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Training Evaluation For Scientific-Based Electronic Module Development Using Sigil Software In MGMP Physics Teacher Surakarta

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Abstrak

Guru yang profesional dan terampil dalam pengajaran berbasis e-learning dibutuhkan untuk mendukung implementasi pengajaran yang sesuai dengan dinamika perkembangan ilmu pengetahuan dan teknologi. Untuk itu, pelatihan diperlukan untuk keberlanjutan, baik di sekolah maupun di luar sekolah. Pelatihan terkait e-learning membutuhkan dana yang tidak sedikit. Hal ini dapat menjadi masalah dalam pengembangan profesional guru Fisika MGMP di Surakarta. Untuk mengatasi masalah ini, Program Studi Pendidikan Fisika FKIP UNS bersama Asosiasi Guru Fisika (MGMP) Surakarta mengadakan pelatihan untuk mengembangkan modul elektronik fisika berbasis sains menggunakan perangkat lunak sigil pada beberapa topik, yaitu (1) Elastisitas dan Hukum Hooke, (2) Suhu, Panas, dan Perpindahan Panas, (3) Dinamika Rotasi, (4) Fluida Statis, (5) Fluida Dinamis, dan (6) Teori Kinetik Gas. Pelatihan ini terdiri dari empat kegiatan, yaitu (1) penjelasan materi tentang hakikat modul elektronik berbasis ilmiah, (2) pengenalan sigil dan prosedur penggunaannya, (3) pelatihan dan praktik pengembangan modul elektronik berbasis ilmiah menggunakan perangkat lunak Sigil, dan (4) diskusi hasil pengembangan modul elektronik..

Kata kunci: *Pengabdian; Modul Elektronik; Sigil*

Abstract

Professional and skilled teachers in e-learning-based instructions are needed to support the implementation of instructions that corresponds to the dynamics of the development of science and technology. For this reason, training is necessary for sustainability, both at school and outside of school. E-learning-related training requires no small amount of funds. That can be a problem in the professional development of the MGMP Physics teacher in Surakarta. To overcome these problems, the Physics Education Study Program FKIP UNS with the Physics Teacher Association (MGMP) Surakarta held training to develop scientific-based physics electronics modules using sigil software on several topics, that is (1) Elasticity and Hooke's Law (2) Temperature, Heat, and Heat Transfer, (3) Rotational Dynamics, (4) Static Fluids, (5) Dynamic Fluids, and (6) Kinetic Theory Gas. This training has four activities, that is (1) the explanation of the material about the nature of scientific-based electronic modules, (2) the introduction of the sigil and the procedures for its use, (3) training and practice to develop scientific-based electronic modules using Sigil software, and (4) discussion of the results of the electronic module development.

Keywords: *Service; Electronic Module; Sigil*

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Introduction

The 2013 curriculum is the current curriculum in Indonesia. The 2013 curriculum aims to prepare Indonesian people to have the ability to live as individuals and citizens who are faithful, productive, creative, innovative, and able to

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contribute to the life of society, nation, state, and world civilization (Permendikbud No. 36 Th. 2018). To achieve this goal, the 2013 Curriculum is implemented by perfecting the mindset related to learning. Based on Permendikbud No 36 of 2018, several improvements in mindset related to learning include, learning can be done using the internet network, and students are required to actively seek knowledge/information using a scientific approach. Learning through a scientific approach is a learning process designed in such a way that students actively construct concepts, laws, or principles through the stages of observing (to identify or find problems), formulating problems, submitting, or formulating hypotheses, collecting data with various techniques, analyzing data, draw conclusions and communicate the concepts, laws or principles found (Machin, 2014).

Learning by using internet networks is also often used, especially in the current pandemic situation. In the situation of the coronavirus disease, 2019 (COVID-19) pandemic which hit almost all countries, learning in Indonesia is carried out online or often referred to as distance learning (PJJ) (SE Mendikbud No. 4 Th. 2020). Implementation of PJJ requires internet networking and the use of various types of electronic media that can be accessed via the internet. Flexible and easily accessible electronic media can accelerate the process of knowledge transformation (Hakeu et al., 2023) Electronic media that can be used by teachers and can be accessed online are very diverse, including the use of e-books, experimental simulations, or electronic modules. Various electronic learning media are expected to support the implementation of scientific-based learning.

