



## Jurnal Pendidikan Fisika

<https://journal.unismuh.ac.id/index.php/jpf>

DOI: 10.26618/jpf.v10i2.7411



# Development of HOTS-Based E-Modules Using Sigil Applications on Circular Motion Materials

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Received: January 16, 2022; Accepted: March 30, 2022; Published: April 25, 2022

**Abstract** – This research aims to examine the validity, effectiveness, and practicality of HOTS-based e-modules using the Sigil application. Employing a research and development method with the ADDIE development model (analysis, design, development, implementation, and evaluation), this research involved 35 students of class X MIPA 8 at SMAN 2 Bangkalan in the academic year of 2021/2022 as the research subjects. This HOTS-based e-module development research includes a pre-experimental design type that used the one-group pre-test post-test method. The obtained data from this study were the results of HOTS-based e-module validation, pre-test results, post-test results, and students' response data to the use of HOTS-based e-modules. In this study, it was found that the results of HOTS-based e-module validation using the Sigil application on circular motion material were 4,556 in the material aspect and 4,498 in the media aspect; both are categorized as very good. The average results of the students' pre-test and post-test were 6.46 and 70.83, respectively. The average n-gain value is 0.69, which indicates that the effectiveness of using HOTS-based e-modules using Sigil applications on circular motion material was in the medium category. The result of the students' response questionnaire was 4.05 (good category), which indicates that the HOTS-based e-module using the Sigil application is practical. The conclusion of this study is that the development of the HOTS-based e-module using the Sigil application on circular motion material is valid and practical.

**Keywords:** circular motion; e-module; HOTS; Sigil application

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## I. INTRODUCTION

The development of information and communication technology (ICT) is currently changing the learning model in schools. The development of this ICT helps teaching techniques develop and experience refinement (Irfan, 2018). The development of ICT has also resulted in the emergence of various interactive multimedia networks, such as

mobile learning (Lin & Chen, 2017).

Technological advances in education are continuously introduced to improve the quality of education and teaching (Al-Rabaani, 2018). Various countries, including Indonesia, have adopted the use of ICT in learning to achieve their educational vision (Septiani & Rejekiningsih, 2020).

The development of ICT has provided various innovations for integrating ICT into learning, and also required the application of ICT in learning. One of the developments in ICT in education is the development of ICT-based learning media (Mahdum et al., 2019). According to Wiana et al. (2018), ICT-based interactive learning media can improve motivation. The use of appropriate learning media can increase the success of the learning process and can help students remember longer learning experiences that have been obtained (Abdullah, 2017).

Learning physics is considered difficult for students to understand because there are many mathematical equations and it looks boring. Therefore, teacher needs appropriate learning media in learning physics so that communication in learning goes well and the message conveyed is clear and can be understood by students. Based on our observations at SMAN 2 Bangkalan, it was found that the students' low motivation to learn physics and the teaching materials used are less attractive and interactive. The students' low motivation to learn physics is due to physics learning only focuses on formulas and questions, and the absence of other supporting learning media. To overcome this problem, teachers at SMAN 2 Bangkalan designed a learning module as a substitute for textbooks that have been used so far. The module for teaching materials are designed to be more systematic and easier to understand. However, this module also has

limitations as it is one of the printed teaching materials; the module can only display text and images and cannot display animation, simulation, and video. This makes learning activities still boring because the printed module is also less interactive, interesting, and has not been able to deliver information through animation, video, and simulation. In contrast to electronic modules (e-modules) which can display text, images, videos, and animations via computer (Herawati & Muhtadi, 2018). E-modules have advantages in reducing paper usage and can be used as an effective, efficient, and interactive learning medium (Laili et al., 2019).

E-modules are very interesting learning media and are in accordance with the development of information and communication technology (Sugiani et al., 2019). Modules accompanied by pictures and real-life examples are expected to increase students' motivation to learn (Anggraini, 2019). E-modules can be developed using the Sigil application. Sigil software is an EPUB format that has the advantage of providing commands for inserting text, image, audio, and video files. In addition, the EPUB format can also be used on all screen device sizes and facilitates access to many electronic components, both PC and mobile (Amalia & Kustijono, 2017). Learning using mobile makes learning become flexible and can be done anywhere and anytime (Johnson & Williams, 2020).

