IMPROVING TEACHER PROFESSIONAL COMPETENCE THROUGH THE TRAINING OF INFORMATION TECHNOLOGY-BASED LEARNING MEDIA IN SOUTHEAST SULAWESI

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Abstract:
This article aims to improve the competence of MIPA (Mathematics and Natural Sciences) teachers using Information Technology (IT)-based learning media. A participatory action research (PAR) was conducted on twenty-five teachers from 3T regions (Frontier, Outermost, and Least Developed) of Konawe Kepulauan Regency. The findings revealed that: 1) The initial comprehension of MIPA teachers was in the low category, with an average score of 43.84. 2) The competence level of MIPA teachers after training was high, with 81.12. 3) Training using IT-based learning media effectively improved teacher competence, particularly the professional competence of teachers in the external domain. The main implementation constraints encountered by teachers were a lack of knowledge about software application installation procedures and a lack of optimality in utilizing the various features possessed by each application. Therefore, IT training is needed to improve teachers' professional competence in optimizing the use of various applications in the 3T area.

Abstrak:
Artikel ini bertujuan untuk meningkatkan kompetensi guru MIPA (Matematika dan Ilmu Pengetahuan Alam) dengan menggunakan media pembelajaran berbasis Teknologi Informasi (TI). Penelitian tindakan partisipatif (PAR) dilakukan terhadap dua puluh lima guru daerah 3T (Terdepan, Terluar, dan Tertinggal) Kabupaten Konawe Kepulauan. Hasil penelitian menunjukkan bahwa: 1) Pemahaman awal guru MIPA berada pada kategori rendah dengan rata-rata skor 43,84. 2) Tingkat kompetensi guru MIPA setelah pelatihan termasuk tinggi yaitu 81,12. 3) Pelatihan penggunaan media pembelajaran berbasis IT efektif meningkatkan kompetensi guru, khususnya kompetensi profesional guru pada ranah eksternal. Kendala utama implementasi yang ditemui guru adalah kurangnya pengetahuan tentang tata cara instalasi aplikasi perangkat lunak dan kurang optimalnya penggunaan berbagai fitur yang dimiliki setiap aplikasi. Oleh karena itu, pelatihan IT diperlukan untuk meningkatkan kompetensi profesional guru dalam mengoptimalkan penggunaan berbagai aplikasi di bidang 3T.

INTRODUCTION

Teacher knowledge of technology is important in education. Many scientific findings have revealed that teacher competence is determined by teachers' attitudes and the acceptance of technology (Yuen & Ma, 2008). There are currently a variety of technologies that can be used in education, so teachers who can use technology are required (Lee, Longhurst, & Campbell, 2017). In response, the Indonesian government has prepared a variety of facilities and learning devices to aid in implementing digitalization and computerization-based learning processes, such as providing electronic system-based textbooks for students and teachers. The Indonesian government has also attempted to conduct various trainings and workshops for teachers in South East Sulawesi, such as curriculum development, lesson module development, lesson study programs, making teaching aids and learning media, and so on, through the Southeast Sulawesi Provincial Government's Education and Culture Department. Indeed, the sustainability of these activities is not visible in the learning process at schools, particularly schools located on the outskirts of cities or in frontier, outermost, and least developed, often referred to as 3T regions such as Konawe, Bombana, and Konawe Kepulauan Regency (Nurjanah, Mardia, & Turmudi, 2021).

Information and Communications Technology (ICT) has been developing in education. ICT is a learning process that involves using all types of electronic devices to support learning, making learning more engaging, effective, and efficient (Syukur, 2014). Indeed, ICT assistance for 3T regions must continue to be rolled out and developed with the help of various elements of society. Partnerships, however, must be carefully designed so that all parties involved can contribute to the greatest extent possible (Warsihna, 2013), particularly academics, including lecturers, who must perform community service.

One application of the educational technology concept is using ICT in education. Educational technology is a discipline that is constantly evolving in tandem with the advancement of technology. However, the essence of educational technology is to solve educational problems effectively and efficiently. There are several characteristics of problem-solving in educational technology, including 1) seeing the problem inclusively using a systems approach; 2) effectively and efficiently utilizing technology, both as a way and a product; 3) optimally and appropriately utilizing learning resources; and 4) being oriented to the needs of users (students, teachers, and educational personnel) (Koesnandar, 2013). Based on these principles, schools should use ICT in various settings, including those in 3T regions. The region's conditions and schools in remote areas are generally deficient regarding teachers, facilities, and learning resources. These flaws can be mitigated with ICT.

Various issues impede the education process in Southeast Sulawesi's 3T regions. These problems include a lack of access to information and limited human resources in using information technology, limited training opportunities for teacher development, a lack of facilities and infrastructure, and a lack of qualified teaching staff. This issue is exacerbated by the findings of the BAN S/M (National Accreditation Board of

School/Madrasah) visit to Southeast Sulawesi Province's 3T regions, where teachers' general pedagogical and professional competence remains relatively low (76%). Likewise, the findings of a study conducted by Syukur (2014) showed that the use of ICT in learning was rarely used by 62.15% of teachers, 34.95% of teachers had a poor understanding of ICT, and 10.03% of existing facilities and infrastructure did not support learning.

Several studies related to IT have been conducted. Rias (2013) stated that computer visualization research has received much attention. However, research on the use of ICT with locus in 3T regions from various perspectives remains unexplored. For instance, Warsihna (2013) conducted research that investigated the use of ICT from the principles of empowerment, bottom-up, sustainability, modern learning approaches, and partnerships. The study's findings revealed that using ICT in 3T regions based on these five principles could encourage teachers to improve the quality of learning, motivate students to attend school regularly, and increase community participation in sending their children to higher education. In addition, educational personnel management in 3T regions can be directed and of high quality if it meets the needs of both teachers and schools in the teaching and learning process (Asiska & Nurmahmudah, 2022). Educator management in 3T regions can be high quality if these issues are addressed. Rivalina and Siahaan (2020), who investigated the shift of learning activities from teacher-centered to student-centered using ICT, discovered that using ICT in learning stimulates teachers to implement student-centered learning models gradually.

