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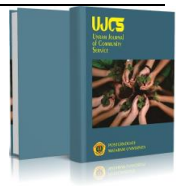

The Development of Innovative Science Learning Tools to Develop 21st Century Skills for Elementary School Teachers Naskat II Santo Ignatius Olilit Timur

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Abstract: The Tanimbar Islands are one of the areas in Maluku Province which is classified as an underdeveloped area in Indonesia and is included in the 3T category. This district borders directly with Australia. The underdevelopment of the Tanimbar Islands covers various sectors including education. The quality of teachers, availability of books, and other facilities and infrastructure are still very minimal. The results of observations and discussions with teachers at Naskat II Elementary School Santo Ignatius Olilit Timur showed that the development of devices is still less innovative because teachers do not participate in training that supports improving teacher competence in science learning in the classroom. Therefore, the purpose of this service is to increase the capacity of teachers in developing innovative learning devices to support 21st century life skills. Therefore, professional lecturers from the Faculty of Teacher Training and Education, Pattimura University, conducted training and mentoringin developing learning tools based on innovative learning.The results achieved from this activity mentoring are 86.28%teachers have been able to develop science learning tools well. Therefore, it is important for lecturers, Widyaiswara at the Education Quality Assurance Center (BPMP) in each province, school supervisors and education observers to continue to collaborate with teachers in sharing experiences and knowledge in improving teacher capacity.

Keywords: Science learning tools; 21st century skills; Elementary school teachers

Introduction

The 21st century framework provides strategies for identifying the skills students will need to enter the future workforce; therefore, educators are tasked with analyzing whether current competencies and learning methods are designed to achieve this (Nikkola et al., 2024). Therefore the 4Cs of communication, collaboration, creativity and critical thinking, as emphasized by the US-based Partnership for 21st Century Skills, highlight the importance of these skills which are increasingly recognized as essential intellectual competencies (Herlinawati et al., 2024). Approximately 40% of students graduating from high school are not sufficiently prepared for their future jobs. In addition, students are reported to have inadequate competencies in several skill areas. For example, employers estimate that the majority of students' basic skills referring to mathematical knowledge and ability (53.3% of students indicated deficiencies) and written performance (72.0%) are not sufficiently developed after graduation. Furthermore, students indicated deficiencies in their applied skills, which include communication skills (80.9%), critical thinking and problem solving (69.6%) and professional work ethic (70.3%) (Kain et al., 2024).

Teachers play a major role in determining 21st century learning outcomes. Teachers' perceptions and understanding of innovations in education influence their actions, decisions, and practices in the classroom (Rusdin, 2018). The Partnership for 21st Century Skills is a collaborative government and business organization

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that defines a framework for developing the skills, talents and attitudes to succeed in the 21st century workplace and society. The framework lists three types of competencies: (1) learning skills; (2) literacy skills, and (3) life skills. Among the competencies that are particularly relevant today is complexity reasoning, where professionals must have the capacity to reflect on how to cope with a changing world (Gonzalez-Perez & Ramirez-(Montoya, 2022).

Science which is the systematic search for truth provides the basis for technology. Without technology, science is powerless, and without science, technology is nothing. Science and technology hold the key to the present and future development of any country. Technology plays a fundamental role in wealth creation, improving the quality of life, and real economic growth and transformation in any society. Science and technology education will not only prepare the Youth who are equipped with science and technology education are also blessed with high employment opportunities. Many countries have developed and grown rapidly because of their huge investments in science and technology. For example: Britain and France benefited greatly from the industrial revolution in the 19th century. Similarly, the United States emerged from an agrarian economy in the 19th century to become an industrial superpower in the 20th century. More recently, Taiwan and Korea have benefited from advances in silicon microelectronics since the early 1960s. China and India have emerged as industrial leaders in manufacturing and information technology. Malaysia has also followed in the footsteps of Asian success in recent times. It is worth emphasizing here that in the achievements recorded, all these countries invested heavily in people, plants and infrastructure that provide the foundation for today's industry. All these successes are based on a carefully designed roadmap of plans and strategies (Anaeto et al., 2016).

Having a strong understanding of science from an early age or while still in elementary school can make it easier to learn science at a higher level (Chris Curran & Kitchin, 2019). Developmentally appropriate engagement with quality science learning experiences is essential to helping children make sense of the world, gather and organize information, apply and test ideas, and develop positive attitudes toward science. Quality science learning experiences provide a strong foundation for the development of later scientific concepts that children will encounter throughout their academic lives.(Batlolona & Mahapoonyanont, 2019). This foundation helps students build an understanding of key science concepts and enables further learning of more abstract ideas. Engaging science experiences enable the development of scientific thinking (Hadzigeorgiou & Schulz, 2019). Supporting children as they develop scientific thinking during the early years of childhood can enable children to easily transfer their thinking skills to other academic domains which can support their academic achievement and self-confidence (Trundle, 2009).