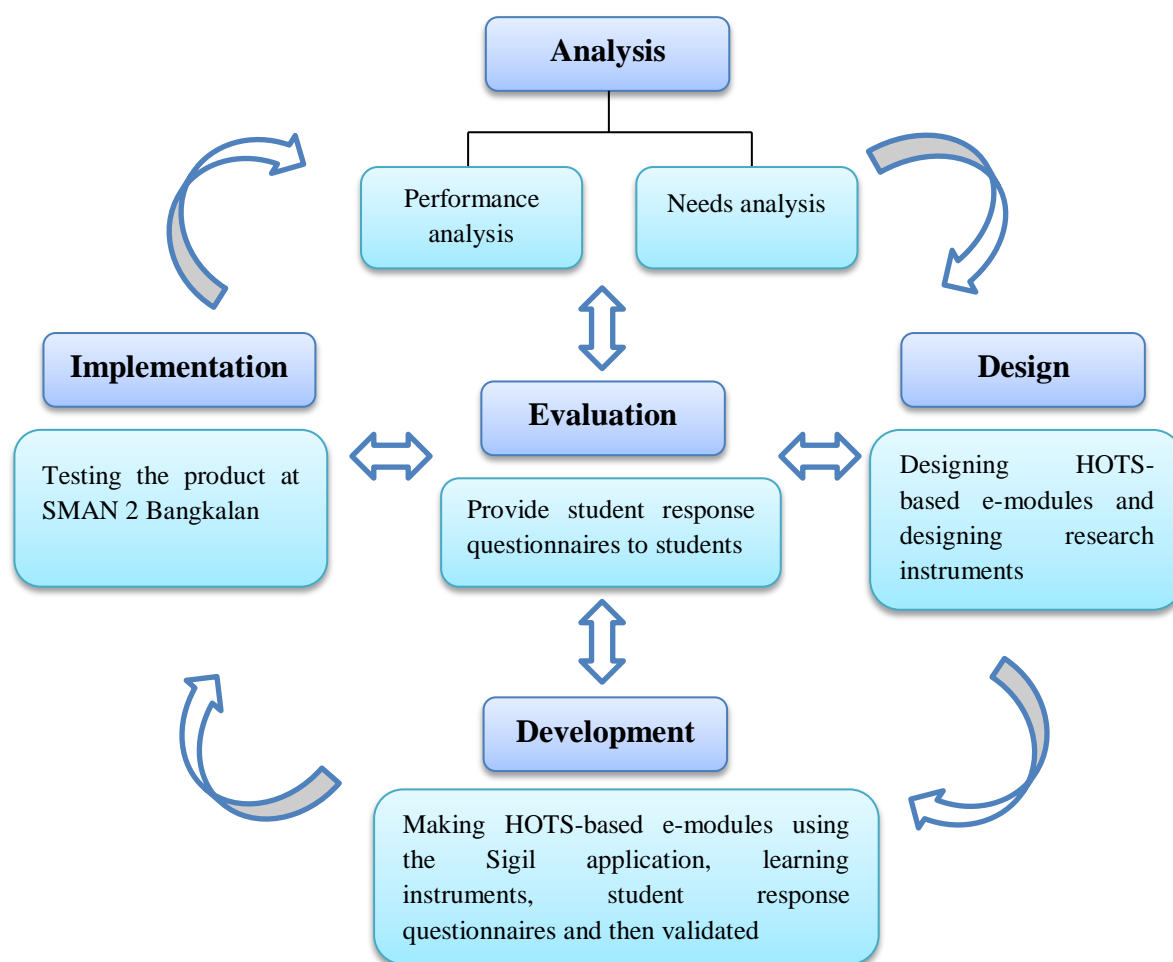
Education in the 21st century must highlight Higher-Order Thinking Skills (HOTS), transferability, and flexible reasoning (Ibrahim et al., 2020). HOTS demands critical, analytical, and creative thinking in the learning processes (Bancong et al., 2021). In Bloom's Taxonomy which has been revised, thinking skills are divided into two, namely Lower-Order Thinking Skills (LOTS) and HOTS (Haryadi et al., 2021). The ability to remember, understand, and apply are included in LOTS while the ability to analyze, evaluate, and create is included in HOTS (Kantar, 2014). In PISA 2018, Indonesia's scientific literacy score actually decreased to 396, while the average score of all participants was 498. These results put Indonesia in 71st place out of 79 PISA 2018 participating countries. The PISA results show that the HOTS of Indonesian students are still low (Agustiani, 2020).

Therefore, based on the problems being faced by SMAN 2 Bangkalan, the solution to develop HOTS-based e-modules using the Sigil application. Research on the development of e-modules using this Sigil application has been carried out by Aisy et al. (2020) for class VIII students with a scientific

approach to teaching the material of a two-variable linear equation system and producing practical and effective products. This e-module research was also conducted by Istikomah et al. (2020) for class VIII junior high school students based on Realistic Mathematical Education (RME) on circle material. However, there are several differences between previous research and this research, such as in terms of the learning approach and the material. The learning approach used in this study is the HOTS approach with circular motion material that has never been developed using the Sigil application in previous studies. The purposes of this study is to describe the validity, effectiveness, and practicality of HOTS-based e-modules using the Sigil application.

## II. METHODS

This type of research is research and development with the ADDIE development model (analysis, design, development, implementation, and evaluation) (Creswell & Creswell, 2018). The development of a HOTS-based e-module using the Sigil application in a circular motion is shown in Figure 1 below.