Furthermore, another study on the development of ICT-based learning innovation discovered that each school requires one teacher to be prepared to be an ICT-based learning innovator (Koesnandar, 2018). Moreover, Lestari (2015) researched various factors that influence teachers' use of ICT and different initial teacher responses to the use of ICT. According to the findings of this study, the constraints on teachers' use of ICT were lack of access, lack of ICT facilities, learning not to integrate ICT, lack of teacher knowledge of ICT, and teachers unwilling to use it. On the other hand, a study discovered that the initial assumptions of principals, teachers, parents, and community leaders in 3T regions were very positive and supportive of ICT utilization activities in learning activities at their schools. It is expected that respondents will be able to gradually improve student learning outcomes by using ICT regularly (Rivalina & Siahaan, 2013).

Researchers have been drawn to fill the research gap related to the use of ICT in frontier, outermost, and least developed regions using a participatory action research design that focuses on the use of Microsoft PowerPoint, iSpring Suite, and Macromedia Flash as teacher learning media in Southeast Sulawesi, which is included in the 3T regions, namely Konawe Kepulauan Regency. Based on preliminary research, various preliminary facts were discovered that various problems that impede the learning process in the 3T regions of Southeast Sulawesi, such as lack of access to information and limited human resources in using information technology, limited training opportunities for teacher development, lack of facilities and infrastructure, and lack of qualified teaching staff, still frequently arise.

The issue was exacerbated by the findings of the BAN S/M visit to Southeast Sulawesi Province in the 3T regions in July 2020, which revealed that teachers' general pedagogical and professional competence remains relatively low (76%). Teachers still preferred conventional learning methods, such as using only printed textbooks and teaching aids from the library. Some other teachers found it difficult to create simple computer-based learning media, such as PowerPoint and Macromedia Flash, which impact students' interest and motivation to learn and understand concepts. Thus, using the Participatory Action Research (PAR) design, this study examined and specifically found teachers' initial knowledge of using technology-based learning media before training, teachers' understanding after training, and teachers' ability to implement technology-based learning media in the learning process. These research results will help teachers improve their ability to use IT in the 3T regions.

RESEARCH METHOD

The Participatory Action Research (PAR) design is used in this study. The PAR research design is a transformative, collaborative, and democratic approach to educational research as a paradigm, methodology, and process that aids higher education in developing professional learning and research (Wood, 2020; Zuber-Skerritt, 2018). This study has four stages of implementation: planning, action, observation, and reflection. The mentoring action was carried out for 25 MIPA (Mathematics and Science) teachers in the 3T regions, namely Konawe Kepulauan Regency, Southeast Sulawesi Province. Those schools and teachers were selected because they represented schools in the 3T area and every teacher in the field of study of MIPA at all levels of schools. The participants of this study were recruited purposively from the field of study of MIPA, and the locations or schools were selected based on the category of 3T schools representing the level and type of schools. This also meant that schools not from the 3T area and teachers who do not teach science subjects were not selected for this study. Training in this study was conducted through discussions about the importance of using information technology in developing learning media that teachers would use in the classroom, including Macromedia Flash, I-Spring Suite, and PowerPoint. This activity was aimed at mathematics and science teachers in the 3T regions of Konawe Kepulauan Regency, Southeast Sulawesi Province. The research activities proceed as follows:

1. Step 1: Activities at this stage were preparing teacher competency, assessment tools, and training modules, conducting an initial assessment of teacher competency using ICT in the learning process (pretest), and assigning teachers to groups based on the pretest results.
2. Step 2: Activities at this stage were providing teachers with introductory materials on the use of ICT in learning, based on the pretest grouping of teachers, providing teachers with training in creating learning media using Macromedia Flash, I-Spring Suite, and PowerPoint, allowing teachers to ask clarifying questions about the methods and challenges of developing learning media with Macromedia Flash, I-Spring Suite, and PowerPoint.

3. Step 3: Activities at this stage assessed and tested the teacher's understanding (posttest). The assessment was carried out through questions about training materials in the form of multiple choice and application utilization practices. The question instruments were validated through trials and expert tests.
4. Step 4: Activities at this stage allowed teachers to use ICT in the learning process and assessed teachers' proficiency in integrating ICT into the learning process.

The PAR cycles, namely diagnosis, action, measurement, and reflection, were used in this study to collect the data.

RESULTS AND DISCUSSION

Initial Understanding of Teachers of Technology-Based Learning Media

Based on the results of data collection through an initial competency test of mathematics and MIPA teachers about participant understanding before being given the treatment of mentoring the use of IT-based learning media, the assessment obtained from 25 participants is presented as follows:

Table 1. Initial Knowledge Scores of Participants in the Teacher Competency Improvement (PKG) Program on the Use of IT-Based Learning Media in Konawe Kepulauan Regency

Respondent Code	Score	Competency Score	Criteria
G-MAT-01	18	72	Completed
G-MAT -02	12	48	Incomplete
G-MAT -03	12	48	Incomplete
G-MAT -04	9	36	Incomplete
G-MAT -05	11	44	Incomplete
G-MAT -06	11	44	Incomplete
G-MAT -07	8	32	Incomplete
G-MAT -08	12	48	Incomplete
G-MAT -09	10	40	Incomplete
G-MAT -10	18	72	Completed
G-MAT -11	12	48	Incomplete
G-IPA -12	10	40	Incomplete
G-IPA -13	11	44	Incomplete
G-IPA -14	10	40	Incomplete
G-IPA -15	12	48	Incomplete
G-IPA -16	10	40	Incomplete
G-IPA -17	10	40	Incomplete
G-IPA -18	12	48	Incomplete
G-IPA -19	9	36	Incomplete
G-IPA -20	13	72	Competed

