Efforts to Improve Teacher Competence in Developing Science, Technology, Engineering, and Mathematics Based Learning Tools Through in House Training Activities

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Abstract. Science, Technology, Engineering, and Mathematics (STEM) education is integrated learning between science, technology, engineering, and mathematics to develop students' creativity through problem-solving processes in everyday life. The purpose of this research is to improve the competence of SMAN 3 Sigi teachers in developing STEM-based learning tools through In House Training (iHT) activities in Semester 1 of the 2021/2022 Academic Year. This research is a classroom action research. The research subjects are 10 teachers at SMAN 3 Sigi, while the object of the research is the improvement of teacher competence in developing STEM-based learning tools through iHT activities. While the data collection method used is observation and documentation. Furthermore, data analysis was carried out through three stages, namely reducing data, describing data, and making conclusions. The results of the study indicate that increasing teacher competence in developing STEM-based learning tools through iHT activities that emphasize collaborative consultative methods will provide opportunities for sharing between one principal and teacher as well as teachers and other teachers. Thus, the understanding and ability, and competence of teachers in the development of STEM-based learning tools can be improved both in theory and in implementation.

Keywords: STEM, iHT, Teacher Competence.

1. Introduction

Intense global competition needs to prepare the young generation with character, character, willingness to advance and develop, and scientific reasoning [1]. The Covid-19 pandemic has indirectly changed the pattern of life in the world of education. Education 4.0 The learning system is carried out remotely by utilizing accelerated information technology due to the pandemic [2], [3]. On March 11, 2020, the government issued a circular letter from the Ministry of Education and Culture No. 4 of 2020 stipulated rules for studying from home for school and work students at all levels of education. Education in Indonesia, this condition is an unexpected thing for teachers, parents and students must find ways to keep the learning process going even though they are at home for an indefinite period. learning distance education for all educational targets from all levels of education, basic education to secondary education through TVRI television shows and various online learning resources.

Students' enthusiasm for learning is very vulnerable to being lost due to changes in learning formats during the COVID-19 pandemic. So both teachers and parents have to find ways to keep students focused on getting quality learning like when they were at school during this pandemic. One method that can be imitated and applied to school activities during the current pandemic is the STEM learning approach. As concluded by Wahyuningsih [4] the learning approach that supports distance learning and the learning approach that meets the learning needs of the 21st century is STEM. The STEM learning approach has special tips to ensure that quality remains met and students remain enthusiastic about learning like at school.

The need for the STEM learning model is a solution to dealing with boredom due to online learning which makes students decrease their interest in learning [5]–[8]. STEM gives students the freedom to express and explore. Students are free to come up with a

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brilliant idea and make it happen. By using a fun learning model, students are sure to be able to understand the teacher's knowledge. Meanwhile, parents are also expected to understand that the STEM learning model improves student growth and development because students are always encouraged to think critically, and creatively, willingly collaborate, and have good communication skills [9]-[12].

The gap that occurs at SMAN 3 Sigi is the low competence of teachers in developing STEM-based learning tools. To motivate teachers to be able to develop STEM-based learning tools optimally, school principals need to carry out training activities to improve teacher competence in developing STEM-based learning tools. This situation is of course a special concern for researchers as school principals. The results of observations in the initial conditions showed unfavorable results, where from 10 teachers there were only 6 teachers who were in the fewer criteria, and 4 teachers in the sufficient criteria, with the acquisition of an average score of 46.25 with fewer criteria.

To overcome this problem, the researcher who serves as the principal at SMAN 3 Sigi seeks to improve the readiness of these teachers in developing STEAM-based learning tools with In House Training (iHT) activities in the form of school action research with the title "Efforts to Improve Teacher Competence. in the Development of STEM-Based Learning Devices through iHT Activities at SMAN 3 Sigi Semester 1 for the 2021/2022 Academic Year."

2. Method

This research is a classroom action research, this research was conducted at SMAN 3 Sigi Sigi which is located at Jalan Jalan Palu - Kulawi Sibalaya, Kec. Tanambulava, Sigi Regency, Central Sulawesi Province. The PTS steps are planning, implementation, observation, and reflection. The subjects of the research were 10 teachers at SMAN 3 Sigi, while the object of the research was increasing teacher competence in developing STEM-based learning tools through iHT activities. While the data collection method used is observation and documentation [13]. Furthermore, data analysis was carried out through three stages, namely reducing data, describing data, and making conclusions [14].