**Figure 1.** Research design of HOTS-based e-module development

The development of a HOTS-based e-module using the Sigil application for circular motion material was carried out at the Department of Physics, State University of Surabaya. The module development was then tested on a limited basis on 35 students at SMAN 2 Bangkalan in the even semester of the 2021/2022 academic year to find out and describe the feasibility level. During module testing, this study uses a pre-experimental research design with a one-group pre-test-post-test method. Before the experiment, the students were given a pre-test, and after the

experiment, the students were given a post-test.

The instruments used in this research are: (1) the pre-test given by the researcher to the students to determine the students' initial abilities before implementing the HOTS-based e-module learning on circular motion material; (2) the post-test given by researchers to students to determine the final ability of students after learning with HOTS-based e-modules on circular motion material; (3) the students' response questionnaires given by researchers to students to determine the

practicality of the HOTS-based e-module product.

Furthermore, the results of the HOTS-based e-module validation were analyzed using quantitative descriptive analysis. The validation results are then calculated using the following equation:

$$\bar{x} = \frac{\sum x}{n} \quad (1)$$

Then the results of the average validation score are converted into qualitative categories as shown in Table 1.

**Table 1.** Level of validity (Ibrahim & Ishartiwi, 2017)

Quantitative score range	Grade	Qualitative category
$\bar{x} > 4.21$	A	Very good
$3.40 < \bar{x} \leq 4.21$	B	Good
$2.30 < \bar{x} \leq 3.40$	C	Enough
$1.79 < \bar{x} \leq 2.30$	D	Less
$\bar{x} \leq 1.79$	E	Very poor

The results of the pre-test and post-test were analyzed using the standard gain formula proposed by Hake (1991) as follows:

$$\text{Standart Gain} = \frac{\bar{x}_{\text{posttest}} - \bar{x}_{\text{pretest}}}{100 - \bar{x}_{\text{pretest}}} \quad (2)$$

The standard gain calculation results are then converted into the categories as shown in Table 2.

**Table 2.** N-gain category (Hake, 1991)

Standard gain value	Category
$(g) \geq 0.7$	High
$0.7 > (g) \geq 0.3$	Medium
$(g) < 0.3$	Low

The data from students' response questionnaires were analyzed using quantitative descriptive analysis. The data were calculated using the following formula:

$$\bar{x} = \frac{\sum x}{n} \quad (3)$$

Then the results of the average validation score are converted into qualitative categories with the guidelines shown in Table 3.

**Table 3.** Guidelines for converting scores into qualitative data (Purnamasari & Lestari, 2017)

Score range	Qualitative category
$\bar{x} > 4.2$	Very good
$3.4 < \bar{x} \leq 4.2$	Good
$2.6 < \bar{x} \leq 3.4$	Enough
$1.8 < \bar{x} \leq 2.6$	Less
$\bar{x} \leq 1.8$	Very poor

### III. RESULTS AND DISCUSSION

The results of this study follow the stages of research and development of the ADDIE model (analysis, design, development, implementation, and evaluation). In the analysis phase, the researcher made observations at SMAN 2 Bangkalan to conduct a performance analysis and needs

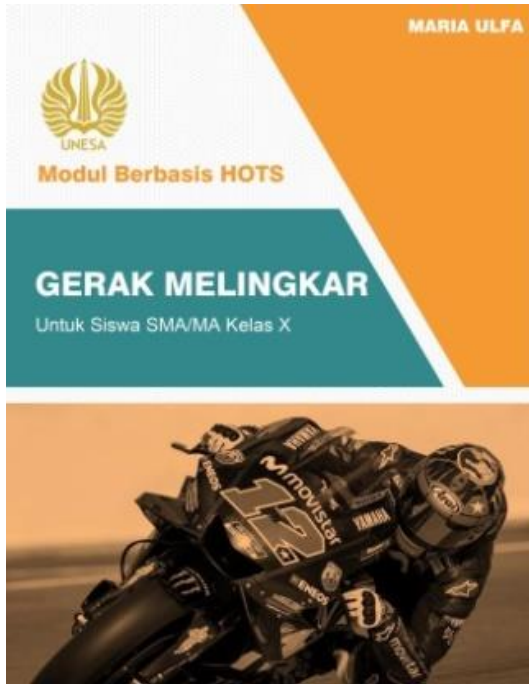
analysis. Performance analysis was conducted to find problems related to learning media in schools. From the performance analysis, it was found that there was no detailed information on the modules used in the school, such as learning instructions, concept maps, core competencies, basic competencies, competency achievement indicators, learning objectives, learning videos, practicum sheets, summaries, and bibliography. Then, a need analysis is carried out to determine the learning media needed by students to improve learning achievement and learning quality. Therefore, researchers developed e-module media that can make physics learning more interesting and less boring. The HOTS-based e-module was developed using a Sigil application that can integrate text, images, video, and audio so that the material and information conveyed is richer than the usual conventional modules.

