Android-Based Digital Teaching Materials as Online Learning in New Normal Era to Improve Physics HOTS for High School Students

Nana Mardiana*, Satria Yudha Prayogi2, Sukarti3, Siti Haslina4, Md Harizan5

1,3 Physics Education, Universitas Islam Sumatera Utara, Indonesia
2 Informatics Engineering, Universitas Islam Sumatera Utara, Indonesia
4 School of Distance Education, Universiti Sains Malaysia, Malaysia

*Correspondence Author: nana.mardiana@fkip.uisu.ac.id

ABSTRACT
The current research was carried out to develop android-assisted digital teaching materials in new normal era in order to improve students' HOTS in physics learning activities. Similarly, the study seeks to realize innovative, creative and up-to-date Physics learning activities. The present development research employs the ADDIE systematic learning model, (1) analysis; (2) design; (3) development; (4) implementation; and (5) evaluation. The data analysis is a type of qualitative-quantitative method by assessing the quality of the product developed by competent experts, such as lecturers and teachers in accordance with the field of physics study presented in the form of numbers. The outputs generated from this research are Android-assisted digital teaching materials as an online learning solution for the new normal era to improve the HOTS of students with the values of digital teaching materials (e-modules) on temperature and heat materials as a whole classified as “Very Eligible” considered 91.6%.

Keywords: digital teaching materials, android, covid-19, physics, HOTS

INTRODUCTION
Teaching materials are all forms of materials used to assist teachers or instructors in carrying out teaching and learning activities in the classroom (Depdiknas.2017:3). Dick & Carey (2009:242) stated that teaching materials are a set of learning materials or substances (teaching materials) that are systematically arranged, displaying a complete figure of competencies that will be mastered by students in learning activities using HOTS (Alperi, 2015). From the point of view of the development of educational science and technology, teaching materials are all forms of materials used to assist teachers or instructors in carrying out teaching and learning activities in the classroom (Depdiknas, 2017:3).

The Covid-19 pandemic has delivered an impact on various sectors of life, including in learning activities. The government as the decision maker makes policies to carry out online or online learning activities to slow the spread of Covid-19. So we need a solution for learning activities that are appropriate and support the government's policy, through learning to become digital-virtual-online based activities in the form of developing hands-on Android-assisted digital teaching materials which are the right and best solutions for the effectiveness of learning activities in the new normal era (J.P. Islam, 2020). Similarly, technology integration in Physics learning
activities through the development of learning applications that contain Physics learning materials such as innovative, creative and more attractive to students.

Higher Order Thinking Skill (HOTS) is the ability to be able to analyze, evaluate and create something that is considered new, best or different (B. Tanujaya, 2016). HOTS is considered a valuable ability that is more difficult than the ability to remember or explain, so that better, innovative, creative, effective and appropriate ways or information media are needed to be able to convey and display Physics learning activities at the HOTS level, namely through the integration of Android-assisted technology (Mardiana, 2017).

METHODOLOGY

The present development research uses the ADDIE systematic learning model, namely (1) analysis (analyze); (2) design (design); (3) development (develop); (4) implementation (implement); and (5) evaluation (evaluate). It can be seen in the following figure 1:

![Diagram of ADDIE model](image)

The analysis stage is carried out by analyzing the media needs of digital teaching materials for development based on the data obtained. The results of the analysis are used as the basis for designing digital teaching materials that contain content, forms, goals, media, instructions, materials, assignments, evaluations, and displays. The results of the initial development are applied to a larger class for refinement. Furthermore, revisions were made in terms of content, appearance, student independence, and other things for improvement. In the final stage, the revised digital teaching materials are evaluated by media and learning experts. The results of the final evaluation are applied as material for revision before being produced to be applied. Evaluation of digital teaching materials can be interpreted as an action or process to determine the quality of these teaching materials. After passing the refinement stage, digital teaching materials can be used for learning. The indicator of research achievement is the creation of android-assisted digital teaching materials that can be used as a solution for innovative, creative and interesting Physics learning activities for students in online learning activities in the new normal era.

The technique of data collection is done by: (1) survey through the distribution of questionnaires on the digital teaching materials used; (2) survey and interview with the Islamic University of North Sumatra about online learning in the normal era with the help of android; (3) media Development Validity Instruments for Material and Media Experts; and (4) literature review related to the development of digital teaching materials.

The data analysis technique of this research is a qualitative-quantitative analysis of the feasibility and effectiveness of the use of android-assisted digital teaching materials. Through the prerequisite test for normality, and homogeneity, as well as the results in the form of a gain test. Limited and field trials through one group pretest-posttest design and non-equivalent control group design (Emzir, 2013).
RESULT AND DISCUSSION

In this study, the product produced is an Android-based digital teaching material to improve students' HOTS on temperature and heat material which will later be used by students in the learning process in the form of electronic modules (e-modules). Data analysis in the study includes material and media aspects of educational e-modules.