However, in implementing PJJ, several problems were encountered by teachers, students, and parents. These problems include students having difficulty concentrating on studying at home, complaining because they are only given a lot of assignments without understanding the material presented by the teacher, and complaining because the internet quota is high when they have to do online learning using video conferencing. One solution to minimize the problems is to use electronic modules that students can access online with less quota usage than video conferencing. By using the electronic module, students not only learn through questions, but students can also understand the material being taught.

Electronic modules present self-learning materials that are arranged systematically as the smallest learning to achieve certain learning objectives presented in an electronic format including animation, audio, and navigation, making users more interactive (Sugianto et al, 2013). Electronic modules not only can make the learning process more interesting and interactive but also can be done anytime and anywhere so the quality of learning can improve (Cecep, 2013). However, there are still a few electronic modules in physics that can be used by teachers to teach.

Several electronic modules with sigil software have been developed. Based on research that has been conducted by Hastin (2020) shows that e-modules assisted by sigil software on relations and functions material are feasible and effective to be used as learning media because of 32 students the average score of attractiveness obtained is 3.48 on very attractive criteria. Another research that has been conducted by Aisy (2019) states that sigil software-assisted e-modules with a scientific approach to SPLDV material are valid (appropriate), interesting, and effective for use as learning resources because of the 29 class VIII A students the average score of attractiveness is obtained is 3.45 with the criteria of "Very Interesting". One of the electronic modules that have been developed in physics learning uses Sigil software. However, this module has not been accompanied by Student Activity Sheets which guide students to carry out exploration and discussion activities. This makes this module not meet the scientific approach, namely 5M.

In addition, the use of Sigil-based electronic modules has proven effective in improving the quality of learning. Research conducted by Malau et al. (2023) shows that Sigil-based electronic module development training at SMA Darussalam Ciputat succeeded in improving the skills of teachers and students in using digital learning technology. This training has provided new insights to teachers regarding creating interactive learning materials that suit student needs.

A sigil is an editor software in epub format and open source (Hidayat, 2017). Epub (electronic publication) is a digital standard format introduced by the International Digital Publishing Forum (IDPF) (Kennedy, 2011). Sigil software has been widely used in the manufacture of electronic learning media. One of them is used in making physics e-books and has succeeded in improving students' critical thinking skills (Amalia, 2019). In addition, this software has also been used in the development of Android-based interactive e-module learning media and has been proven to be

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able to increase understanding of the concept of Dynamic Electricity. Sigil software is proven to be able to make electronic learning media more interesting, useful, and easy for students to use (Liana, 2019).

Based on the analysis of partner problems, RG Physics Learning Innovation wants to play an active role in overcoming these obstacles. Physics Education Study Program, especially RG Physics Learning Innovation can help to optimize digital technology innovation in physics learning, in addition to preparing resilience, adaptability, critical thinking skills, and the ability to innovate Physics teacher candidates and Physics teachers. Digital technology-based innovations that have great opportunities are the development of learning models, learning media, and learning instruments. This is in line with the RG Roadmap for Physics Learning Innovation.

The solution offered by the RG Physics Learning Innovation team in this PKM activity is to provide training on: Preparation of scientific-based physics electronic modules using sigil software on Physics material for class XI even semester which includes six subject matter, namely (1) elasticity and Hooke's law, (2) temperature, heat, and heat transfer, (3) rotational balance and dynamics, (4) static fluids, (5) dynamic fluids, and (6) the kinetic theory of gases.

Method

The implementation of community service is a collaboration with MGMP Physics SMA Surakarta City partners. The activity is targeted to be attended by 30 Physics Teachers from Surakarta City High School. The method of activity is by presenting material (presentations and discussions), and direct training to teachers on the application of scientific-based physics electronic modules using sigil software. The court activities are presented in Table 1.

