

## Assistance in the Development of RBL-STEM Learning Tools Based on AI and IoT to Improve Students' Thinking Skills

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### ABSTRACT

A teacher is an educator who is required to continuously develop his skills and knowledge. Learning today is no longer learning that can be packaged conventionally if the teacher wants good learning outcomes. Current learning must be able to increase students' interest in learning. One type of learning that is currently trending is learning based on artificial intelligence and Internet of things (IoT). The quality of human resources can be seen from the ability of graduates who have skills, master technology, and have extensive knowledge and professional expertise. To improve the digital literacy competency of educators, the Unej service team carries out community service. The training activities carried out aim to increase teacher competency in utilizing AI and IoT as learning media especially in developing RBL-STEM learning tool. The implementation of this training uses the IHT method, lectures and mentoring. As a result, participants were able to create digital learning assisted by AI and IoT. Based on the results of media trials on students based on pretest and posttest, a probability or Sig value was obtained. (2-tailed) is equal to 0.000 with an alpha of 0.05, meaning there is a significant difference between the results on the pretest and posttest. In the posttest results, it was found that students' scores had increased in their thinking abilities.

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## INTRODUCTION

Difficulties experienced by students and feelings of disinterest in learning are common things found in every generation. This is caused by the implementation of learning in class which tends to be monotonous and boring. This is in line with Masyukur's opinion (Suzana et al., 2019). The learning process is less creative and monotonous, making students bored and bored, causing students to become sleepy, not concentrating, busy with themselves, etc. which results in the material not being able to be absorbed properly well by students (Trapsilasiwi et al., 2019).

Factors and learning models applied in the classroom also support student success in learning mathematics, so they are not only influenced by the students' own abilities (Purwati et al., 2016). Implementation of mathematics learning only uses lecture methods and conventional learning models which are commonly applied by teachers in the classroom so that the material presented is difficult for students to understand (Lutvaidah, 2016). The development of learning media is an important means of developing human resources because it includes development in the field of education. The role of teachers is important in this case because they are directly involved in the teaching and learning process (Ja'far et al., 2014). Therefore, new media innovation is needed to encourage students' interest in learning. Current learning must be able to increase students' interest in learning (Fatahillah et al., 2017). One type of learning that is currently trending is artificial intelligence-based learning (Subekti et al., 2021). Artificial intelligence (AI) is a field of computer science devoted to solving cognitive problems commonly associated with human intelligence, such as learning, problem solving, and pattern recognition.

Artificial Intelligence, often abbreviated as "AI", may connote robotics or a futuristic scene, Artificial Intelligence (AI) moves beyond science fiction robots, into modern advanced computer science non-fiction. Artificial Intelligence (AI) or artificial intelligence in Indonesian, is intelligence possessed by humans which is modeled in machines and programmed so that they can think like humans. AI is also a field of computer science which is devoted to solving cognitive problems which are generally related to human intelligence, such as learning, problem solving, and pattern recognition. The quality of human resources can be seen from the ability of graduates who have skills, master technology, and have extensive knowledge and professional expertise (Ja'far et al., 2014). The Research Based Learning-Science, Technology, Engineering and Mathematics (RBL-STEM) learning approach by integrating its four components is able to produce student thinking activities that are useful in helping to bring out students' critical thinking which is characterized by the ability to solve problems, make decisions, analyze assumptions, evaluate and carry out investigations (Safiati et al., 2022). The STEM learning approach by integrating its four components is able to produce student thinking activities that are useful in helping to bring out students' critical thinking which is characterized by the ability to solve problems, make decisions, analyze assumptions, evaluate and carry out investigations (Kristiana et al., 2022).

Responding to these conditions, the service team considers it necessary to provide training on the use of AI and IoT for learning purposes (Runisah et al., 2019). The service team provides training to school teachers in East Java. This training aims to train teachers to use AI and IoT in learning (Adawiyah et al., 2023). After this training, it is hoped that teachers will be able to apply AI and IoT in the classroom both online and offline so that they can improve students' thinking abilities.

## METHODS

This community service activity was carried out at SMAN Paiton, SMPN 6 Tanggul, and SMKS PGRI 3 Tanggul. Participants in this activity are teachers who teach in those school in math subject especially, but also all the teacher who wanna join this activity is welcome. Activities carried out in this training and mentoring include mentoring, training on the use of AI and IoT in learning, discussions and sharing seasons,

as well as dissemination in the form of media results created by participants (Prasetyaningrum et al., 2023). Training and mentoring activities that apply the following methods: a) In house training is a training program that is held as an effort to increase teacher competence in carrying out their work by optimizing the abilities and potential of participants. b) lecture, which is a method of delivering material and providing understanding to participants. This method is used to convey material in the form of important concepts that must be mastered by training participants regarding the creation and steps in creating and utilizing AI and IoT in learning, and c) mentoring, namely a method of assisting training participants (Djuhartono et al., 2023). The implementation of training and mentoring is carried out through several stages. We can see the stage of this community service in the figure 1. The explanation of each stages are as follows:

- Preparation is the stage of preparing introductory AI and IoT material.
- Implementation is the stage of implementing the program, designing the creation of the media and how to use it (Najib et al., 2023). At this stage, theory and practice are presented, namely introducing AI and IoT, uses, and procedures for making and applying them in learning.
- Evaluation is the stage of developing learning assisted by AI and IoT. This evaluation aims to determine the increase in teachers' understanding and skills in creating and implementing AI and IoT-based learning that has been created

