x< 79%	Not valid enough
0% ≤x< 55%	Strongly invalid

After that, the students' response. Just like the validation questionnaire, the students' response also was analyzed with the likert scale just like the Table 1. Then, were transformed into percentage with the following formula, which was adopted from Akbar (2013).

$$P = \frac{T_{Se}}{T_{Sh}} \times 100\% \qquad 2$$

Where P is the percentage of the response, T_{SE} is the total obtained score from the students, and T_{SH} is the maximum expected score.Then, this percentage was translated into the criteria on Table 3.

Table 3. The Criteria of Product Response from the Students

Percentage	Level of Response
90% ≤x< 100%	Strongly practical
80% ≤x< 90%	practical enough
65% ≤x< 79%	Not practical enough
0% ≤x< 55%	Strongly impracital

RESULT AND DISCUSSION

Research was done at the Physics Education Study Program of the Faculty of Education and Teacher Training of Mulawarman University which is located at the Jalan MA Pahu, Gunung Kelua, Samarinda Ulu, Samarinda, East Kalimantan. The study program has 11 lecturers and 2 educational staffs. This study program has been accredited as 'unggul' or excellent from LAMDIK since 2023, and also accredited

internationally by ASIIN since December 2022. The research's final product is an observation module of Astronomy lecture based on Sky Portal application, which was developed through three steps of ADDIE, which are:

Analyze

At this stage, there were two steps. First was analyzing the needs by observing the Astronomy lecture and the availability of observation instruments. After an observation has been done by doing an interview, problems and solutions were obtained which are shown on Table 4.

Table 4. Obtained Problems and Solutions

Problems	Solutions
The activity in the Astronomy lecture is focused on classroom activity without any observation activity	A development of module to help student in observation is needed
The teaching materials are only books which only discuss teories without any real implementation	
Limited source of instruments which makes the observation in huge scale impossible to do	An alternative media of observation which is accessibe for everyone is needed
Some of Astronomy observations needs a long time to obtain the comparison	

After analyzing the needs, the curriculum was analyzed through the RPS (Rancangan Pembelajaran Semester or Semester Learning Plan). Through this, the researcher analyzed the materials which observations can be done with the Sky Portal application, and also done the literature study from various sources which helped to compose a systematic module. Moreover, the material in the module was matched with the CPMK (Capaian Pembelajaran Mata Kuliah or in English The Learning Outcomes of the Lecture) and also the sub-CPMK (sub of the Learning Outcomes of the Lecture) so it aligns with the outcomes of the lecture.

Design

The second stage is design according to obtained analyze data. This stage was started with mapping the material that would be in the module. After that, flowchart is made to map the module.

From the flowchart then developed a draft of the module which was contained the gross material from various sources as the reference for the final product. Also, the questionnaires for validation and reponse was prepared in this stage.

Development

In this stage, the draft was then developed into the early stage observation module of Astronomy lecture based on Sky Portal. After that, the validation for material and media was done by the experts. There were two experts for material, and also two experts for the media.

For the validation of material, there were 6 aspects, which were self instruction, self contained, stand-alone, adaptive, user friendly, and the utility fo Sky Portal. The result for this aspect can be seen in the Table 5.

Table 5. Result of the Validation by the Experts of Material

Aspect	V1	V2	Avg	Category
Self Instruction	75%	96%	86%	Valid
Self Contained	100%	100%	100%	Strongly Valid
Stand-Alone	62,5%	87,5%	75%	Not valid enough
Adaptive	75%	100%	88%	Valid
User Friendly	75%	100%	88%	Valid
Utility of Sky Portal	100%	100%	100%	Strongly Valid
Validity of Material			90%	Strongly Valid

The self-instruction focuses on how the module can be used independently without any help by other individuals (Sari et al., 2024). It obtained a percentage of 86% or valid. According to the experts there needed some improvement and has been improved in order for the activity to be done more independently such as some illustrations which were not aligned with the material.