Aspects of the Characteristics of the Guided Inquiry Module

The validator assesses the module to see the suitability of the learning stages starting from orientation, problem formulation, formulating hypotheses, collecting data, analyzing data, and drawing conclusions.

| Aspect                    | Score | Item | Total Score | F.h | %   | Category     |
|---------------------------|-------|------|-------------|-----|-----|--------------|
| Orientation               |       |      |             |     |     | Very Eligible|
| Formulation of the problem|       |      |             |     |     | Very Eligible|
| Formulating Hypotheses    |       |      |             |     |     | Very Eligible|
| Collecting data           |       |      |             |     |     | Very Eligible|
| Analyzing Data            |       |      |             |     |     | Very Eligible|
| Drawing conclusion        |       |      |             |     |     | Very Eligible|
| **Total**                 | 550   |      |             |     |     | Very Eligible|
| **Mean**                  | 91.6  |      |             |     |     | Very Eligible|

Note:

Fh (expected frequency) = item × number of experts × scoring score (4 scales)

Item = Number of statement items

The results of the calculations in Table 10 show that in terms of the characteristics of android-based digital teaching materials (e-modules) to increase the HOTS of students on temperature and heat material as a whole it is classified as "Very Eligible" with the mean "91.6%".

Each aspect is considered feasibility aspect known as Orientation of 87% very eligible category, Problem Formulation of 81% very eligible, Formulating Hypotheses of 100% very eligible, Collecting Data by 90% very eligible, and Analyzing Data by 92% very eligible, Drawing conclusion 100% very eligible.
Figure 2. Graph Percentage of inquiry module characteristics

Product Overview

Figure 3. E-Module cover

Figure 4. Mind-Mapping of e-Module
CONCLUSION

Based on the calculation of the data obtained, it can be concluded that the Physics learning module based on the guided inquiry model based on the overall assessment results is classified as very valid with each characteristic aspect of 92.6% considered very eligible. Based on the results of the test conducted by the validators, the characteristics of e-module Physics learning are overall classified as "Very Eligible" with mean "91.6%". Each aspect is considered very eligible, namely Orientation by 87%, Problem Formulation by 81%, Formulating Hypotheses by 100%, Collecting Data by 90%, and Analyzing Data by 92%, Drawing Conclusion by 100%.

And therefore, it can be concluded that the physics learning module based on the guided inquiry model is very valid to be used in the learning process. E-Physics learning module based on guided inquiry model on temperature and heat material seeks to improve HOTS skills and provide new knowledge for students, presented in the form of electronic modules thus they become more interesting.

ACKNOWLEDGMENTS

The researchers express their deepest gratitude to the Islamic University of North Sumatera because through the Internal Research Grant for the 2021 Fiscal Year, researchers can conduct research and development thus digital teaching material in the form of electronic modules can be created without any significant obstacles.

REFERENCES

B. Nadeak and C. P. Juwita. (2021). Kepemimpinan Kepala Sekolah dalam Menjaga Tata Kelola Sekolah selama Masa Pandemi Covid-19, 8(3), 207–216.

B. Tanujaya. (2016). Development of an Instrument to Measure Higher Order Thinking Skills in Senior High School Mathematics Instruction, J. Educ. Pract, 7(21), 144–148.
D. Subran. (2013). Developing Higher-Order Thinking with ICT, *Bienn. Conf. Univ. West Indies Sch. Educ.*, 2000, 1–7.

E. Istiyono, D. Mardapi, and Suparno. (2014). Developing Higher Order Thinking Skills Test of Physics (PhysTHOTS) for Senior High School Students. *Penelit. dan Eval. Pendidik.*, 18(1), 1–12.

Jaslin Ikhsan. (2014). The Use of ICT-based Media in Web-Based Collaborative Assistance of Hybrid Learning on Chemical Kinetic to Improve Students Academic Performance. *The International Conference On Research, Implementation and Education of Mathematics and Science*.

J. P. Islam and M. (2020) Blended Learning sebagai Sarana Optimalisasi Pembelajaran Daring di Medina Nur Asyifah Purnama Institut Agama Islam Sunan Giri (INSURI) Ponorogo, 2(2), 106–121, 2020.

Kuswanto, H, dkk. (2015). *Pengembangan Physics Education Publishing (PEPSHI) Melalui Cultural Characteristics Berbantuan Android Untuk Mengatasi Kesulitan Belajar Siswa SMA*. Jakarta: Hibah Dikti 2014.

M. Alperi. Peran Bahan Ajar Digital Sigil dalam Mempersiapkan Kemandirian Belajar Peserta Didik. *Learning Independence*, 99–110.

Mardiana, N. (2017). Android-Assisted Physics Mobile Learning to Improve Senior High School Students’ Divergent Thinking Skills and Physics HOTS. *American Journal of Physics*. August 2017.

Mardiani, N. (2016). Pengembangan Physics Interactive Learning Berbantuan Android untuk Peningkatan Scientific Literacy pada materi Suhu dan Kalor. *Tesis*. Universitas Negeri Yogyakarta.

N. Mardiana and H. Kuswanto. (2017). Android-assisted Physics Mobile Learning to Improve Senior High School Students’ Divergent Thinking Skills and Physics HOTS, *AIP Conference Proceedings*, vol. 1868.

R. Herawati and E. Nurulila. (2019). Pengembangan Panduan Eksperimen Fisika menggunakan Smartphone dengan Aplikasi Phyphox pada Materi Tumbukan, 10(2), 101–107.

S. P. Sumenep. (2020). Guru Profesional di Era New Normal: Review Peluang dan Tantangan dalam Pembelajaran Daring, 10(2), 238–247.

Sugiyarto. (2014). *Pengembangan Media Mobile Learning CHEM-EDU berbasis Android sebagai Suplemen Materi Kimia berdasarkan Kurikulum 2013*. Makalah Pemaparan disajikan dalam Seminar Nasional Pendidikan Sains pada tanggal 19 November 2015., di Universitas Negeri Surakarta.