3. Results and Discussion

3.1 Cycle One Corrective Action

In this first cycle of corrective action, iHT is developing STEM-based learning tools by referring to the basics of reference for developing STEM-based learning devices. After the corrective action in the first cycle, it was found that it was still difficult to develop STEM-based learning tools considering the many components included in it, and the principal still had difficulties in carrying out guidance due to the limited facilities and infrastructure used due to the rules regarding the implementation of activities during the Covid-19 pandemic. From the implementation of the activities in the first cycle, the following results were obtained.

Table 1: Recapitulation of the Average Value of Teacher Competence in the Development of STEM-Based Learning Devices in the Initial Conditions and the First Cycle.

No	Cycle	Average-2 Value	Grade Qualification	Completeness			
				T	%	BT	%
1	Beginning	46.25	K	0	0	10	100
2	First	70,50	C	5	50	5	50

The results of observations of the first cycle of actions on teacher competence in developing STEM-based learning tools show that the initial conditions have an average score of 46.25 and fall into the poor criteria (K). The results of the first cycle showed an increase in the average score to 70.50 and were included in the sufficient category (C) and there were 5 teachers who were declared to have increased their competence in developing STEM-based learning tools. To clarify in the form of a bar chart as described in the graph below.
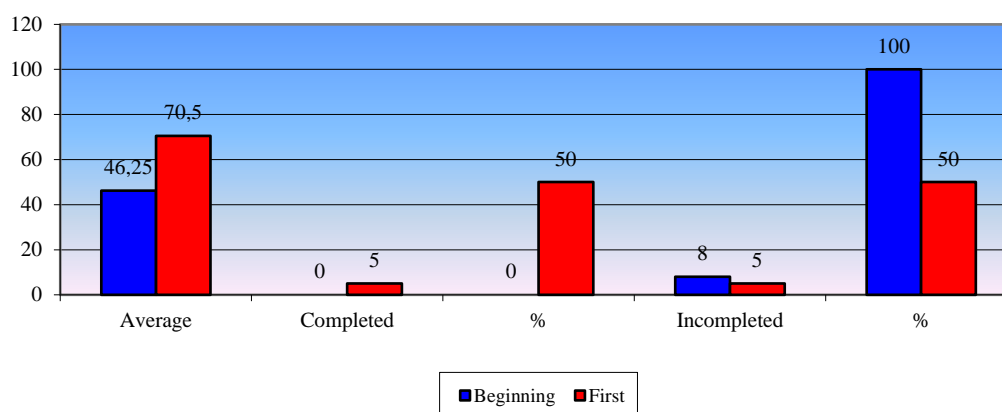

Figure 1: Increasing the Average Value of Teacher Competence in the Development of STEM-Based Learning Devices in the Initial Conditions and the First Cycle.

3.2 Second Cycle Corrective Action

As in the second cycle of corrective action, iHT development of STEM-based learning tools. After the second cycle of corrective actions, it can be concluded that they meet the criteria and indicators of success that have been set so that all teachers who take part in IHT activities are declared to have increased competence in developing STEM-based learning tools. From the implementation of activities in cycle II, the following results were obtained.

Table 2: Recapitulation of the Average Value of Teacher Competence in the Development of STEM-Based Learning Tools in the First Cycle and Second Cycle.

No	Cycle	Average-2 Value	Grade Qualification	Completeness			
				C	%	IC	%
1	First	70,50	C	5	50	5	50
2	Second	90.00	B	10	100	0	0

The results of observations on corrective actions in the second cycle showed that all teachers had increased their competence in developing STEM-based learning tools. This is evidenced by the increase in the average score to 90.30 and is included in the Good category (B). To clarify in the form of a bar chart as described in the graph below.
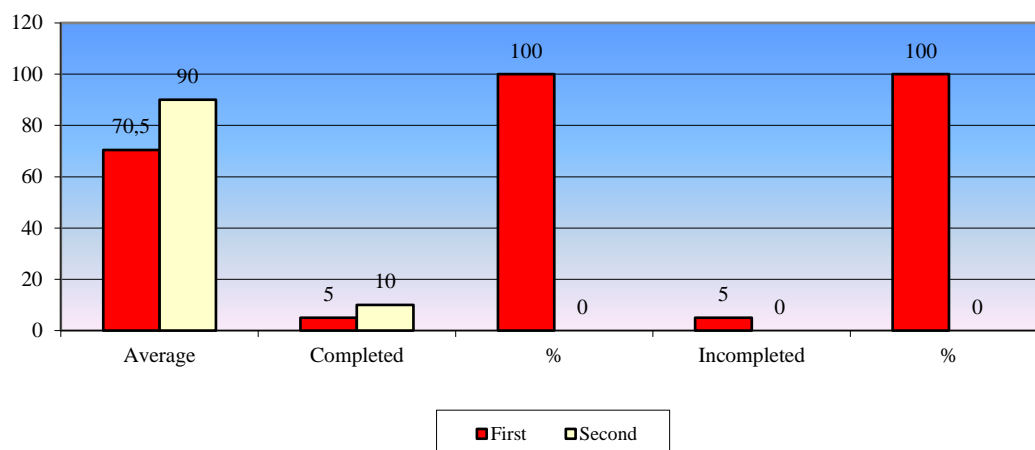