In the design phase, the researcher designed a HOTS-based e-module using the Sigil application and designed a research instrument that would be used in the study. HOTS-based e-modules are designed based on a format. The formats for this e-module are: (1) cover; (2) preface; (3) learning instructions; (4) concept map; (5) core competencies, basic competencies, competency achievement indicators, and learning objectives; (6) material; (7) practicum; (8) summary; (9) bibliography. The HOTS content in the circular motion e-module includes: (1) the material begins with

critical problems and questions to build critical thinking skills; (2) let's think: HOTS content is to form a concept about a material and students are expected to be able to analyze the problems that have been given; (3) let's discuss: HOTS content for students' discussion rooms with their friends so that students can analyze everyday problems related to the material; (4) let's practice: HOTS content for students' practice rooms so that students can analyze HOTS questions; (5) let's prove it: HOTS content to prove a concept or equation so that students can analyze and evaluate a concept from the material; (6) practicum: HOTS content leading to experiments so that students can analyze, evaluate, and draw conclusions from the experiment.

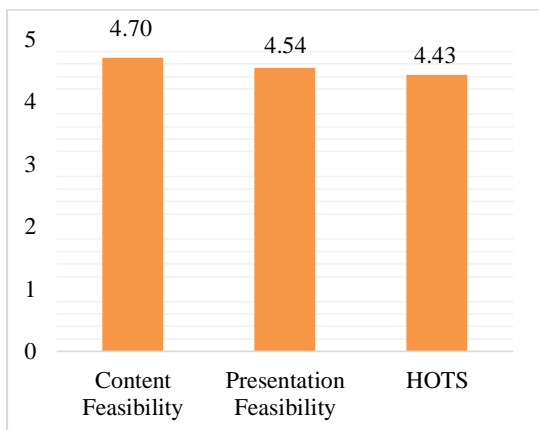
In the development phase, the researcher made a HOTS-based e-module using the Sigil application with circular motion material, learning instruments (syllabus, lesson plans, student worksheets, pre-test, and post-test questions), and students' response questionnaires. First, the HOTS-based e-module was developed using microsoft word in accordance with the format that was designed. After the HOTS-based e-modules were made according to the format, the HOTS-based e-modules were edited using the Sigil application and added other features like learning videos and covers. After the HOTS-based e-module had been developed, the e-module was saved using the EPUB format. The following is the result of developing a

HOTS-based e-module using the Sigil application.



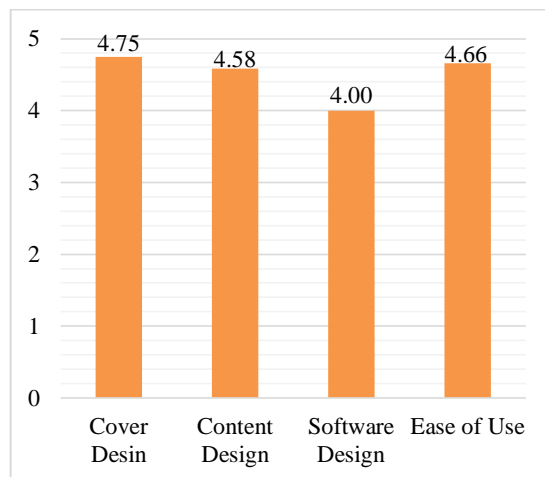
**Figure 2.** Cover of HOTS-based e-module

After the HOTS-based e-module had been developed, they were validated by media expert lecturers to received input and suggestions. The following are the results of the validation of the e-module based on material (Figure 3) dan based on media (Figure 4).



**Figure 3.** Module validation results based on material

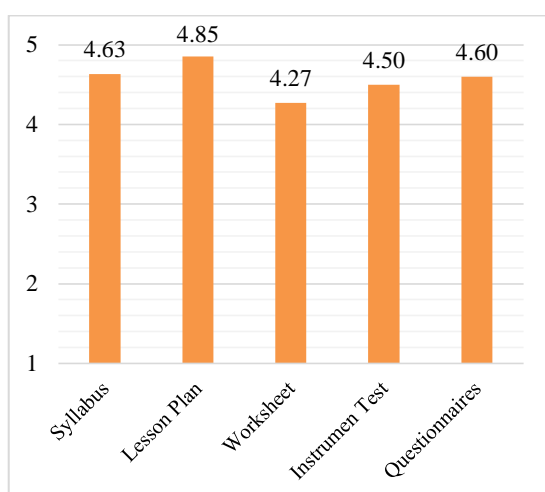
Figure 3 shows the results of module validation based on the material. There were three aspects being validated, namely the content feasibility aspect, the presentation feasibility aspect, and the HOTS aspect. The aspect of content feasibility scored 4.70 (very good category), presentation feasibility obtained 4.54 (very good category), and HOTS aspect obtained 4,43 (very good category). The average module validation result based on the material is 4.56 (very good category).