G-IPA -21	11	44	Incomplete
G-IPA -22	11	44	Incomplete
G-IPA -23	9	36	Incomplete
G-IPA -24	11	44	Incomplete
G-IPA -25	10	40	Incomplete
Total	274	1096	
Average	10.96	43.84	Incomplete
Completeness	3	12%	Completed 12%, Uncompleted 88%

Based on the results of the offline activity in Table 1, the understanding of mathematics and natural science teachers on the PKG material on the Utilization of IT-Based Learning Media in the table above, the completeness data was only 12%, indicating that it was 88% incomplete. Furthermore, as shown in the following table, the data was processed and summarized in detail based on the division of training materials that were distributed to PKG participants:

Table 2. Participants' Initial Ability Data on the PKG Activity Material (IT-Based Learning Media Offline)

Training Material	Score	Number of Participants	Frequency	Percentage (%)	Category
Ms. Powerpoint	24	25	11	44.00	Low
iSpring Suite	40	25	7	28.00	Very Low
Macromedia Flash	36	25	8	32.00	Very Low

Based on Table 2, mathematics and science teachers have a low level of understanding about the use of IT-based learning media (offline). Using Microsoft PowerPoint media reveals that 44% of teachers have a low understanding; iSpring Suite media reveals that 28% of teachers have a very low understanding; and Macromedia Flash media reveals that 32% of teachers have a very poor understanding. This indicates that MIPA teachers in the 3T area of Konawe Kepuluan Regency are mostly in the low category. This can be discussed in various facts, including teachers are still very limited in utilizing IT-based learning media offline, low literacy levels, limited learning resources and information, minimal availability of IT devices, and low motivation, interest, and curiosity of teachers about the advantages that can be obtained in the use of IT.

Based on the initial competence test results on IT-based learning media (offline applications), teachers generally did not have competence in utilizing offline IT-based learning media. Data also shows that the utilization of Microsoft PowerPoint media only has a medium category, iSpring Suite media has a very low category, and Macromedia Flash material is also very low.

Training using ICT-Media

After collecting data on teachers' understanding and competence in using ICT-based learning media, the teachers were given a three-day training led by three experts

in the field of ICT-based learning media. During the training, teachers were trained to use Microsoft PowerPoint, iSpring Suite, and Macromedia Flash applications as theoretical and practical learning media and to design interactive questions. The following table shows the training materials organized by application type:

Table 3. Training Materials for the Development of ICT-Based Learning Media

Type of Application	Training Materials	Sub-Item of Materials
Microsoft PowerPoint	- Worksheet	- Slide/outline - Notes Pane - Slide Pane - Normal Views - Slide sorter view - Slide show - Fit Slide to window
	- Ribbon	- Home - Insert - Design - Transition - Animations - Review - View
	- Creating and Setting Animations	- Shape or Text: Animations (Entrance, Emphasis, Exit), Animation Pane, Timing
	- Creating hidden buttons and hyperlinks	- Insert - Labeling - Shape - Place in
	- Inserting Videos and Audio	- Insert Video
	- Creating Questions on VBA Features	- Input Questions - Duplicate slide - Navigations of Answer Results - Displaying Student Identification - Developer Menu - Various VBA Formulas - How to insert VBA Formulas - Navigation Menu Activation - Determination of True-False Answers - Navigation to Check Values

iSpring Suite	- Component	- Narration
		- Insert
		- Content Library
		- Presentation
		- Publish
		- About
	- Creating Teaching Materials	- Installation
		- Storyboard
		- Theme Design
		- Tool shapes
		- Tool action
		- Hyperlink
		- Exit, next, preview
	- Creating Questions	- Form view
		- Introduction and user info
		- Question type selection (quiz, essay, multiple choice)
		- Select the correct answer
		- Adding Questions, videos, and images
		- Equiption
	- Settings	- Properties
		- Scoring
		- Question Properties
		- Question list
		- Navigation
		- Preview
	- Publishing Materials	- File Storage
		- Share link
	- Creating Books	- Preparing book files
		- Browsing
		- Visual
	- Creating Formula Dictionaries	- Insert
		- Visual
		- Catalog
		- Glossary
		- Operations
		- Formula Input
		- Video and audio input
		- Preview
		- Publish
Macromedia Flash	- Introducing	- Menu, timeline, stage, layer, frame,

	Terms	keyframe, animation, movie clip, scene, masking, toolbox, color window, action frame, properties, components
	- Working Components	- Selection tool, sub-selection tool, free transform tool, gradient transform tool, line, lasso, pen, text, oval, rectangle, pencil, brush tool, ink bottle, paint, eyedropper, eraser, hand, zoom, stroke color, fill.
	- Worksheets	- Setting (modify, properties, dimension, background, frame rate, ruler units) - Guide (selection, grid - Storage
	- Creating Animations	- Frame by frame - Motion tween - Shape tween - Keyframe - Moving object - Changing, rotating, and splitting an object
	- Publication	- Publish setting

Teacher Understanding After Training

The process of collecting data from the activities was measured through a posttest about the level of understanding and skills of participants in the PKG activity materials that had been given based on the results of observations and mentoring in the PKG activities of mathematics and MIPA (Mathematics & Natural Science) teachers in Konawe Kepulauan Regency. The following table shows the posttest results obtained from 25 participants:

Table 4. Posttest Results of PKG Participants in the Use of IT-Based Learning Media

Respondent Code	Score	Competency Score	Criteria
G-MAT-01	23	92.00	Completed
G-MAT -02	21	84.00	Completed
G-MAT -03	20	80.00	Completed
G-MAT -04	21	84.00	Completed
G-MAT -05	20	80.00	Completed
G-MAT -06	20	80.00	Completed