21st century science learning by implementing innovative learning is supported by the teacher's ability to plan and implement learning. Learning planning is provided by the teacher before teaching and is described in the learning device. The learning device used by the teacher as a guideline in implementing the learning process in the classroom so that the learning process can take place more directed towards the intended competency (Azka, 2015). The learning tools created must be adjusted to the level of knowledge and experience of students to achieve the expected learning objectives (Astuti et al., 2019).

The results of observations and discussions with teachers at Naskat II Elementary School, Santu Ignatius Olilit Timur, the development of devices is still less innovative because teachers do not participate in training that supports improving teacher competence in science learning in the classroom. The application of innovative learning models according to the government's mandate has not been implemented properly in learning or included in learning devices. This is due to the lack of teacher knowledge about the various types of innovative learning that exist. However, teachers are often considered difficult to change and tend to be resistant to innovation or policy changes introduced by education policy makers. Teachers are often considered difficult to change due to several complex factors. Long experience in teaching often crystallizes certain mindsets and teaching methods that are difficult to change. In addition, uncertainty about the effectiveness of new changes is also a supporting factor in the inability to change. Teachers tend to maintain proven practices rather than try something new that is considered risky. In addition, high workloads and lack of adequate support and training in implementing change can also make teachers feel uncomfortable with change.

To overcome the challenges of the inability to change in the teaching profession, concrete steps need to be taken, namely it is important for educational policy makers to involve teachers in the process of planning and developing new policies. By involving them from the start, teachers will feel more ownership of the changes and be more motivated to implement them. In addition, providing adequate training and support for teachers in adopting new changes is essential. This can be done through workshops, mentoring, or other professional development programs that focus on the integration of new technologies, innovative teaching strategies, or more dynamic curriculum approaches.

Therefore, professional lecturers from the Faculty of Teacher Training and Education, Pattimura University, provide training and mentoring.in developing learning tools based on innovative learning.Innovative learning emphasizes assessment in 21st century learning which is designed and developed to measure student learning achievements which include critical thinking and problem solving, creativity and innovation, collaboration and communication (Nuraziza & Suwarma, 2018). Innovative learning must be understood by teachers as an effort to improve student achievement and learning outcomes, where teachers must also have skills in mastering and utilizing the learning model. Teachers must provide more interesting learning innovations with all their creativity (Nurhayati et al., 2023).

Around the world, educational institutions are implementing new ideas, methods, and innovations to enhance students' knowledge. Innovative teaching is necessary for today's and tomorrow's education to help students reach their full potential. Education should serve the long-term intellectual needs of students, for example, whether the provision of new materials by teachers helps students gain new insights or opens new channels of intellectual stimulation or enhances students' essential and creative thinking (Marshall & Marshall, 2003). Innovative teaching is a necessity for all teachers to meet the educational needs of the new generation. However, teacher competence for innovative teaching is a key factor that influences the performance of innovative teaching.

Method

Community Service Activities (PKM) were carried out at SD Naskat II Santo Ignasius Olilit Timur in Saumlaki, Tanimbar Islands Regency. This activity was attended by 12 teachers, namely several teachers from SD Naskat I Santo Ignasius Olilit Timur and several non-permanent teachers and teaching practice students from PGSD Universitas Pattimura. This activity was carried out for 3 days from November 9-11, 2021. The speakers in this activity were Lecturers from the Faculty of Teacher Training and Education, namely Dr. Marleny Leasa, S.Pd., M.Pd from the Elementary School Teacher Education Study Program with a background in biology education. Other speakers were John R. Batlolona, S.Pd., M.Pd from the Physics Education Study Program with a background in physics education.

There are 6 important topics presented during the training activities, namely; 1) 21st century life skills; 2) Character values based on national culture; 3) Professional teachers; 4) 4C Plus Learning Design; 5) Innovative learning models; 6) Innovative learning tools; 7) Innovative test instruments. This PKM uses the Student Centered Learning approach with a problem based learning model. This model is used so that training participants can explore, assess, interpret, synthesize, and provide information to improve the quality of learning in the classroom.