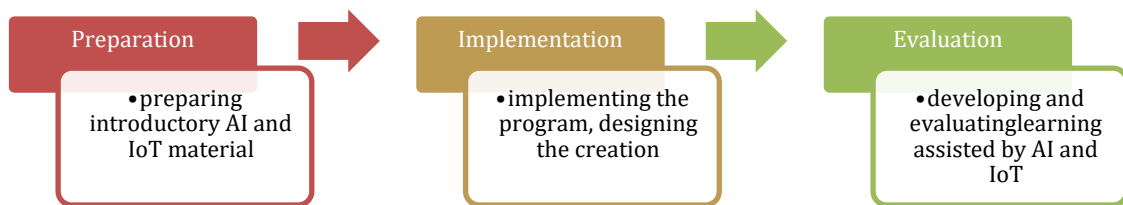


FIGURE 1. Community Service Method

## RESULTS AND DISCUSSION

This community service activity is carried out in the form of socialization and programmed training. Implementation Socialization is intended for teachers in East Java. There are 3 schools and several teachers participating in this training and mentoring activity. This training and mentoring activity is divided into 5 stages, namely:

- In the initial stage, participants are introduced to theories, concepts, various AI and IoT applications that can support learning activities. Then, participants were introduced to the theory and concept of RBL-STEM based learning development which is the core material in this activity. The material was delivered using a lecture method by presenting material slides and then a short discussion was held regarding the material presented, the aim of which was to explore participants' understanding regarding the use of AI and IoT. in developing RBL-STEM learning.
- After explaining the concepts and theories regarding AI and IoT and their applications, we then explain the steps for creating AI and IoT based learning tools. This stage is the stage of implementing service using the Focus Group Discussion method and practice in creating learning materials along with practice questions with the help of Canva, GPT chat, copy.ai, etc. Apart from that, the service team also delivered material regarding the development of RBL-STEM based learning tools. Before carrying out training activities, the service team distributed questionnaires presented in Google Form to determine the initial abilities of training participants regarding the ability to use AI and IoT, knowledge related to digital-based

learning media, knowledge related to IoT, and knowledge related to ICT skills of training participants in developing teaching materials. digital-based to support the learning process



FIGURE 2. Community Service Activities

- In the practical session using the in house training method, participants are divided into several groups, group divisions are based on grade level, class 1 teachers will be in groups with class 1 teachers from other schools, one group consists of 4-5 participants. In accordance with the direction of the community service team, participants tried to create learning tools with their own creativity by taking a theme for each class according to group agreement. Each group demonstrates or disseminates the results of their group's work so that it can be used as a reference in the future by the group
- Evaluation, at this stage each group that demonstrates their work results will be evaluated and have a sharing session where participants from other groups can provide input or additions regarding their performance and other group work results, this is so that each participant knows where their weaknesses lie. and the shortcomings of the AI that is created also knows the obstacles in creating the big book itself so that it can be corrected in the future. This activity generally runs smoothly without any problems and the output of this activity is the work of AI and IoT based learning tools.

In general, the use of AI and IoT by teachers in practical training and mentoring activities has been carried out well even though it appears that teachers are still awkward in implementing learning simulations (during dissemination). This is because teachers are just not familiar with the use of AI and IoT. This training is important for participants because it turns out that many teachers do not understand the use and utilization of AI and IoT. Several obstacles or problems encountered during the practice of creating AI and IoT-based learning devices were then discussed together to find solutions to the problems, including that

not all participants were good at drawing. This in the future will be an obstacle if participants want to create AI and IoT-based learning devices. The results obtained in this training and service activity apart from successfully training participants' skills in designing and creating their own IoT and AI-based learning media that suit the characteristics and cognitive development of their students, producing RBL-STEM based devices that are in line with learning achievement goals, and also Participants become more knowledgeable and understanding about AI and IoT, both in concept, use and how to create learning media and are able to implement AI and IoT in the process of learning activities in class. The resulting device is then tested on students. Based on the results of the trial, it shows an increase in student learning outcomes based on test results. The test results showed that of the 26 students who took the test, 22 of them had achieved the school's Minimum Completeness Criteria (KKM), namely 76 out of a maximum total score of 100. Hobri (2010) stated that learning was said to be effective if at least 80% of students were able to achieve reference value for the success of achieving predetermined competencies. The research results show an increase in the *posttest results* based on the results of hypothesis testing using *paired-sample t test*. The *pretest* and *posttest* results show that Sig. (2-tailed) worth  $0.00 < 0.05$  then  $H_0$  is rejected and  $H_1$  accepted, meaning there is a significant difference between the results on the *pretest* and *posttest*. The results of the *paired samples t test* in Figure 4.12 in Appendix 37 obtained a probability or Sig value. (2-tailed) is equal to 0.000 with an alpha of 0.05 so  $0.000 < 0.05$ . In this study, a significance level of 95% was used with a probability of error of 5%. So that  $H_0$  rejected and  $H_1$  accepted, meaning there is a significant difference between the results on the *pretest* and *posttest*. This shows that there is a positive influence on improving the thinking abilities of students who have implemented *Research-Based Learning learning tools* with a STEM approach assisted by AI and IoT.

## CONCLUSION

This community service aims to provide training on the use of AI and IoT to teachers so they are able to utilize AI and IoT in classroom learning both offline and online. Apart from that, teachers are expected to be able to provide instructions and direct students to be active in technology-based learning. This service activity has been carried out offline. The implementation of this training uses the IHT method, lectures and mentoring. As a result, participants were able to create digital learning assisted by AI and IoT. Based on the results of the questionnaire, teachers felt enthusiastic and interested in participating in the training. Based on the results of media trials on students based on pretest and posttest, a probability or Sig value was obtained. (2-tailed) is equal to 0.000 with an alpha of 0.05, meaning there is a significant difference between the results on the pretest and posttest. In the posttest results, it was found that students' scores had increased in their thinking abilities.

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