G-MAT -07	20	80.00	Completed
G-MAT -08	21	84.00	Completed
G-MAT -09	19	88.00	Completed
G-MAT -10	23	92.00	Completed
G-MAT -11	21	84.00	Completed
G-IPA -12	19	88.00	Completed
G-IPA -13	20	80.00	Completed
G-IPA -14	19	76.00	Completed
G-IPA -15	21	84.00	Completed
G-IPA -16	19	76.00	Completed
G-IPA -17	19	76.00	Completed
G-IPA -18	21	84.00	Completed
G-IPA -19	18	72.00	Completed
G-IPA -20	22	88.00	Completed
G-IPA -21	20	80.00	Completed
G-IPA -22	20	80.00	Completed
G-IPA -23	21	84.00	Completed
G-IPA -24	20	80.00	Completed
G-IPA -25	19	76.00	Completed
Total	507	2.028	
Average	20.28	81.12	Completed

The data was processed and summarized based on the division of training materials that had been given to PKG participants. As shown in Table 4, the PKM (community services activities) results in understanding mathematics and natural science teachers of the PKG learning media-based IT (offline) materials increased to 81. 12, which was categorized as completed.

Table 5. Participant Posttest Data on Activity Materials

Training Material	Score	Number of Participants	Frequency	Percentage (%)	Criteria
Ms. Powerpoint	24	25	23	92.00	Very high
iSpring Suite	40	25	20	80.00	High
Macromedia Flash	36	25	21	84.00	High

Based on Table 5, teachers' understanding of the use of ICT-based learning media (offline) using Microsoft PowerPoint applications is very high (92%), iSpring Suite is high (80%), and Macromedia Flash materials are also high (84%). These results mean that MIPA teachers in Konawe Kepulauan Regency's have significantly improved after participating in the PKG (ICT-Based Learning Media Offline) activity.

Implementation of Activity Results

The researchers divided the implementation of PKM (community service activities) results into three schools. This division was determined by the participation of mathematics and science teachers from three schools: MTsN 2 Wawonii Tengah, SMAN 1 Wawonii Tengah, SMPN 1, and Wawonii Tengah. The following is a description of how the PKG activity results were put into action:

SMAN 1 Wawonii Tengah

Based on the findings of interviews with mathematics and science teachers at SMAN 1 Wawonii Tengah, it was discovered that they were eager to put the training's outcomes into practice. Teachers continue to learn individually and in groups and use offline IT-based (information technology) learning media in the process. Microsoft PowerPoint, iSpring Suite, and Macromedia Flash are three software programs for creating learning media. According to a mathematics teacher at SMAN 1 Wawonii Tengah, Microsoft PowerPoint was the most commonly used learning media in the classroom during the learning process because teachers were familiar with Microsoft PowerPoint learning media. Furthermore, Microsoft PowerPoint's ease of use makes it a popular choice among teachers.

> "The teachers at SMAN 1 Wawonii Tengah frequently use PowerPoint as a teaching tool. We have previously used PPT, particularly when we were in college. However, there are still some menus that we are unfamiliar with, so we enlisted the help of other teachers who attended the workshop that day."

The teachers' learning activity used a screen display through an LCD (liquid-crystal display) projector as stated by a teacher as follows:

> "Another advantage of this program is the simplicity of the icon display, and the icons for creating presentations are more or less the same as the icons for Microsoft Word that are already familiar to most computer users."

Creativity and innovation are fundamental to improving teacher competence, particularly in IT-based learning media. Some SMAN 1 Wawonii Tengah teachers have already started using Hyperlink to make PowerPoint visuals more engaging for their students. As a result, using computer programs does not necessitate learning programming languages; instead, the program can be operated using familiar icons.

Meanwhile, iSpring Suite software and Microsoft PowerPoint extension were also used in the learning process in mathematics and science. Math and science teachers used the iSpring Suite learning medium to make their classroom presentations more interactive. Furthermore, learning is more interesting and less boring for students than it used to be. Boredom can occur when learning is monotonous, and the teacher fails to innovate. MA stated that interactive learning media based on the iSpring Suite is highly beneficial during the learning process. Students are less bored and become more active as a result. However, due to a lack of laptops for most teachers and the inability of teachers to install the software on their laptops, some teachers have difficulty implementing it consistently in the learning process in the classroom.

Learning media using Macromedia Flash, similar to iSpring Suite software, is a special attraction for mathematics and natural science teachers who have attended PKG training or workshops. This is because the software's output may take the form of games. Learning media created with Macromedia Flash, similar to iSpring Suite software, is a particular draw for mathematics and natural science teachers who have received PKG training or workshops. MA also stated that:

> "Macromedia Flash applications have an advantage over other learning media applications, PowerPoint and iSpring Suite. It can be turned into educational games. However, as the SMAN 1 teachers, we do not know how to install the Macromedia Flash application on other computers."

According to the SMAN 1 Wawonii Tengah principle, the teachers' professional development activities positively impacted the mathematics and science learning process. Teachers were no longer required to explain directly to students in class; instead, they could simply download learning videos corresponding to the material to be studied and show them to the students. This means that teachers act as learning facilitators rather than monopolize the learning process and ignore students' rights. However, this did not imply that teachers neglected their duties and responsibilities. Instead, they allowed students to learn so that they could be more active while briefly explaining what they did not understand.

On the other hand, researchers discovered another barrier to computer-based learning, namely, technical knowledge of the computer program itself, can be reduced. This application program is a program for creating presentations that can be used to create learning programs so that the resulting program will be visually appealing due to the colour and animation composition used. Meanwhile, another advantage of computer programs is that they can be linked to the internet network, which other users can use.