Self-contained focuses on how align the material with the target outcome of the lectures. This aspect obtained a percentage of 100% or strongly valid. The module itself was developed through the lecture's outcomes and sub-outcomes, so that it was already aligned from the start to the outcomes.

Stand-alone focuses on how the module can be operated without any other media (Purnama, 2023). It obtained a percentage of 75%, not valid enough. It is understandable because in order to do the activities, we

need the Sky Portal App from the phone.

Adaptive focuses on how this modul can still keep on adapting to the fast development of technology . This aspect obtained 88% or valid. It is because the sky in this application is always up to date with the sky view for years to come.

User friendly focuses on how accessible and usable the the application and the module (Permani & Priyanto, 2019). This aspects obtained a percentage of 88% or valid. This due to the fact that the application is free and easy to install in both of the most popular operating system, which are Android and iOS).

Utility of Sky Portal focuses on the how the Sky Portal is used in the whole activity of the module. It obtained a percentage of 100%.

Overall, the material obtained a percentage of 90% or strongly valid.

For the validation of media, there are two aspects which are the graphical feasibility and language feasibility. The result for this aspect can be seen in the Table 6.

Table 6. Result of the Validation by the Experts of Media

Aspect	V1	V2	Avg	Category
Feasibilty of Graphical	89%	87%	88%	Valid
Feasibility of Language	90%	85%	88%	Valid
Validity of Media			88%	Valid

1. The feasibilty of graphical focuses on the module's appearance such as the size, cover and content's design with an average of 88%.
2. The feasibility of language focuses on the language aspects such as directness, communicative, dialogic and interactive, and the suitability of the development of the students, suitability with the language rules, and the utility of terms, symbols or icons with an average of 88%.

   Overall, the language aspects gets an average of 88%.

After the revision based on the experts' comments and advices, module was ready to go through the next stage, which is the respond from the students. This stage was done at the Physics Education study Program of Faculty of Education and Teacher Training of Mulawarman University, with the students on 6th semester. There were 31 students, with 5 of them are boys, and 26 of them are girls. This stage was done in one meeting for 60 minutes. This phase was done with the introduction of the activity and the module. Then, the students were divided into several groups and did the activities in the module.

After that, they did the response by filling out the questionnaire from the Google Form. In this questionnaire, there are three aspects which are the material, language, and attractiveness. The result can be seen on Table 7.

Table 7. Result of the Response from the Students

Aspect	Avg	%	Category
Material	17,7	88%	Practical
Language	10,4	86%	Practical
Attractiveness	25,4	90%	Strongly Practical
Student's Response		88%	Practical

1. The material aspect focuses on how easy the material is being learnt and understood (Ningsih et al., 2024). This aspect gets an average of 88%. This shows that the material is easily understood.
2. The language aspect focuses on how the language in the module: communicative and easily understood for individual learning (Nurani & Hidayati, 2023). This aspect gets an average of 86%. This shows that the language is already on target to the targets on the questionnaire. However, this is the lowest one because there are still some unfamiliar terms, especially in foreign languages in the module and application. Hence, there's a glosarium to give explanation about some Astronomy terms.
3. The attractiveness focuses on how the module can push and increase the student's interest in learning astronomy (Zahidah et al., 2023). This aspect gets an average of 90% which shows that this module is capable to increase the student's willingness to learn in the Astronomy lecture. Some students said that this thing was new fro them and increases their desire to learn Astronomy and work in a group.

   Overall, the response from the students gets an average of 88%. According to the validation from the experts, also the response from the students, this module fulfils the criteria of valid and can be used.

CONCLUSION

According to the research that has been done, can concluded that:

1. The developed module, which is The Observation Module of Astronomy Lecture based on Sky Portal Application, is valid and can be taken its response after getting an average of 90% on the validity of material and 88% on the validity of media.
2. The response of students of the Physics Education Study Program of Mulawarman University shows that the module is practical and feasible on an average of 88%.

The researchers advice to the next researchers is that to test this module in the process of learning because this research is limited to the response of the students. In the implementation stage, can be applied all of the activity to the students.

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