Figure 2: Increasing the Average Value of Teacher Competence in the Development of STEM-Based Learning Tools in the First Cycle and Second Cycle.

3.3 Corrective Action Between Cycles

From the data obtained as a result of the implementation of repair activities carried out in 2 cycles, the results can be summarized as follows:

Table 3: Recapitulation of Assessment Results of Teacher Competency Improvement in the Development of STEM-based learning tools in Initial Conditions, Cycle I, and Cycle Two.

No	Cycle	Mark	Assessment criteria	Note:
1	Initial Condition	46.25	D	-
2	Cycle I	70,50	C	-
3	Cycle II	90.00	B	-

Clearly in the form of a graph, the increase in the competence of teachers at SMAN 3 Sigi in the development of STEM-based learning tools is described in the image below.
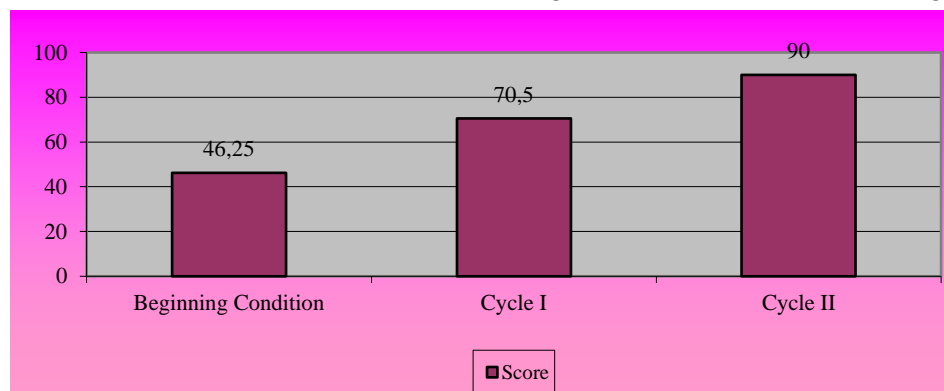

Figure 3: Improving Teacher Competence in Developing STEM-Based Learning Tools in Initial Conditions, Cycle I and Cycle II.

The explanation for increasing teacher competence in developing STEM-based learning tools is based on the mastery of each teacher individually as described in the table below.

Table 4: Recapitulation of Assessment Results of Teacher Competency Improvement in Teachers in the Development of STEM-Based Learning Tools in Initial Conditions, Cycle I and Cycle II.

No	Cycle	Complete		Not Completed	
		Quantity	%	Quantity	%
1	Beginning	0	0	10	100
2	First	5	50	5	50
3	Second	10	100	0	0

Clearly in the form of a graphic diagram, the improvement of teacher competence in teachers at SMAN 3 Sigi in the development of STEM-based learning tools as described in the image below.
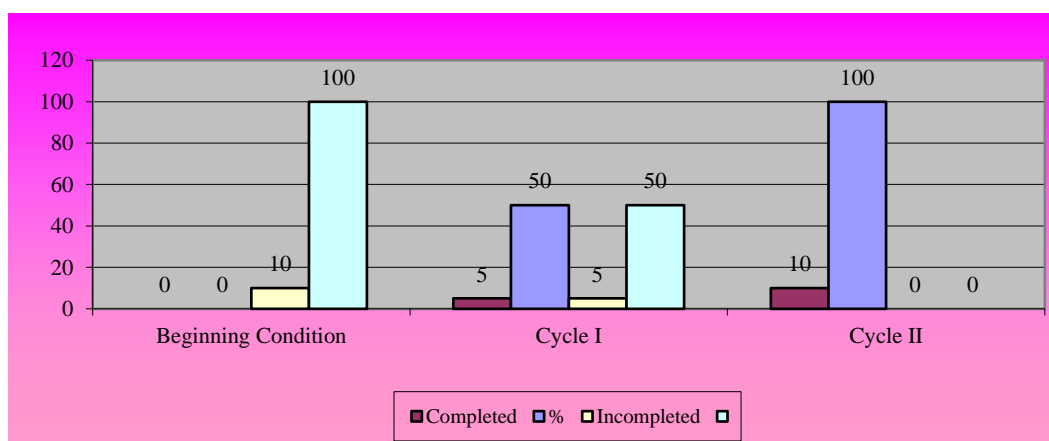

