



# Validity of Distance-Based Science Learning Materials for Higher Education Students

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**Abstract.** Science is one of the required subjects for higher education students in primary school teacher education. To effectively teach pupils, it is crucial to provide them with a variety of abilities and a grasp of scientific principles. Distance learning, implemented during the pandemic, makes teachers provide appropriate learning materials for students. Students also still have to be able to achieve learning objectives. This study aims to test the feasibility of distance learning-based learning materials. The learning materials developed are handouts. This research uses research and development (R & D) with the Four D teaching material development model by Thiagarajan. However, this study was only conducted up until the third stage, Development. *Define* stage required handouts through needs analysis by providing Google forms to students. *Design* stage required by designing handouts according to the needs of students and materials. *Develop* stage by testing the feasibility of handouts that have been designed were validated by material, media, and linguistic experts. The results of the feasibility test show that the percentage of feasibility is 90%, so it is very feasible. From the findings of the review of content expert, media expert, and linguist, this study demonstrated that handouts can be one of the ideal instructional materials for students in distance learning. It enhances the material's depth, accuracy, and consistency while providing straightforward examples. The use instructions, visuals, and links for autonomous study have all been improved in the media component. The phrasing of references from the sources utilized has improved, in addition to the spelling and writing of terminology in foreign languages. The handouts have been revisions, and it is now important to assess their potency in order to ascertain that how these contribute to student learning objectives when applied.

**Keywords:** validity, distance learning, science learning material, handout.

## 1 Introduction

Higher education students majoring in primary school teacher education must take one of the compulsory subjects because science is one of the mandatory subjects in elementary schools. As prospective teachers, students are required to master all these subjects. It aims to produce an adult generation who masters science so that they can face the

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challenges of life in an increasingly competitive world, able to participate in selecting and processing information to be used in making decisions. The scope of science study materials in elementary schools generally includes two aspects, namely scientific work and understanding concepts. The scope of scientific work includes investigation activities, scientific communication, creativity development, problem solving, attitudes, and scientific values (Rizema, 2013). Science is formed and developed through a scientific process. In learning science, the scientific process must be developed for students as a meaningful experience. Therefore, it is important to equip students with various skills and an understanding of scientific concepts in order to teach them well.

Due to the COVID-19 pandemic, face-to-face learning was shifted to online distance learning in early 2020. This also had an impact on learning in higher education. Online learning is learning that is done through virtual or virtual media. Online learning can be done through devices or PCs. As stated by Al-Arimi (2014), distance learning is learning that focuses on pedagogy and andragogy, technology, and the design of an integrated instructional system that is effectively integrated in providing learning to students. Teachers and students can communicate asynchronously and synchronously. Therefore, distance learning is not just about sending materials, assignments, and questions to be distributed to students through virtual media, but also needs to be designed, implemented, and evaluated as in face-to-face learning. The required information is learned by the individual during distance learning (Khurshida, 2020). Teaching materials have an important role in learning, so in the development of materials teaching must be appropriate and in accordance with learning needs in order to improve students' abilities (Sistyarini & Nurtjahyani, 2017) One of the problems is the limitations of teaching materials for distance learning. Teaching materials that suit make it easier for students to build knowledge and activities that support learning to formulate their own discoveries. The limitations of this learning tool will certainly affect the quality of learning. Teaching materials are important factors that also affect the success of learning.

Designing learning materials is one of the main components prepared by the teacher. In the process of designing distance learning. Learning material needs to be presented to provide a stimulus or stimulation that guides students in obtaining knowledge according to learning objectives. Teaching materials are all information materials (tools and texts) containing learning materials, methods, limitations, and ways to evaluate competencies that will be mastered by students, designed systematically and used in the learning process (Astra et al., 2019). In distance learning, learning materials are a supporter of the implementation of learning. The selection and use of appropriate teaching materials in a learning process is a matter of concern and important in directing students to gain learning experiences (Ardianto et al., 2019). The development of teaching materials that are appropriate to the needs of students and the material being studied is the best effort to improve understanding of the concept. The development of learning materials also needs to adapt to the learning needs and conditions of students. Therefore, providing appropriate learning materials for students can be an advantage for teachers so that students are more active in building knowledge independently because interactions with teachers are limited by distance.