The methods used in this training are discussion, demonstration, and work demonstration methods. This method begins with an explanation of the material. Furthermore, training participants are given the opportunity to develop learning devices based on and end with evaluating the implementation of training activities. Every aspect of teacher competence canassessed by teacher competence in developing learning tools with the criteria as shown in Table 1.

Table 1. Conversion Values of Teachers' Competency

Teachers' Competency Values	Category
91% – 100%	Very good
76% – 90%	Good
61% – 75%	Enough
51% – 60%	Medium
≤ 50%	Less

Source:(Margunayasa, 2018)

Results and Discussion

The training activities were well attended by the teachers. This activity was directly monitored by the Principal of SD Naskat II Santo Ignasius Olilit Timur, Belandina Luturmas, S.Pd. The Principal hopes that for 3 days the teachers can focus on participating in the activities so that they can develop learning in the classroom well. Moreover, there are new things that are shared as a wealth for teachers in improving teacher capacity. The Principal also admitted that teachers rarely attend training and only hope for friends who share information. They also attend webinars or educational seminars online but still have limitations due to internet network problems. They are very happy if the activities are offline so that they can follow well and can ask questions directly to the speakers who are experts in their fields.

Figure 1. Training Activities Monitored Directly by the Principal of Naskat II Elementary School, Santu Ignatius Olilit Timur - Belandina Luturmas, S.Pd

The importance of teacher training in choosing appropriate teaching methods and improving student learning achievement and interest(Hafeez, 2021). Training is a process of acquiring the skills needed for a particular subject. Training is a valuable practice for teachers to improve their teaching skills. Trained teachers have more skills and techniques to apply for better academic achievement for students.(Ulla, 2018). Teachers who have better teaching skills can also foster students' interest in certain subjects. Many studies explain the importance of teacher training. Teacher training provides solutions to educational problems.(Darling-Hammond et al., 2020). In this modern era, teacher training is an essential requirement and a vital component for all educational activities including a conducive learning environment, curriculum development and implementation, and assessment.(Findeisen et al., 2021). Trained and skilled teachers have more ability to teach students and apply various teaching methods successfully.(Saira et al., 2021). When teachers apply various teaching methods and techniques according to the skills acquired, students will achieve higher academic results and student interest will also increase.(Wuryaningsih et al., 2019).

Teachers' subject matter knowledge and teaching approaches can be enhanced through training. Elementary school teachers need to be trained to adapt to the changing demands of their profession, which is especially important in today's environment. Elementary school teachers who have received training in elementary education are better positioned to create a better environment in which students can learn. Teachers' subject matter knowledge, demonstration strategies, and other knowledge can be enhanced through training. Performance style characteristics are incorporated into teachers' perceptual and cognitive approaches to interacting with the world. As a result, individuals are more likely to act in ways that better utilize their abilities.(Syafrina, 2021).

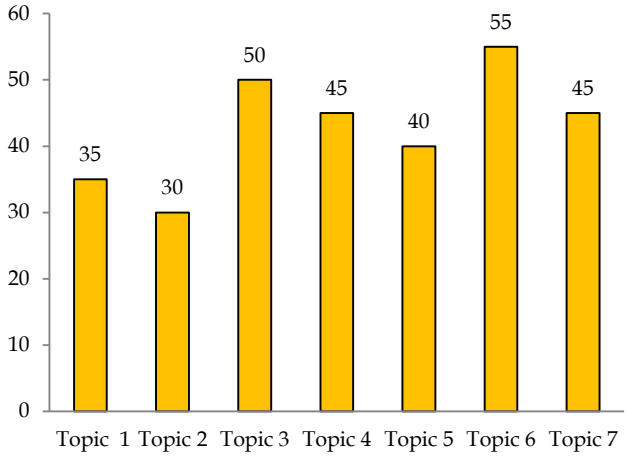

Figure 2. Teacher Pretest Results Before Training Activities

Pretest data based on Figure 2 shows that teachers still have a low understanding of the topics that will be given. This is evident from the pretest results with an average of 42.85 with poor teacher competence. Many factors influence this problem. This is in line with the resultsA survey of Colorado, USA public school science teachers revealed that 17% of them had never participated in any learning experiences. The most common methods used were websites, magazines, and books. Most teachers did not report participating in real-world research as a way to learn.(Wise, 2010).

Figure 3. Teacher Activities in Participating in Training Activities

Teacher training and competency development are very important to improve the capacity and quality of teaching. By participating in training, teachers can gain new skills that can be applied in the learning process. In addition, training also provides an opportunity for teachers to develop more effective teaching methods and strategies. Improving the capacity and quality of teaching through teacher training and development also has other benefits, namely increasing teacher motivation and confidence in carrying out their duties. By having better knowledge and skills, teachers can make a greater contribution to improving the quality of education.