Figure 4: Recapitulation of Assessment Results of Teacher Competency Improvement in Teachers in the Development of STEM-Based Learning Tools in Initial Conditions, Cycle I and Cycle II.

Discussion

The Covid-19 pandemic, which is still endemic to this day, requires all parties, one of which is the education sector, to carry out smart and innovative strategies so that various learning activities can be carried out properly. The concept of continuous learning in all situations must make the spirit of teachers to be creative to help educate students as the nation's golden generation in the future.

The development of information technology today is very rapid so it affects all aspects of life, including education. In the field of education, a teacher must master technology [15], [16]. Technology can be used in the manufacture of media in learning. Two very important elements in the teaching and learning process are teaching methods and teaching media. These two aspects are interrelated. The selection of one particular teaching method will affect the type of appropriate teaching media, although there are

still various other aspects that must be considered in choosing the media, including the teaching objectives, the types of tasks and responses that students are expected to master after teaching takes place, and the learning context including student characteristics.

The root of the problem is that not many teachers can carry out professional development activities. The low motivation and competence of teachers in developing learning tools in this case learning tools can result in low learning motivation of students. This is Purwono's opinion [12] which states that learning tools can also make learning more interesting and fun.

To overcome the problems above, an appropriate and fast effort is needed, one of which is the implementation of iHT for SMAN 3 Sigi teachers in helping teachers develop STEM-based learning tools. iHT is a training program held in its place, as an effort to improve teacher competence, in carrying out their work by optimizing existing potential. iHT activities can be carried out in schools with the consideration that these activities can be used to improve abilities and competencies with other teachers who have competencies in their duties as teachers. With this strategy, it is hoped that it will save more time, and costs, and can utilize the potential that exists in schools. iHT is a training program that is held in its place, [17]. iHT is a training that is carried out internally by a working group of teachers, schools or other places that are designated as the implementation of training carried out based on the idea that some abilities in improving teacher competencies and careers do not have to be done externally, but can be done internally by teachers as trainers. who has competencies that other teachers do not have While the conditions for participants in iHT are a minimum of 4 people and a maximum of 15 people [18]

In pandemic conditions, adaptation is needed to meet the demands of distance learning in the world of education, one of the important things to prepare is learning devices that have been modified according to the conditions of the Covid-19 pandemic. This is important for every teacher to prepare so that students get interesting material to learn. Based on the observations, the following problems emerged: 1) Teacher competence in developing STEM-based learning tools is very low. 2) Teacher awareness is still low on digital literacy. 3) Lack of teacher motivation to upgrade themselves to be more sophisticated and professional. So problems arise, one of which is that teachers are still carrying out conventional learning which results in the learning motivation of generations of students also decreasing.

From the explanation above, it shows that increasing teacher competence in developing STEM-based learning tools through iHT activities which emphasize more on consultative collaborative methods will provide opportunities for sharing between one principal and teacher and teacher with other teachers. Thus, the understanding and ability, and competence of teachers in the development of STEM-based learning tools can be improved both in theory and in implementation.

4. Conclusion

Based on the results of research regarding what has been carried out, the following conclusions are drawn: 1) the implementation of in-house training activities has been proven to be able to improve the competence of teachers at SMAN 3 Sigi in developing STEM-based learning tools; 2) increasing the competence of teachers at SMAN 3 Sigi in developing STEM-based learning tools as evidenced by the improvement in the results of the competency assessment of teachers at SMAN 3 Sigi in developing STEM-based

learning tools. wherein the initial conditions the average value is 46.25 and is included in the Less (K) category, increasing in the first cycle with an average value of 70.50 and is included in the Enough (C) category and in the second cycle with an average value 90.00 and included in the Good category (B).

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