Distance learning also has an impact on border area students who are in limited network conditions. The study of online learning in developing countries often focuses on students'

limitations in access to devices and the internet (Baticulon et al., 2021; Nepal et al., 2020). So the learning materials developed need to also consider this. One of the media that can be used is handouts. There are two types of handouts: printed handouts and digital handouts. The benefit of using digital handouts is that they can display content with interactive learning (Pahlawan et al., 2021). Digital handouts can be presented, such as books that can be opened simply on smartphones, PCs, notebooks, and other electronic devices (Rianti et al., 2020). Digital handouts are designed for easy access for students wherever they are. It can show factual pictures, videos and practical guides to aid in learning (Khotimah et al., 2021). As stated by Putri & Rinaningsih, (2021), handouts can be accessed through digital media such as smartphones and laptops without the need for continuous internet access. This shows that the handout is a learning material that is needed according to the student's condition. The handout contains concise and dense material, and there are also evaluation questions that are expected to make it easier for students to understand the material (Novitaningrum et al., 2014). Meanwhile, learning that requires handouts has the following components: competencies, previous learning materials, learning procedures, learning materials to be studied, exercises, and evaluation questions (Hernawan et al., 2008). Because the information is brief, obvious, and written in simple words that are easy for students to understand, the presentation of the subject in the student handouts is clear and accessible (Pratiwi et al., 2022).

Based on the above considerations, it is necessary to handouts as distance-based science learning materials for higher education students. This study aims to test the feasibility of handouts as distance learning-based learning materials. It is hoped that this can help provide handouts that are suitable for students to use in distance learning.

## 2 Method

This research uses the 4D Development Model (Define, Design, Develop, and Disseminate) by Thiagarajan (Thiagarajan, 1976). However, this development is only carried out until the third stage, namely the development stage. The research begins with the first stage of definition in the form of defining the required handouts through needs analysis by providing Google forms to students. Furthermore, in the second stage of design, in the form of designing handouts according to the needs of students and materials, The third stage is development by testing the feasibility of handouts that have been designed for material, media, and linguistic experts.

The data collection instrument used in this study was a validation questionnaire for content expert, media expert, and linguist. Data obtained from experts in the form of quantitative data and qualitative data Quantitative data is in the form of scores indicating the feasibility of teaching materials, while qualitative data is in the form of suggestions from material experts, media, and linguists to improve the design of teaching materials. Quantitative data analyzed as a feasibility test can be seen based on data obtained from experts and practitioners using the formula proposed by Purwanto (2014).

$$NP = \frac{R}{SM} \times 100\%$$

NP = the score

R = the obtained score

SM = the highest score

The results are then matched with the following criteria.

**Table 1.** Table Score Conversion for content, media, and linguistic experts

Score	Criteria
81% - 100%	Very Feasible
62% - 80%	Feasible
43% - 61%	Feasible Enough
33% - 42%	Less Feasible
<32 %	Not Feasible

### 3 Result & Discussion

#### 3.1 Define

The first stage of development is Define, which is defining the teaching materials needed by students. Students analysis by observing and giving a questionnaire via Google Form to students. Observation results show that distance learning-based teaching materials are not yet available. The teaching materials used so far are teaching materials commonly used in face-to-face learning, so it is necessary to develop appropriate teaching materials. In addition, the results of the questionnaire also showed that 85.7% of students agreed that it was necessary to develop handouts as learning materials in science learning. Based on the analysis of student needs, the results showed that students needed teaching materials that were easy to understand and easily accessible given the network conditions in their area. This is in line with (Ali, 2020) and (World Bank, 2020) that provide material on distance learning needs to be known and student readiness and access to the devices used need to be considered at all times. This shows that the handout is a learning material developed according to the needs of students. One of the teaching tools that users may easily produce and actually understand is the handout(Ajizah & Rahma, 2017).