**Figure 4.** Module validation results based on media

Figure 4 shows the results of the module validation based on the media. The cover design aspect obtained a score of 4.75 (very good), the content design aspect obtained 4.58 (very good), the software design aspect obtained 4.00 (good), and the ease of use aspect obtained 4.66 (very good). The average module validation result based on the media was 4.49, and it was categorized as very good.

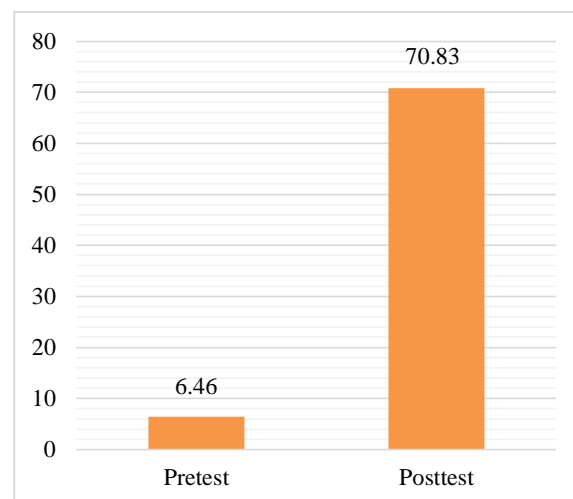
Research instruments were also developed. After the research instrument was revised based on the input and suggestions that had been given, the research instrument was validated by media experts. Table 5 below is the result of the validation of the research instrument. As can be seen, the syllabus validation result was 4.63 (very good category), the lesson plan validation result was 4.85 (very good category), and the pre-test and post-test validation result was 4.50 (very good categories).



**Figure 5.** Research instrument validation results

In the Implementation phase, researchers tested HOTS-based e-modules and learning tools that had been validated in school. This implementation stage was carried out in class X MIPA 8 at SMAN 2 Bangkalan. Research on the development of HOTS-based e-modules used a pre-experimental design with one group pre-test post-test method. Before learning was carried out using HOTS-based e-modules, the students were given a pre-test

first. Then, researchers conducted learning using HOTS-based e-modules. After the learning was carried out, students were given a post-test to determine the effectiveness of the HOTS-based e-module. Figure 6 shows the average pre-test and post-test of students.

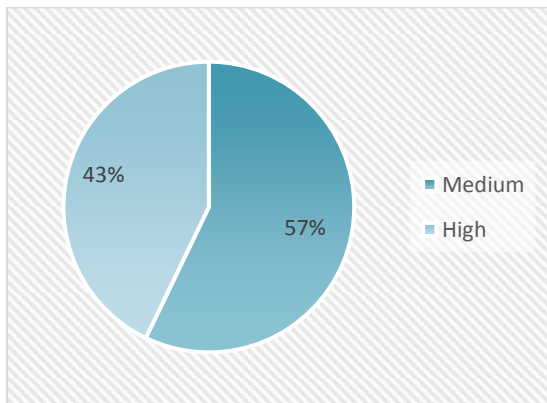


**Figure 6.** Average pre-test and post-test results

Based on Figure 6, it is found that the average pre-test result is 6.46, and the post-test average result is 70.83. This shows that there is an increase in the results of the pre-test to the post-test results of 64.37. This post-test increase indicates an increase in students' problem solving skill by using HOTS-based e-modules using the Sigil application. The results of the pre-test and post-test were analyzed using the standard gain formula and obtained an N-gain of 0.69 (medium category). Figure 7 shows that 43% or 15 students experienced a significant increase in problem-solving skill, and 57% or 20 students experienced a moderate increase in problem-solving skill. This means that the effectiveness of using HOTS-based e-



modules using the Sigil application in the medium category.



**Figure 6.** N-gain result

At the evaluation phase, the researcher asked students to fill out a student response questionnaire related to the use of HOTS-based e-modules in learning activities. The questionnaire given consisted of 10 questions about HOTS-based e-modules. From the results of the distributed questionnaires, it was obtained that the average score of the student response questionnaire was 4.05 (good category). The highest score from the results of the student response questionnaire is 4.6, with the statement that the HOTS-based e-module is easy to carry and practical. In addition, students also strongly agree that the HOTS-based e-module uses the easy-to-use Sigil application, with a score of 4.23. Students also strongly agree that the color combination used in the HOTS-based e-module is very good, with a score of 4.31.