SMPN 1 Wawonii Tengah

SMPN 1 Wawonii Tengah's teachers also gave their statement on implementing the PKG results. A teacher, MR, stated that:

> "Through the Microsoft PowerPoint computer program, a teacher can design various learning programs that follow the material, methods, and learning objectives that the program designed using Microsoft PowerPoint wants to achieve."

However, some teachers have not maximized the use of audio and video in its implementation. Using these two facilities provided by Microsoft PowerPoint supports learning programming. For example, two options will appear in IPA learning to insert a video: press the insert menu and then the movies and sounds menu. Sounds from the file and gallery will appear. Similarly, movies can be from a file or a gallery. Microsoft PowerPoint users simply select the type of file to insert.

Students' interest and motivation to participate in the program increased because of interesting presentations. Although Microsoft PowerPoint has several features that can make presentations more interesting, one of the most difficult challenges teachers face is

making them more attractive. MR stated that the teachers usually use the same background. On the other hand, PowerPoint has various background options to make presentations more visually appealing. Teachers can always add their images or files if they get tired of using backgrounds.

Animation tools are another feature that makes presentations more engaging. Images and text can be displayed on the screen using these tools. Images or other objects can be animated to appear from different angles or ways. Objects can float from the top, the bottom, the right, the left, or the corner. Objects can also appear from the center or the edge of the screen. Students can understand better by balancing verbal and visual explanations in PowerPoint learning. According to Mr. K, a mathematics teacher, PowerPoint learning media facilitated the teaching and learning process in the classroom, motivating students to learn the material.

During the COVID-19 pandemic, implementing iSpring Suite at SMPN 1 Wawonii Tengah became a learning solution in schools. As previously stated, iSpring Suite is an application created with the help of additional developers from Microsoft PowerPoint. Thanks to this additional application, learning is more effective and easier to understand for students. The teacher, NH, argued that the exciting and engaging learning videos occurred after the school implemented the iSpring Suite application in creating the learning material. It turned out that the students became more active and enthusiastic.

Similarly, using Macromedia Flash, students feel that they have discovered a new atmosphere in the teachers' delivery and teaching in the classroom, reducing the boredom that can sometimes grip them. However, using this application necessitates sufficient time to create interactive learning materials. Teachers must be creative when designing teaching materials for use with these applications. As a result, perseverance is required to produce effective and efficient learning.

MTsN 2 Wawonii Tengah

The hyperlink program is the least well-known application in MTsN 2 Wawonii Tengah. The researchers defined a hyperlink as a facility for connecting to other files. A teacher stated that he/she did not know how to use Hyperlink, but after attending PKG, he/she understood and tried to apply it in teaching. Hyperlink programming can connect to internet programs if the computer is connected. This facility is essential and beneficial to the learning process. Programmers can provide direct feedback on the learning process via hyperlinks or connections with another program.

Relationships with other programs enrich the facilities that support the learning process, and relationships with the internet open up new, more personal, and authentic learning opportunities. According to the researchers, creating a hyperlink entails selecting an object to link to another program or the internet. It requires a computer and an LCD to project the message, as stated by teacher D. It is necessary to plan if you intend to use complex presentation techniques (animations). Special skills and systematic work are required to use. It takes special skills to incorporate good messages or ideas into the design of Microsoft PowerPoint computer programs in such a way that students can understand them, so we must learn more thoroughly.

"We recently discovered many useful features in PPT after the PKG," one of the teachers said.

The presented concepts, messages, and learning materials should be simple. The writing should be clear and easy to read, and the sentences should be simple but meaningful. It is best to use simple fonts in capital letters that are clear, easy to read, and easy to understand. Use different fonts with the same transparency if necessary, but avoid artistic fonts that are unclear and may confuse the message's recipient. In general, the fewer images and text poured into the PowerPoint, the clearer it will be and the less strain the eye will be. If the teachers want to visualize complex data, divide it into multiple simple designs to read and understand.

> "We understand that our understanding of learning media is very narrow, so we only use PPT, even though other programs and applications are just as useful. We already know and will learn, but it will take time to practice," said Teacher D.

Teachers' skills are evaluated based on their ability to use PowerPoint media, Manage PowerPoint-based learning so that it runs smoothly, make efficient use of time in PowerPoint-based learning, design an engaging learning process in PowerPoint-based learning, and instill student excitement in learning.

The three applications presented during the training have been implemented in principle by the teachers at MTsN 2 Wawonii Tengah. Furthermore, the training took place at MTsN 2 Wawonii Tengah. This means that the teachers at this school no longer have to waste time installing software on their laptops or computers. They can use the apps to create IT-based learning offline. This is due to the teachers' shortcomings in their creativity in designing the visual display of learning media rather than their ability to apply the software.

Based on the findings of the preceding data, it is possible to conclude that the implementation of ICT-based instructional media in schools still needs to be improved. This is evident from the fact that, before receiving training, science teachers' understanding of ICT-based instructional media was very limited. However, after receiving training, science teachers' understanding improved significantly. This indicates that the researcher's training as part of the PAR research activity was very effective. Although science teachers' understanding has improved, in practice, they still prefer Microsoft PowerPoint applications over iSpring Suite and Macromedia Flash applications. This is because teachers are already familiar with the Microsoft PowerPoint application. However, teachers still have limited knowledge and understanding of how to optimize the application's various features.

Another intriguing finding of this study is that teachers' difficulties in utilizing ICT-based learning media in the learning process are related to the availability of internet networks and limited electricity networks and the application installation process. As a result, when providing teacher training, it is critical to include information about the installation process of various applications on laptops or computers and the various features that can be optimally utilized in each application. According to Andriani et al.

(2021), teachers in 3T regions of Southeast Sulawesi are still at the first level of ICT competence. There are 4 levels of ICT competence, namely, mastering the basics of IT (ICT literacy), deepening knowledge (acquisition and engineering of knowledge) through ICT, having the ability to create knowledge with ICT, and sharing knowledge using IT or about ICT, both with students and other teachers. As a result, periodic activities are still required to improve teacher competence in ICT so that teachers can reach a higher level of competence. Furthermore, professional teacher learning includes teachers' ability to use ICT for self-development, participation, and contribution in professional forums and using IT as a research and professional development tool (Rivalina & Siahaan, 2020).