#### 3.2 Design

The second stage is *Design*, which is designing handouts needed by students. The handout that was developed was a distance learning-based handout used by students in science material. The handout is made in the form of a file in.pdf format so that it can be accessed by students through gadgets with limited signals. The handout contains concept maps, materials, evaluation questions, and references. The handout teaching materials contain several components, as it is said that the handout contains material descriptions, charts, assignments, and reference materials that have been prepared (Sari et al., 2014). Students use concept maps to make it easier for them to understand the

flow of the material being studied. The material on the handouts varies from various sources. Evaluation questions are adjusted to learning outcomes to make it easier to evaluate student achievements. A reference is another learning resource that students can use to broaden their understanding. This is consistent with (Yulia et al., 2020) that the role of the handout is to assist in the memorization of the main ideas presented, to offer feedback, and to evaluate learning outcomes. The handout contains concise and dense material, and there are also evaluation questions that are expected to make it easier for students to understand the material (Novitaningrum et al., 2014). A handout is one of the teaching materials that are packed systematically. It contains a set of planned-learning experiences and is designed to help the students cover specific learning purposes. At least, the handout should contain the following: learning purpose, learning material/substance, and evaluation (Kusuma, 2017).

### 3.3 Develop

#### 3.3.1 Content expert

The third stage is Develop, the initial shape modification is carried out using learning materials that have been prepared at the stage defined through a validation test which is developing handouts that have been designed to become appropriate handouts for students. The feasibility of the handout was carried out by validating it with the help of a content expert to check the learning and material aspects. The results of material expert validation are shown in the following table.

**Table 2.** The results of material expert validation

No	Aspects	Score (%)	Criteria
1	Material Compatibility with Learning Objectives	100	Very Feasible
2	Material Compatibility with Sub-Learning Objectives	100	Very Feasible
3	Conformity of the concept map with the material	100	Very Feasible
4	Conformity of the summary with the material	100	Very Feasible
5	The suitability of practice questions with the material	100	Very Feasible
6	Content/concept accuracy	80	Feasible
7	Material clarity	80	Feasible
8	Material depth	80	Feasible
9	Accuracy of the selection of images to explain the material	80	Feasible
10	Logical presentation is systematic	80	Feasible
	Average Score	90	Very Feasible

Based on Table 2, the average percentage of material feasibility is 90%, which indicates that the material on the handout is very feasible. Based on the table and suggestions from the expert, in general, the content has met the achievement and competence of students but still needs to be improved regarding clarity, accuracy, and depth of the material and to the material and giving simple examples. This is in line with (Fitriani, 2018) that the content of teaching materials must be in accordance with the concepts and theories that apply in the field of science and the development of science, so that

the content of teaching materials developed can be scientifically justified. This is consistent with (Akhsan et al., 2021) that the teaching material must be relevant to competency standards and the elements of design are sufficient to assist learning goals.

### 3.3.2. Media expert

The feasibility of the handout was carried out by validating it with the help of a media expert to check the visual and technical aspects. The results of media experts validation are shown in the following table.

**Table 3.** The results of media experts validation

No	Aspects	Score (%)	Criteria
1	Compatibility of writing and colors on the cover	80	Feasible
2	Accuracy of Handout Presentation Order	80	Feasible
3	Text Layout Precision	80	Feasible
4	Consistency in Font Size	80	Feasible
5	Image Size	80	Feasible
6	Concept Image Suitability	80	Feasible
7	Placement image	80	Feasible
8	Image Clarity	100	Very Feasible
9	Easy access to the learning platform	100	Very Feasible
10	Handout Size	100	Very Feasible
	Average Score	86	Very Feasible

Based on Table 3, the average percentage of media eligibility is 86%, which indicates that the visual and technical aspects of the handout are very feasible. Based on the table and suggestions from the expert, researchers revise by improving some of these suggestions, as shown Figure 1

- a. Providing instructions for using handouts. Instructions for use are needed to make it easier for students to access and use handouts. Instructions in the form of how to use handouts and technical evaluation questions through the learning platform. This is the function of teaching materials that make it easier for students to learn, which is in line with (Fitriani, 2018) opinion that teaching materials should be tools that can make it easier for students to learn the contents of teaching materials known as Mnemonic Devices.
- b. Giving inclusion of image sources. Image sources need to be included to prevent plagiarism of other people's work. Plagiarism will determine the decline in educational performance (Salleh et al., 2013).
- c. The material being delivered shorter and accompanied by links so that students explore the material independently. The material on the handout is provided with variations in providing website or video links so that

students can explore learning independently and not get bored because they only read text. The benefit of using digital handouts is that they can display content with interactive learning (Pahlawan et al., 2021). This is in accordance with the principle of using media. (Hardianto, 2011) argues that in order to improve user understanding, it is necessary to combine various elements of learning media.