In this study, the HOTS-based e-module validation score using the Sigil application on circular motion material was 4.56 or in a very good category in the material aspect and 4.49

or in a very good category in the media aspect. This research is relevant to [Wijayanti \(2018\)](#) research, which is about the development of an e-book based on Sigil application in the physics subject at SMPN 23 Simbang, Maros regency with a validation score of 3.56 or in a valid category. In this development research, it was also found that the HOTS-based e-module using the Sigil application is easy to use, practical, and easy to carry. This is similar to what [Hastin \(2020\)](#) stated that e-modules using the Sigil application are practical, simple, can be opened anywhere, and can be opened repeatedly, and that is why it is very suitable to be used as a learning medium. In their research, [Liana et al. \(2019\)](#) also stated that interactive e-modules with Sigil applications on dynamic electrical materials are very easy to use and easy to access anywhere and anytime.

This study also found that the development of HOTS-based e-modules can improve students' HOTS learning outcomes. This is because the use of interactive learning media emphasizes independent learning methods that make it easy for students to achieve good learning outcomes because independent learning prioritizes students' self-control ([Sahronih et al., 2019](#)). In addition, the selection of the appropriate learning media can stimulate the cognitive development of students through several phases, including the attention phase, storage phase, reproduction phase, and motivation

phase (Sahronih et al., 2019). This research is relevant to the research of Wati et al. (2019), which is about developing a HOTS-based interactive physics module to improve students' scientific literacy with a gain value of 0.59 in the medium category.

Several studies on e-modules, HOTS, and Sigil applications have been carried out, one of which was conducted by Hanifah (2019), namely the development of the HOTS assessment instrument in elementary schools, which states that if students have high-level thinking skills, students will succeed in understanding a concept. The concepts resulting from higher-order thinking will stick for a long time in the memory of students. Therefore, it is important for students to have HOTS skills so that the concepts obtained are always attached to memory. In this study, it was also found that the HOTS-based e-module using the Sigil application helped in understanding the concepts of students well. Widana (2018) stated that the use of HOTS assessment in learning can significantly improve students' critical thinking skills. This HOTS assessment proved to be very effective in improving critical thinking skills. Therefore, it is highly recommended for teachers to use the HOTS assessment as an alternative assessment to improve students' critical thinking skills.

In this study, it was found that the development of HOTS-based E-modules using the Sigil application made learning more interesting and not boring. McKnown in

his book "audiovisual aided teaching" suggests that learning media makes learning more interesting and can focus students' attention, so that learning media can generate learning motivation and it can be said that learning media become extrinsic motivation for students (Sastramiharja et al., 2021). This is relevant to the research conducted by Fitriana et al. (2021) which found that the development of an electronic module using a Sigil application with integrated geogebra in mathematics is interesting because in the electronic module, there are learning videos, easy-to-understand material, and there are evaluation questions where users can click on the answer directly.

This study found that learning using HOTS-based e-modules made students more motivated. This is similar to what has been stated by Syam (2017) that one of the functions of media in learning is as a game, to catch students' attention and motivate them. Zaman (2018) also stated that the use of learning media in the teaching and learning process can generate new desires and interests, increase motivation, stimulate learning activities, and even bring psychological effects to students. This research is relevant to the research conducted by Munandar et al. (2021) which found out that the development of e-modules using Sigil software can make students interested in learning. This is due to the variety of images and video material in the module so that it can motivate students in learning.

The results of this study contribute to physics education as well as to teachers. For physics education, the results of this study contribute in a way that it enriches learning media regarding the development of HOTS-based e-modules on circular motion material using the Sigil application. The development of HOTS-based e-modules on circular motion material is a new product that has never been developed before. Practically, HOTS-based e-modules can be used as learning media for circular motion material at SMAN 2 Bangkalan. In addition, this research can be used as a reference in the development of further learning media.

#### IV. CONCLUSION AND SUGGESTION

This study concludes that the validation of the HOTS-based e-module using the Sigil application on circular motion material is valid for both the material and media aspects. In addition, the effectiveness of using HOTS-based e-modules using the Sigil application on circular motion material is in the medium category. The results of student responses to HOTS-based e-modules using the Sigil application are also quite practical.

This development research has limitations because the HOTS-based e-module that was developed can only be used for physics learning in class X SMA students on circular motion material. Therefore, the suggestion for further research is to develop e-modules using the Sigil application on other

physics materials. Further research is also suggested to be able to develop e-modules using the Sigil application with other learning approaches. In addition, in making e-modules using the Sigil application, it is better to use files in the form of doc/docx so that it is easier to edit and image files can be avoided because they are a bit difficult to edit.