Meanwhile, according to Redecker (2017), the competence of teachers in the 3T regions of Southeast Sulawesi is still in the category of the New Comer (A1) level, which is a level of competence in which teachers are still in the stage of realizing the importance of the potential of digital technology in improving their pedagogical and professional competence but they still rarely use it. As a result, they still require guidance and encouragement to improve their ability to use digital technology in the learning process. This indicates that additional effort is still needed to improve teachers' digital competence to move to a higher level of competence as one of the parameters of teachers' pedagogical and professional competence in 3T regions.

The Explorer (A2) level of competence is where teachers can comprehensively, consistently, or sustainably explore digital technology in the learning process. Teachers at this proficiency level require encouragement and motivation, inspiration, role models, and guidance from colleagues or someone who is already proficient. Integrator (B1) is the next level, where teachers can experiment with various digital technologies and creatively use them in the learning process to demonstrate their professionalism. Expert-level (B2) teachers are already proficient in using various digital technologies with confidence, creativity, and critical thinking to improve their professionalism. They can selectively choose digital technologies needed to meet their learning needs because they understand the strengths and weaknesses of various digital technologies that can be used. The next level is Leader (C1), where teachers use digital technologies consistently and comprehensively to improve their pedagogical and professional competencies. Teachers have techniques for determining which digital technologies can be used appropriately and are constantly reflecting on and developing them. Teachers at this level of expertise have served as both an inspiration and a teacher to other educators. The final level is Pioneer (C2), where teachers can make additional educational innovations by leveraging digital technologies, experimenting with digital technologies in novel and complex ways, and developing new pedagogical and professional approaches to become leaders of innovation and role models for other teachers.

ICT can also foster creativity and independence in learning by stimulating creativity in the creation of new information and knowledge and independence in the discovery of a variety of learning resources that can support the students' learning process. Andri (2017) stated that educational technology is a complex and integrated process that can be used to solve various problems and improve learning quality. The

learning process is about delivering information or knowledge through technology and media and conditioning students to learn. In other words, the use of information technology can change a teacher's role as a teacher and a student's role in learning so that the learning process shifts from being teacher-centered to student-centered, and the teacher is no longer the only source of truth but only one of several sources that students can access (Wardinur & Mutawally, 2019). Learning through the use of or integration of ICT can also make it easier for teachers and students because it allows students to learn dynamically and interactively (Angsori, 2019).

Another intriguing finding of this study is that teachers are generally open to attending training on ICT-based learning media organized by the researcher. One of the most common barriers to ICT use is resistance to change, particularly among school policymakers and teachers (Rivalina, 2014). It is especially common in remote regions, where there are a variety of fundamental constraints, so resistance is very likely. The findings of this study, on the other hand, show that teachers are very enthusiastic and participatory in attending training, which is an important part of this research. This is because teachers and other stakeholders recognize the importance of ICT in improving the learning process.

On the other hand, this study successfully demonstrated that teachers' use of ICT-based learning media can help teachers vary learning methods by stimulating teachers' creativity in creating more appealing learning media. It is crucial because, in today's world, teachers are constantly required and challenged to train and develop their creativity in the use of learning methods (Al Rashid, Sara, & Adiyono, 2023) and the use of technology to aid in the delivery and presentation of learning materials (Sudarman, Riyadi, & Astuti, 2020), as well as one of the strategies for dealing with the disruptive era, namely the development of digital skills for teachers in trying out and applying new technologies in the field of learning media (Dewi, Wardani, & Wijayanti, 2019). The preceding evidence suggests teachers can improve their professional competence through the PAR research design. Other research findings indicate that many teachers of virtual learning media can create effective learning environments (Ghofur, 1970). Training as a form of action in this PAR research is also an attempt to improve teachers' professional competence. It becomes very important because it is a requirement for teachers' professional development (Griffin & Care, 2014). The key to meeting the challenges of a constantly changing world of uncertainty, complexity, and ambiguity is using digital tools (OECD, 2018).

This study is based on the interconnected model of teacher professional growth of Clarke & Hollingsworth (2002). It falls into the external domain, which focuses on the inputs to the professional development process, such as information, resources, and other support (Moore, Coldwell, & Perry, 2021). The following activities should be considered to improve teacher professional competence effectively: 1) coaching, in which participants encourage one another to achieve individual goals; 2) collaboration, in which larger groups collaborate to achieve common goals; and 3) assessment, in which individuals evaluate the performance of others, both formatively and summatively