**Fig. 1.** Revision Results from Media Expert Suggestions

Figure 1. Illustrates how the researcher revised the part about using handouts, providing picture sources, and providing video links in following the recommendations of media experts. In order for students to properly use handouts that would be included on the Google Classroom platform, one of the learning platforms used in distance learning, researchers had to provide guidelines for using handouts. Since the image source has not been mentioned before, researchers must now do so in order to prevent plagiarism. In order to make the information in the handouts more diverse and accessible, researchers also include video links.

Digital handouts are designed for easy access for students wherever they are. It can show factual pictures, videos and practical guides to aid in learning (Khotimah et al., 2021).

**3.3.3. Linguist**

The feasibility of the handout was carried out by validating it with the help of a linguist to check legibility and use proper spelling. The results of linguist validation of are shown in the following table.

**Table 4.** The results of linguists validation

No	Aspects	Score (%)	Criteria
1	Use the rules of good and correct language	100	Very Feasible
2	Using terms that match the concept of the material	100	Very Feasible
3	Language that is simple and easy to understand	100	Very Feasible
4	Reach for the delivered message	100	Very Feasible
5	Confusion of meaning	100	Very Feasible
6	Spelling accuracy	80	Feasible
7	Consistency of using terms	80	Feasible
8	Consistency of using symbols	100	Very Feasible
9	Suitability of the reference used	80	Feasible
10	The language used is communicative	100	Very Feasible
	Average score	94	Very Feasible

Based on table 4, the average percentage of language eligibility is 94%, which indicates that the linguistic aspect of the handout is very feasible. based on the table and suggestions from the validator, among others, improving the spelling and writing of foreign language terms and writing quotes from the references used. The linguistic aspect is critical because it influences how students understand the handouts that have been distributed. Language usage is an important consideration when creating teaching materials. Good teaching materials are expected to motivate students to read, do their assignments, and arouse students' curiosity to continue exploring the contents of teaching materials (Fitriani, 2018). The correct language is a language that is in accordance with linguistic rules. The use of good, clear, and correct language will encourage good language skills among students both orally and in writing (Nerita et al., 2018). Corrections are made by checking for errors, capitalizing words, creating more powerful sentences, and improving the readability of the illustrations (H. R. Putri & Ekawati, 2019).

The handout is in the form of short learning materials sourced from several relevant literatures with basic competencies and the main material taught and given to students to make it easier for them to follow the learning process. Handouts are systematically arranged based on learning outcomes and made in a language that is easy for students to understand, often accompanied by the help of pictures (Marlina et al., 2021). Based on quantitative data validation by content experts, media experts, and linguists, the average percentage of handout scores is 90%, meaning that distance learning-based handouts are very feasible for science material. This is in line with previous research regarding the feasibility of handouts as learning materials (Astra et al., 2019; Marlina et al., 2021; Nerita et al., 2018; Rianti et al., 2020; Sari et al., 2014; Yanti & Haryono, 2018). In the material aspect, it improves on the clarity, accuracy, and depth of the material and gives simple examples. In the media aspect, the instructions for use, pictures, and links for independent learning are improved. In the language aspect, the spelling and writing of foreign language terms are improved, as well as the writing of quotations from the references used. Revisions to the handouts have been made. Because the information is brief, obvious, and written in simple words that are easy for students to understand, the presentation of the subject in the student handouts is clear



and accessible (Pratiwi et al., 2022). This study shows that handouts can be one of the appropriate teaching materials for students in distance learning.

## 4 Conclusion

Distance learning requires appropriate teaching materials for university students, including science teaching materials. The results of the feasibility test show that the percentage of feasibility is 90%, so it is very feasible. This study shows that handouts can be one of the appropriate teaching materials for students in distance learning from the results of the assessment of content expert, media expert, and linguist. In the material aspect, it improves on the clarity, accuracy, and depth of the material and gives simple examples. In the media aspect, the instructions for use, pictures, and links for independent learning are improved. In the language aspect, the spelling and writing of foreign language terms are improved, as well as the writing of quotations from the references used. Revisions to the handouts have been made, and it is necessary to test the effectiveness of the handouts to determine the effect of application in achieving student learning goals.

## Recommendation

The impact of handouts on higher education students needs to be further investigated. So, this research needs to be continued to determine the effectiveness of handouts in classroom learning to test the effectiveness of the handouts to determine the effect of application in achieving student learning outcomes.

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