Figure 4. Presentation of Material by Dr. Marleny Leasa, S.Pd., M.Pd.

Through the official website of Medan Area University on September 26, 2023, it was released regarding the importance of continuous training for teachers.

1. *Rapid Development in Education*: The world of education is undergoing rapid change. Technology continues to develop, educational paradigms change, and demands on teachers are increasingly complex. Teachers must remain relevant and ready to face these changes.
2. *Improving the Quality of Teaching*: Continuous training helps teachers improve the quality of their teaching. They can acquire new skills, understand different teaching methods, and integrate educational technology into their learning.
3. *Professional Growth*: Ongoing teacher training is a step towards continued professional growth. Teachers who invest in their own development will be more motivated and prepared to teach effectively.
4. *Improving Student Learning Outcomes*: Teachers who continually develop their skills tend to produce better learning outcomes for their students. They can design more engaging and relevant learning.
5. *Better Understanding of Students*: Through ongoing training, teachers can better understand the individual needs and characteristics of their students. This allows them to align their teaching with the students' needs.

The five aspects described above are very helpful for teachers in the Tanimbar Islands Regency. The Tanimbar Islands area of Maluku Province is one of the areas classified as underdeveloped in Indonesia and is included in the 3T category. The Tanimbar Islands are located in the southern part of Maluku Province, and directly border Australia. The underdevelopment of the Tanimbar Islands covers various sectors including education. The quality of teachers, availability of books, and other facilities and infrastructure are still very minimal. This condition results in education in the Tanimbar Islands still being far behind compared to several cities and regencies in Maluku Province. This is very ironic, considering that the people living in the Tanimbar Islands really hope for a decent education for their children(Marian, 2019). With this training program, at least it has helped teachers a little in designing learning devices. This is evident from after the training activities were completed, where teacher competence increased significantly as shown in Figure 5.

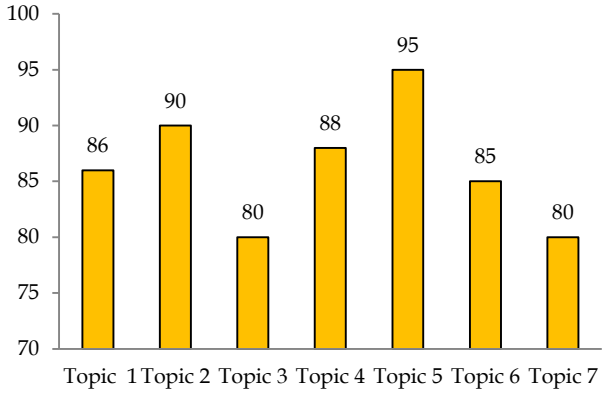

Figure 5. Teacher Posttest Results After Training Activities

The results achieved from this activity mentoring are on average 86.28%teachers have been able to develop science learning tools well. This posttest is in line with the results of a study of 100 elementary and middle school teachers in Florida, USA revealed that our fall teacher training workshop increased teachers' knowledge in the topics described earlier. We also provide a variety of resources including educational videos (some bilingual), power points, articles, and constant communication between teachers and scientists that enrich the experience. Better prepared teachers will be able to provide better instruction, leading to positive impacts on student achievement. In addition, teacher participation during data collection and analysis increases their engagement and motivation to teach the subject (Tserej et al., 2024).

Another finding when training and mentoring were conducted was that the pretest and posttest results achieved by the participants showed an increase in the participants' ability to design learning devices. As seen from the posttest results, the partners' ability to develop these abilities had reached 65% or increased by 45% after being given training.(Leasa et al., 2020).The same thing whenAfter conducting training for teachers at SD Inpres 19 Ambon, teachers finally have a positive and adequate understanding in developing student worksheets based on the PBL model. The contribution of this training is also considered an opportunity to develop teacher independence in the classroom, analysis of real problems, cooperation and social interaction, and self-management (Leasa et al., 2024).

The importance of teacher training to address challenges in education. Here are some reasons why this investment is necessary:

1. *Improving the quality of learning*

Quality teacher training provides them with a better understanding of effective teaching methods, innovative learning strategies, and individualized approaches to addressing student differences. Well-trained teachers will be able to provide better learning and improve student academic achievement.