#### REFERENCES

- Abdullah, R. (2017). Pembelajaran dalam perspektif kreativitas guru dalam pemanfaatan media pembelajaran. *Lantanida Journal*, 4(1), 35-49. <https://doi.org/10.22373/lj.v4i1.1866>
- Agustiani, E. D. (2020). Guru IPA dan calon guru IPA menghadapi soal-soal berkarakter PISA. *Jurnal Studi Guru dan Pembelajaran*, 3(1), 67-86. <https://doi.org/10.30605/jsgp.3.1.2020.237>
- Aisy, D. R., Farida, F., & Andriani, S. (2020). Pengembangan e-modul berbantuan Sigil software dengan pendekatan saintifik pada materi sistem persamaan linier dua variabel (SPLDV). *Edu Sains: Jurnal Pendidikan Sains dan Matematika*, 8(1), 61-71. <https://doi.org/10.23971/eds.v8i1.1499>
- Al-Rabaani, A. H. (2018). Social studies teachers' perspectives on the advantages and challenges of interactive whiteboard application in Oman. *European Journal of Educational Research*, 7(4), 753-762. <https://doi.org/10.12973/eu-jer.7.4.753>
- Amalia, F., & Kustijono, R. (2017). Efektifitas penggunaan e-book dengan Sigil untuk melatih kemampuan berpikir kritis. In *Prosiding Seminar Nasional Fisika (SNF)* (Vol. 1, pp. 81-85).
- Anggraini, R. M. (2019). Developing a module on sound wave of solid, liquid, and gas substances through problem

- solving model with matlab simulation on wave and optical courses. *Jurnal Pendidikan Fisika*, 7(2), 173-182. <https://doi.org/10.26618/jpf.v7i2.1996>
- Bancong, H., Nurazmi, N., Fiskawarni, T. H., & Park, J. (2021). Trending research topics in the field of physics education from 2017 to 2019 in highly reputable international journals. *Jurnal Ilmiah Pendidikan Fisika Al-Biruni*, 10(1), 29–36. <https://doi.org/10.24042/jipfalbiruni.v10i1.8341>
- Creswell, W. J., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative and mixed methods approaches*. SAGE Publications Inc
- Fitriana, R., Rinaldi, A., & Suherman, S. (2021). Geogebra pada aplikasi Sigil sebagai pengembangan e-modul pembelajaran matematika. *Prisma*, 10(1), 106-120. <https://doi.org/10.35194/jp.v10i1.1118>
- Hake, R. R. (1999). Analyzing change/gain scores. *Unpublished.[Online]* URL: <http://www.physics.indiana.edu/~Sdi/AnalyzingChange-Gain.Pdf>, 16(7), 1073–80.
- Hanifah, N. (2019). Pengembangan instrumen penilaian higher order thinking skill (HOTS) di sekolah dasar. *Procciding Conference Series*, 1(1), 1–8.
- Haryadi, R., Situmorang, R., & Khaerudin. (2021). Effectiveness of use direct learning models for higher order thinking skills of pre-service physics teachers. *Journal of Physics: Conference Series*, 1806(1), 1-8. <https://doi.org/10.1088/1742-6596/1806/1/012042>
- Hastin, D. A. (2020). Pengembangan e-modul matematika berbantuan Sigil software dengan pendekatan matematika realistik. *Skripsi*. Universitas Islam Negeri Raden Intan.
- Herawati, N. S., & Muhtadi, A. (2018). Pengembangan modul elektronik (e-modul) interaktif pada mata pelajaran Kimia kelas XI SMA. *Jurnal Inovasi Teknologi Pendidikan*, 5(2), 180–191. <https://doi.org/10.21831/jitp.v5i2.15424>
- Ibrahim, N., & Ishartiwi, I. (2017). Pengembangan media pembelajaran mobile learning berbasis android mata pelajaran IPA untuk siswa SMP. *Refleksi Edukatika: Jurnal Ilmiah Kependidikan*, 8(1), 80-88. <https://doi.org/10.24176/re.v8i1.1792>
- Ibrahim, N. N., Ayub, A. F. M., & Yunus, A. S. M. (2020). Impact of higher order thinking skills (HOTS) module based on the cognitive apprenticeship model (CAM) on student's performance. *International Journal of Learning, Teaching and Educational Research*, 19(7), 246–262. <https://doi.org/10.26803/IJLTER.19.7.14>
- Irfan. (2018). Desain dan uji coba multimedia pembelajaran fisika interaktif untuk siswa kelas XI IPA SMA Muhammadiyah 3 Makassar. *Jurnal Pendidikan Fisika*, 6(2), 175–188. <https://doi.org/10.26618/jpf.v6i2.1307>
- Istikomah, I., Purwoko, R. Y., & Nugraheni, P. (2020). Sigil: Pengembangan E-Modul berbasis realistik pada materi lingkaran untuk siswa kelas VIII SMP. *JP3M (Jurnal Penelitian Pendidikan Dan Pengajaran Matematika)*, 6(2), 91–98. <https://doi.org/10.37058/jp3m.v6i2.1957>
- Johnson, J. D., & Williams, C. (2020). Mobile learning features preferred: an examination of students in The United Arab Emirates. *International Electronic Journal of Mathematics Education*, 15(3), em0596. <https://doi.org/10.29333/iejme/8325>
- Kantar, L. D. (2014). Assessment and instruction to promote higher order thinking in nursing students. *Nurse Education Today*, 34(5), 789–794. <https://doi.org/10.1016/j.nedt.2013.08.013>
- Laili, I. (2019). Efektivitas pengembangan e-modul project based learning pada mata