Table 1. The Community Service Activity

Activity	Material	Method
1	The essence of scientific-based electronic modules	Presentation and discussion
2	Introduction to sigil software and how to use it	Presentation and discussion
3	Practice developing scientific-based physics electronics modules using sigil software	Discussion and practice
4	Discussion of the results of electronic modules	Presentation and discussion

All training activities will be attended by all MGMP Physics teachers in Surakarta City. At the end of the training, the training participants will then be asked to fill out a questionnaire regarding their level of satisfaction and suggestions for the training activities carried out.

The results of the questionnaire will be used as a basis for evaluating community service activities that have been carried out. Materials and methods contain the main materials used in research and methods used in solving problems including analytical methods.

Results and Discussion

The service activity begins with conducting a preliminary study by distributing questionnaires via Google form to all members of the Surakarta City Physics MGMP. The preliminary study aims to find out the background of the training participants, the participants' experience in implementing and developing sigil-based electronic modules, and the participants' willingness to take part in the training. Based on preliminary study data, the training participants were attended by 63.6% female teachers and 36.4% male teachers. Most of the participants were in the range of 30-39 years, which was 45.5%. While the least, namely 18.2%, are in the age range of 50 and above. Participants were also asked about their experience in participating in electronic module training using the previous sigil software. As a result, 36.4% of participants had attended training on using sigil software and another 63.6% had never attended training on using sigil software.

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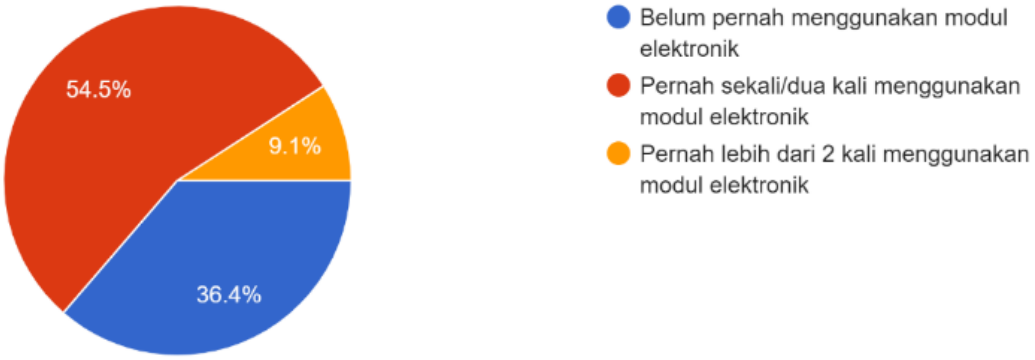

Figure 1. Data on the Experience of Trainees in Implementing Electronic Modules in Class

Data on the experiences of participants in implementing electronic modules in class can be seen in Figure 1. Based on Figure 1, 36.4% of participants had never used electronic modules in class and only 9.1% of participants had used electronic modules more than 2 times in their learning. Upon further investigation, 18.2% of participants thought that implementing electronic modules in class was relatively difficult, although another 54.5% thought that implementing electronic modules in class was relatively easy. The difficulties experienced by participants included that some teachers had weaknesses in operating IT, difficulties in making electronic modules to be used, and students who still asked for explanations so the implementation of electronic modules in class did not go well.

In addition to experience using electronic modules, participants were also asked about their experiences in developing electronic modules, either with sigil software or with other software. As a result, 45.5% of participants had never made/developed electronic modules, 18.2% of participants had made electronic modules using other software, and 36.4% of participants had used sigil software in making electronic modules.

After the preliminary study, the Physics Learning Innovation Research Group together with students who contributed to the service carried out initial coordination activities. Initial coordination activities with the team were carried out in the 2nd week of April. This activity discusses the division of tasks when carrying out community service and the technical implementation of activities. The focus group discussion (FGD) documentation can be seen in Figure 2.

Figure 2. Documentation of Initial Coordination Activities

Coordination activities with partners are carried out via Whatsapp chat and discuss the timing of activities. Coordination with representatives of the Surakarta City Physics MGMP resulted in the implementation of activities being held on 6, 7, 13, and 14 August 2021. The material guide preparation activity consisted of preparing material 1) The nature of scientific-based electronic modules, 2) an Introduction to sigil software and installation procedure, and 3) the Handbook on how to use sigil software in making modules.