(Thurlings & Brok, 2017). Figure 1 presents the Interconnected Model of teacher professional growth as follows:
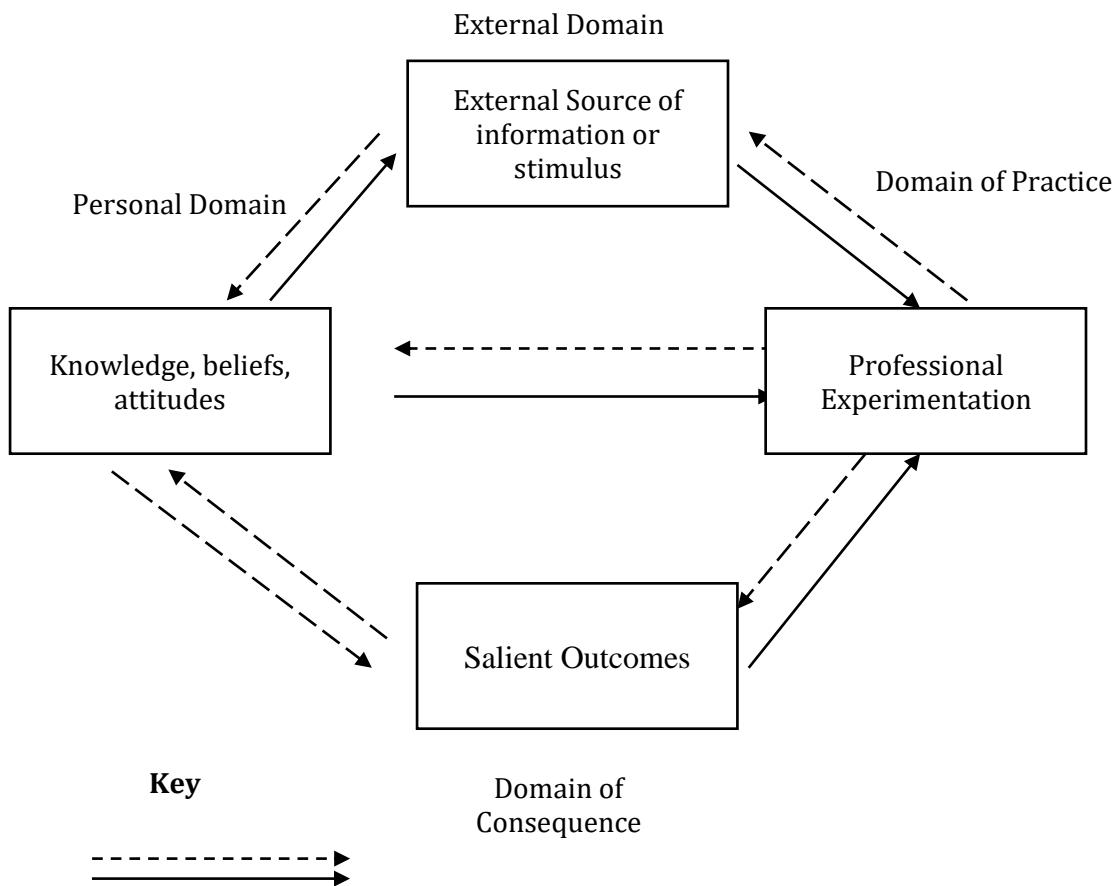

External Domain

External Source of information or stimulus

Personal Domain

Domain of Practice

Knowledge, beliefs, attitudes

Professional Experimentation

Salient Outcomes

Key

Domain of Consequence

Figure 1. Interconnected Model of Teacher

This study confirmed that through the PAR research design, teachers could improve their competencies in utilizing ICT-based learning media despite remaining at the first level of competency, namely the ICT Literacy or Newcomer (A1) level. As a result, more research or action is required that also employs the PAR research design to assist teachers in reaching higher levels of competency, namely, knowledge acquisition and engineering through ICT, knowledge creation with ICT, and the ability to share knowledge and become an inspiration and pioneer for other teachers. Furthermore, this study discovered that the main barrier is not only a lack of facilities and infrastructure because many ICT-based learning media applications can be used offline but also a lack of teachers' knowledge and understanding of optimizing the various features available in each application and the installation procedure of applications on laptops or computers. As a result, special training is required to improve teacher competencies in optimizing the use of various applications in the learning process, as well as applications that have been installed on teachers' laptops or computers, so that there is not much time wasted on the process of downloading and installing applications during training.

CONCLUSION

The findings of this study are that teachers who initially had little understanding of the use of various applications as ICT-based learning media increased significantly and were even able to implement them in the learning process after participating in training, implying that PAR research can be said to be effective in assisting in the improvement of teacher competence, particularly teacher professional competence in the external domain. More strategic efforts from relevant parties are also required to improve teacher competence in utilizing ICT at a higher level, namely from basic mastery (ICT literacy) to the highest level to become a creator or from the newcomer level to the pioneer level of ICT utilization in the learning process. The main challenges teachers face in rural regions are limited electricity supply, unsupported internet conditions, a lack of LCD projectors, personal laptops or computers, and a lack of teacher learning resources to update their abilities in understanding and improving ICT utilization competence. Indeed, teachers are aware of how to use ICT-based learning media but do not fully utilize the features available in each application. Therefore, Offline-based applications are preferable in these regions. Researchers are well aware that this study cannot clearly measure how much influence the training conducted has on improving teachers' ability to use ICT as a learning medium and can only improve teachers' abilities at the ICT literacy stage. Therefore, quantitative research is needed to measure the effect clearly, and PAR research design is needed to help teachers achieve a higher level of competence in ICT utilization.

REFERENCES

Abdul Syukur, I. (2014). Profesionalisme Guru dalam Mengimplementasikan Teknologi Informasi dan Komunikasi di Kabupaten Nganjuk. *Jurnal Pendidikan Dan Kebudayaan*, *20*(2), 200–210. https://doi.org/10.24832/jpnk.v20i2.138.

Al Rashid, B. H., Sara, Y., & Adiyono, A. (2023). Implementation of Education Management With Learning Media in Era 4.0. *International Journal of Humanities, Social Sciences and Business (Injoss)*, *2*(1), 48–56. https://injoss.org/index.php/joss/article/view/52.

Andri, R. M. (2017). Peran dan fungsi teknologi dalam peningkatan kualitas pembelajaran. *Jurnal Ilmiah Research Sains*, *3*(1), 122–129.

Angsori, M. L. (2019). Optimalisasi Macromedia Flash Untuk Mendukung Pembelajaran Berbasis Komputer Pada Program Studi Ilmu Komputer. *Jurnal Pendidikan Teknologi Informasi Dan Komunikasi*, *1*(2), 1979–9264.

Asiska, I., & Nurmahmudah, F. (2022). Pengelolaan Tenaga Pendidikan di Daerah 3T SMP Negeri 1 Maratua. *Jurnal Pendidikan Dan Konseling*, *4*, 7124–7131. https://doi.org/10.31004/jpdk.v4i6.9475.