- pelajaran instalasi motor listrik. *Jurnal Imiah Pendidikan Dan Pembelajaran*, 3(3), 306-315. <https://doi.org/10.23887/jipp.v3i3.21840>
- Liana, Y. R., Ellianawati., & Hardyanto, W. (2019). Pengembangan e-modul interaktif berbasis android menggunakan Sigil software pada materi listrik dinamis. *Prosiding Seminar Nasional Pascasarjana Universitas Negeri Semarang*, 2(1), 926–932.
- Lin, M. H., & Chen, H. G. (2017). A study of the effects of digital learning on learning motivation and learning outcome. *Eurasia Journal of Mathematics, Science and Technology Education*, 13(7), 3553-3564. <https://doi.org/10.12973/eurasia.2017.00744a>
- Mahdum, M., Hadriana, H., & Safriyanti, M. (2019). Exploring teacher perceptions and motivations to ICT use in learning activities in Indonesia. *Journal of Information Technology Education: Research*, 18, 293–317. <https://doi.org/10.28945/4366>
- Munandar, R. R., Cahyani, R., & Fadilah, E. (2021). Pengembangan e-modul Sigil software untuk meningkatkan hasil belajar siswa di masa pandemi Covid-19. *Biodik*, 7(4), 191–202. <https://doi.org/10.22437/bio.v7i4.15204>
- Purnamasari, K., & Lestari, H. P. (2017). Pengembangan perangkat pembelajaran untuk SMP Kelas VII materi segitiga dan segi empat melalui pendekatan kontekstual dan model pembelajaran probing prompting. *Jurnal Pendidikan Matematika*, 6(1), 18–30.
- Sahronih, S., Purwanto, A., & Sumantri, M. S. (2019). The effect of interactive learning media on students' science learning outcomes. *ACM International Conference Proceeding Series, Part F148391*, 20–24. <https://doi.org/10.1145/3323771.3323797>
- Sastramiharja, U. S., Nathanael, L., Sari, R. W. P., & Kusriani, F. (2021). Pengaruh penggunaan media video terhadap motivasi belajar peserta didik. *Edutech*, 20(1), 72–86. <https://doi.org/10.17509/e.v20i1.30997>
- Septiani, A. N. N. S. I., & Rejekiningsih, T. (2020). Development of interactive multimedia learning courseware to strengthen students' character. *European Journal of Educational Research*, 9(3), 1267-1280. <https://doi.org/10.12973/eu-er.9.3.1267>
- Sugiani, K. A., Degeng, I. N. S., Setyosari, P., & Sulton. (2019). The Effects of electronic modules in constructivist blended learning approaches to improve learning independence. *International Journal of Innovation, Creativity and Change*, 9(10), 82–93.
- Syam, N. (2017). Pengembangan media tutorial pembelajaran IPA berbasis web untuk peserta didik kelas VIII SMPN 5 Pallangga. *Jurnal Pendidikan Fisika*, 5(2), 156–174. <https://doi.org/10.26618/jpf.v5i2.621>
- Wati, R. W. I., Lesmono, A. D., & Prastowo, S. H. B. (2019). Pengembangan modul fisika interaktif berbasis HOTS (High Order Thinking Skill) untuk meningkatkan kemampuan literasi sains siswa SMA pada pokok bahasan suhu dan kalor. *Jurnal Pembelajaran Fisika*, 8(3), 202–207. <https://doi.org/10.19184/jpf.v8i3.15225>
- Wiana, W., Barliana, M. S., & Riyanto, A. A. (2018). The effectiveness of using interactive multimedia based on motion graphic in concept mastering enhancement and fashion designing skill in digital format. *International Journal of Emerging Technologies in Learning*, 13(2), 4-20. [doi: 10.3991/ijet.v13i02.7830](https://doi.org/10.3991/ijet.v13i02.7830)
- Widana, I. W. (2018). Higher order thinking skills assessment towards critical thinking on mathematics lesson. *International Journal of Social Sciences and Humanities*, 2(1), 24–32. <https://doi.org/10.29332/ijssh.v2n1.74>
- Wijayanti, M. (2018). Pengembangan e-book

- IPA fisika berbasis program Sigil peserta didik SMPN 23 Simbang Kabupaten Maros. *In Prosiding Seminar Nasional Fisika PPs Universitas Negeri Makassar*, 1, 1–5.
- Zaman, A. Q. (2018). Pengaruh penggunaan media pembelajaran kreatif terhadap hasil belajar IPS siswa sekolah dasar Negeri Di Surabaya Selatan. *Buana Pendidikan: Jurnal Fakultas Keguruan Dan Ilmu Pendidikan*, 11(20), 79-84. <https://doi.org/10.36456/bp.vol11.no20.a1356>