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Figure 3 Cover of the Sigil-Based Electronic Module on the Topic of Temperature, Heat, and Heat Transfer

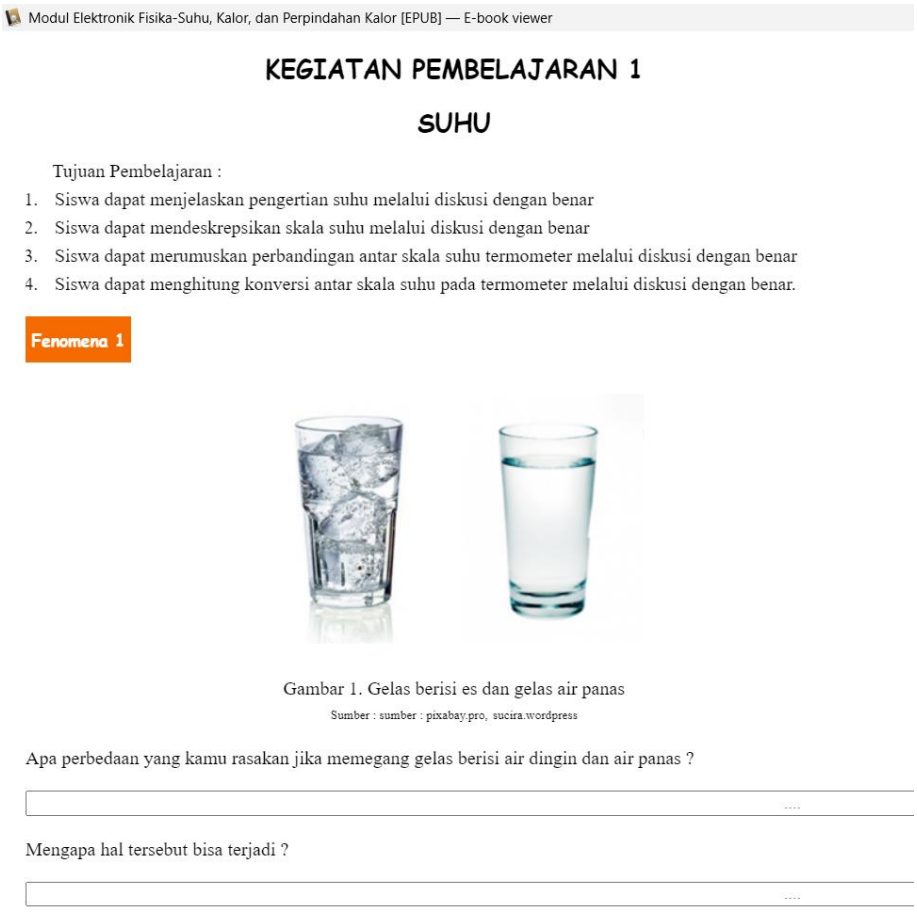

Figure 4. Initial Display of Learning Activity 1

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After preparing the material guide, the community service activities are carried out in 4 days according to the agreed date. The dedication activity began with a speech by the Head of the Physics Education S1 Research Group FKIP UNS and the Head of the Surakarta City High School Physics MGMP. Then, it was continued with material about the essence of scientific-based electronic modules delivered by Dr. Elvin Yuliana Ekawati, S.Pd., M.Pd. Then, Sabrina Kusuma Dewi, S.Pd. delivered an introduction to sigil software and how to use it. After giving these two materials, the training participants were divided into 6 (six) groups to carry out hands-on practice and were guided by lecturers and students. One of the results of the sigil software-based module can be seen in Figure 3 - 5. Figure 4 shows the beginning part of Learning Activity 1 in the electronic module. It presents the learning objectives related to temperature, followed by an introductory phenomenon (Phenomenon 1) that compares a glass of ice water and a glass of hot water to engage students in observing temperature differences through tactile experience. Figure 5 presents a discussion worksheet from the electronic module that helps students understand how fixed points (boiling and melting points of pure water) are used to define temperature scales. It includes a visual comparison of Celsius, Fahrenheit, Reaumur, and Kelvin scales, along with a table for students to fill in key values such as upper and lower fixed points and the number of divisions in each scale.