Clarke, D., & Hollingsworth, H. (2002). Elaborating a model of teacher professional growth. *Teaching and Teacher Education*, *18*(8), 947–967. https://doi.org/10.1016/S0742-051X(02)00053-7.

Dewi, R. K., Wardani, S., Wijayati, N., & Sumarni, W. (2019). *Demand of ICT-based*

chemistry learning media in the disruptive era. *8*(2), 265–270. https://doi.org/10.11591/ijere.v8i2.17107.

Ghofur, A. (1970). The Teachers' Perceptions of the Effectiveness of Using Virtual Learning Media. *Ideas: Jurnal Pendidikan, Sosial, Dan Budaya*, *7*(4), 87. https://doi.org/10.32884/ideas.v7i4.453.

Griffin, P., & Care, E. (2014). Developing learners' collaborative problem solving skills. *European Schoolnet*, 11. https://vp-learningdiaries.weebly.com/uploads/9/4/9/8/9498170/developing_learners_collaborative_problem_solving_p_griffin.pdf.

Koesnandar, A. (2013). Pengembangan Model Pendayagunaan Teknologi Informasi Dan Komunikasi (Tik) Untuk Pendidikan Di Daerah Terpencil, Tertinggal, Dan Terdepan. *Kwangsan: Jurnal Teknologi Pendidikan*, *1*(2), 122. https://doi.org/10.31800/jtp.kw.v1n2.p122--142.

Koesnandar, A. (2018). Inovasi Pembelajaran Berbasis TIK di Sekolah 3T Provinsi Papua dan Papua Barat Melalui Pendampingan Jarak Jauh. *Jurnal Teknologi Pendidikan*, *06*(02), 177–198. https://doi.org/10.31800/jtp.kw.v6n2.p177--198.

Lee, H., Longhurst, M., & Campbell, T. (2017). Teacher learning in technology professional development and its impact on student achievement in science. *International Journal of Science Education*, *39*(10), 1282–1303. https://doi.org/10.1080/09500693.2017.1327733.

Lestari, S. (2015). Faktor-Faktor Yang Mempengaruhi Pemanfaatan Tik Oleh Guru. *Jurnal Kwangsan*, *3*(2), 121. https://doi.org/10.31800/jurnalkwangsan.v3i2.29.

Moore, N., Coldwell, M., Perry, E., & Perry, E. (2021). Professional Development in Education Exploring the role of curriculum materials in teacher professional development. *Professional Development in Education*, *47*(2–3), 331–347. https://doi.org/10.1080/19415257.2021.1879230.

Nurjanah, Mardia, I., & Turmudi. (2021). Ethnomathematics Study of Minangkabau Tribe: Formulation of Mathematical Representation in the Marosok Traditional Trading. *Ethnography and Education*, *16*(4), 437–456. https://doi.org/10.1080/17457823.2021.1952636.

OECD. (2018). The Future of Education and Skills: Education 2030. *OECD Education Working Papers*, 1–23. https://www.oecd.org/education/2030/E2030 Position Paper (05.04.2018).pdf.

Rias, R. M., & Zaman, H. B. (2013). Understanding The Role of Prior Knowledge in a Multimedia Learning Application. *Australasian Journal of Educational Technology*, *29*(4), 537–548. https://eric.ed.gov/?id=EJ1017841.

Rivalina, R. (2014). Pemanfaatan Tik dalam Pembelajaran: Kearah Pembelajaran Berpusat Pada Peserta Didik. *Jurnal Teknodik*, *4*, 165–176.

Rivalina, R., & Siahaan, S. (2013). Kegiatan Pembelajaran Di Kabupaten Belu (Initial Response To The Use Of Ict In Learning Activities In The Belu District). *Jurnal Teknodik*, *17*(4), 419–429.

Rivalina, R., & Siahaan, S. (2020). Pemanfaatan Tik Dalam Pembelajaran: Kearah Pembelajaran Berpusat Pada Peserta Didik. *Jurnal Teknodik*, 73–87. https://doi.org/10.32550/teknodik.v0i2.690.

Sudarman, Riyadi, R., & Astuti, R. F. (2020). *Development of Interactive Learning Multimedia to Increase Understanding of Basic Skills Teaching Procedures.*

432(Esic 2019), 132–136. https://doi.org/10.2991/assehr.k.200417.030.

Thurlings, M., & Brok, P. Den. (2017). Learning outcomes of teacher professional development activities : a meta-study. *Educational Review*, *1911*, 1–23. https://doi.org/10.1080/00131911.2017.1281226.

Wardinur, & Mutawally, F. (2019). Peningkatan Kompetensi Guru Melalui Pelatihan Pemanfaatan Teknologi..... *Jurnal Sosiologi USK (Media Pemikiran & Aplikasi)*, *13*(2), 167–183. https://doi.org/10.24815/jsu.v13i2.16422.

Warsihna, J. (2013). Pemanfaatan Teknologi Informasi dan Komunikasi (TIK) untuk Pendidikan di Daerah Terpencil, Tertinggal, dan Terdepan (3T). *Jurnal Teknodik*, *17*(2), 238–245. https://doi.org/10.32550/teknodik.v0i0.82.

Wood, L. (2020). *Participatory Action Learning And Action Research*. New York: Routledge.

Yuen, A. H. K., & Ma, W. W. K. (2008). Exploring teacher acceptance of e-learning technology. *Asia-Pacific Journal of Teacher Education*, *36*(3), 229–243. https://doi.org/10.1080/13598660802232779.

Zuber-skerritt, O. (2018). An educational framework for participatory action learning and action research (PALAR). *Connecting Research and Practice for Professionals and Communities*, *0792*(May). https://doi.org/10.1080/09650792.2018.1464939.