2. *Adaptation to changes in curriculum and technology*

Investing in teacher training enables them to keep up with changes in curriculum and teaching methods that are more relevant to the demands of today's world. Teachers who receive adequate training can use modern educational technologies and resources to improve the quality of learning.

3. *Increased motivation and self-confidence*

Good teacher training not only improves their knowledge and skills, but also provides the motivation and confidence needed to face challenges in the learning process. Motivated teachers will actively contribute to improving the quality of education and inspire students.

4. *Increased professionalism*

Teacher training is an important step in building a quality future of education. Through good training, teachers will have the skills, knowledge, and motivation needed to face challenges in the learning process. In addition, teacher training also contributes to improving the overall quality of education and encouraging the development of a stronger educational community.

The expected success indicators in training activities are: (1) training participants can develop innovative learning tools in the learning process in the classroom, so that teachers can improve their potential and the quality of learning to become professional teachers, (2) training participants can develop teaching materials in the learning process in the classroom, so that teachers can improve their potential and the quality of learning to become professional teachers, and (3) training participants can develop innovative learning tools in improving 21st century life skills in the learning process in the classroom, so that teachers can improve their potential and the quality of learning to become professional teachers.(Kamaruddin, 2019).

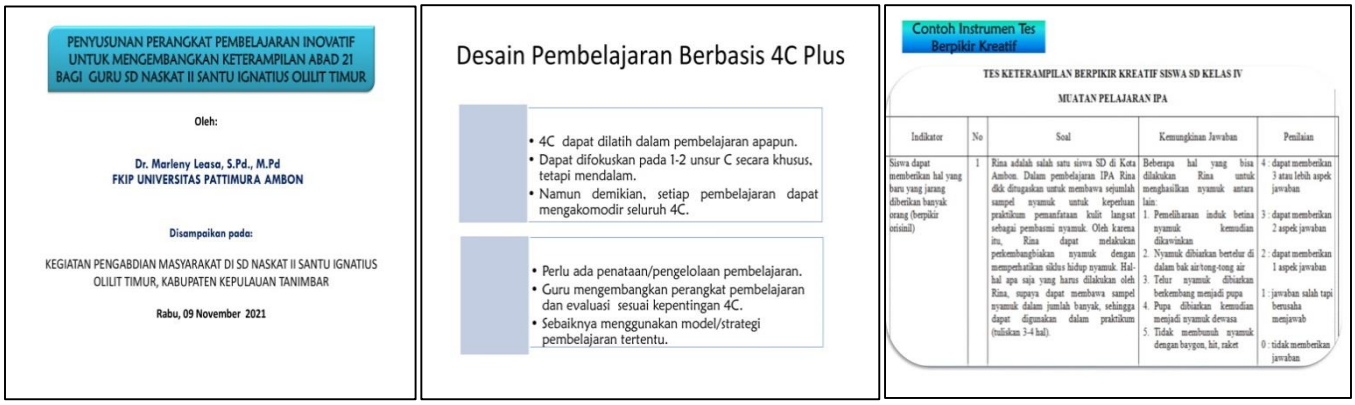

Figure 6. Some Training Activity Materials

Conclusion

The results achieved from this training were that teacher competency increased from 42.85 to86.28. Thusteachers have been able to develop innovative science learning tools in improving 21st century life skills well. Therefore, it is important for lecturers, Widyaiswara at the Education Quality Assurance Center (BPMP) in each province, school supervisors and education observers to continue to collaborate with teachers in sharing experiences and knowledge in improving teacher capacity.However, this Community Service activity is very useful, especially for teachers in an effort to improve their performance to become professional teachers who can produce quality students. For this reason, it is necessary to plan community service activities periodically and continuously.

This PKM activity was held as an effort to improve the performance of teachers at Naskat II Elementary School, Santo Ignasius Olilit Timur through training in developing learning tools to improve 21st century life skills in the classroom learning process, in order to become professional teachers and produce quality students. Through this training, it is hoped that teachers can develop learning tools in order to increase student learning motivation. Based on the results of the training implementation, there are several things that can be suggested, namely: (1) training in developing innovative tools for elementary school teachers should be held continuously, because it is very important for improving the quality of the learning process, and it turns out that there are still many teachers who are not used to developing their competencies properly, especially the development of learning models and test instruments, (2) the allocation of time for organizing training should

be longer, because this training will produce real products in the form of science learning tools, (4) more teachers should be involved in various trainings organized by the school or parties outside the school so that there is an increase in performance for each teacher who teaches at Naskat II Elementary School, Santo Ignasius Olilit Timur.

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