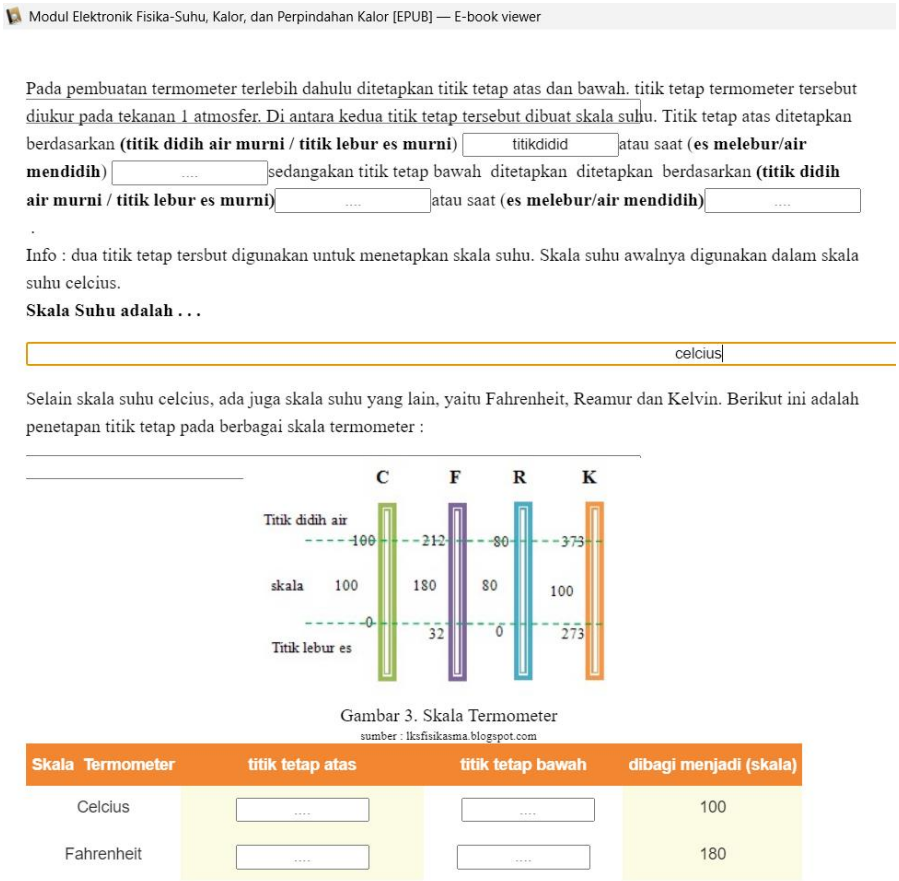

Figure 5 Discussion Worksheet in the Electronic Module

Table 2. Summary of Participant Ratings on Training Aspects

Training Aspect	Very Poor (1)	Poor (2)	Fair (3)	Good (4)	Very Good (5)
Training Content	0.0	0%	0%	0%	100%
Training Technicals	0.0	0%	0%	18,20%	81,80%
Teaching Methodology	0.0	0%	0%	45,50%	54,50%
Q&A Session	0.0	0%	0%	36,40%	63,60%
Understanding Sigil	0.0	27,30%	27,30%	27,30%	18,20%

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After the implementation of the activity, an evaluation is carried out by distributing questionnaires via Google Forms to the training participants. Questions in the evaluation include the attractiveness or satisfaction of the participants regarding the training content, the technical implementation of the training, and the teaching methods used during the training. In addition, questions were also asked about the experiences, understanding, and perceptions of the training participants regarding the Electronic Module using the Sigil Software.

Based on the evaluation results summarized in Table 2, it can be concluded that the training program was well-received by the participants. All participants rated the training content as very good, reflecting the relevance and clarity of the material provided. Regarding the technical implementation of the training, 81.8% of participants expressed very high satisfaction, while the remaining 18.2% rated it as good. The teaching methodology also received positive feedback, with 54.5% considering it very good and 45.5% rating it as good. Similarly, the question-and-answer sessions were perceived as beneficial, with 63.6% of participants rating them very good and 36.4% good, indicating that these sessions effectively addressed participants' confusion and supported hands-on practice.

The level of participant satisfaction with the training is also supported by the method used in the training on making electronic modules using the professional 3D flip program for science teachers in welcoming the industrial revolution 4.0 era at SMPN 11 Bengkulu City (Purwanto & Risdianto, 2022). Training carried out in the form of direct training, discussions, and through books accompanied by video tutorials has been proven to provide motivation to teachers to further improve their abilities in creating more interesting and innovative teaching materials. Training on making electronic modules for MGMP Science in Ogan Ilir Regency, which was also carried out through material delivery, discussion and direct practice, was also proven to increase teacher competency in making E-Modules (Akhsan et.al., 2024)

However, participants' understanding of the training material, particularly the use of Sigil software, was more varied. Only 18.2% of participants reported a very good understanding, while 27.3% rated their understanding as good, fair, or poor respectively. This variation highlights a gap in digital competence, particularly in operating content-authoring tools such as Sigil. These findings are supported by responses regarding the perceived difficulty of using Sigil software. A total of 9.1% of participants considered the software very difficult to use, 9.1% found it difficult, and 36.4% rated it as moderately difficult. Participants indicated that challenges stemmed from the time-consuming process of creating modules, the complexity of the interface, limited understanding of programming languages, and a strong need for direct guidance due to limited experience with digital tools.

This finding is consistent with Hsu and Lin (2020), who demonstrated that reflection and instructional design strategies can effectively enhance teachers' technological skills but require sustained support for practical application. The need for scaffolding and guided practice is further emphasized by Mbambo and Du Plessis (2024), who caution that digital tools, while beneficial, may exacerbate socio-economic and skills gaps without appropriate training.

Further insights can be drawn from participants' backgrounds. A significant proportion, 63.6%, had never attended previous workshops or training sessions on using Sigil, and 45.5% had never created an electronic module at all. While 54.5% had used an e-module once or twice, only 36.4% had experience using Sigil specifically. Despite these limitations, there is a positive outlook for future use of electronic modules, with 45.5% of participants indicating that they would use e-modules more frequently in the classroom. This optimism suggests that with ongoing support and more accessible training, especially through step-by-step tutorials and offline workshops, teacher confidence and capacity in developing digital learning materials can improve significantly.

Comparable findings are reported in the study by Nilsen et al. (2020), which emphasizes the importance of involving teachers as subject matter experts in the design of digital learning resources. Training programs that include interactive elements, step-by-step guidance, and interdisciplinary collaboration have been shown to enhance teacher engagement and development. Participants in this training recommended future improvements such as conducting offline sessions (with proper health protocols), providing accessible video tutorials, and allocating more time for individual guidance. These suggestions align with the findings of Malau et al. (2023), who stressed the importance of video-based instruction, extended training time, and active participant involvement for long-term integration of digital tools in teaching. Overall, this study confirms that training programs on electronic module development using

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Sigil can significantly benefit teacher professional development, especially when coupled with reflective instructional design and adequate technical support. This echoes conclusions from Latuapo (2023) that module-based training enhances teacher professionalism and digital capacity, particularly when accompanied by structured support and hands-on practice.

Conclusion

The conclusion that can be drawn from the training activities for the preparation of scientific-based physics electronic modules using sigil software in the city of Surakarta is that the implementation of the training can improve the insights and skills of the Surakarta MGMP Physics teacher regarding the application and development of the Physics electronic module using sigil software. Based on the results of the evaluation and the suggestions given by the participants, improvements that can be made in the next training include conducting offline training in compliance with health protocols, providing online tutorials on YouTube or certain sites, and providing more time for explanations and assistance to participants.

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