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Augmented Reality-Based Learning Media Training to Develop Elementary School Teachers' Creativity

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Abstract. Learning using technology is currently the main thing because it has entered the Society 5.0 era. This community service activity aims to provide opportunities for elementary school teachers in Cirebon City to conduct training on the use of augmented reality-based teaching media to support the development of their creativity and role in the learning process in the classroom. This activity has a target, namely teachers who are members of the Teacher Working Group Forum (FKKG) who are members of the board of directors of a total of 40 teachers from representatives of their respective schools in Cirebon City. This activity aims to: (1) develop the role of teachers in the digital economy era to better master technology in the learning process; (2) providing opportunities for elementary school teachers in Cirebon City to develop creativity in making interesting teaching materials; (3) facilitating teachers in creating digital augmented reality-based teaching materials; (4) utilizing AR technology to present interactive teaching media; and (5) support Merdeka Belajar-Kampus Merdeka (MBKM) program. This service activity uses the Participatory Action Research (PAR) method which includes activities that will be carried out ranging from identifying problems (to know), understanding (to understand), acting (to act), making changes (to change). The stages in this activity include (a) socialization and FGD; (b) the training process in several meetings; (c) the application of technology; (d) assistance and evaluation; (e) program sustainability, which provides broad opportunities for teachers to implement AR technology in learning and share knowledge with peers. The results of the training activities had a good response from the participants, including being able to increase the creativity of teachers in compiling AR learning media. In addition, the results of the questionnaire response have a score of 4.45 in the "excellent" category.

Keywords: Augmented reality, Learning media, Teachers' creativity, Elementary school student.

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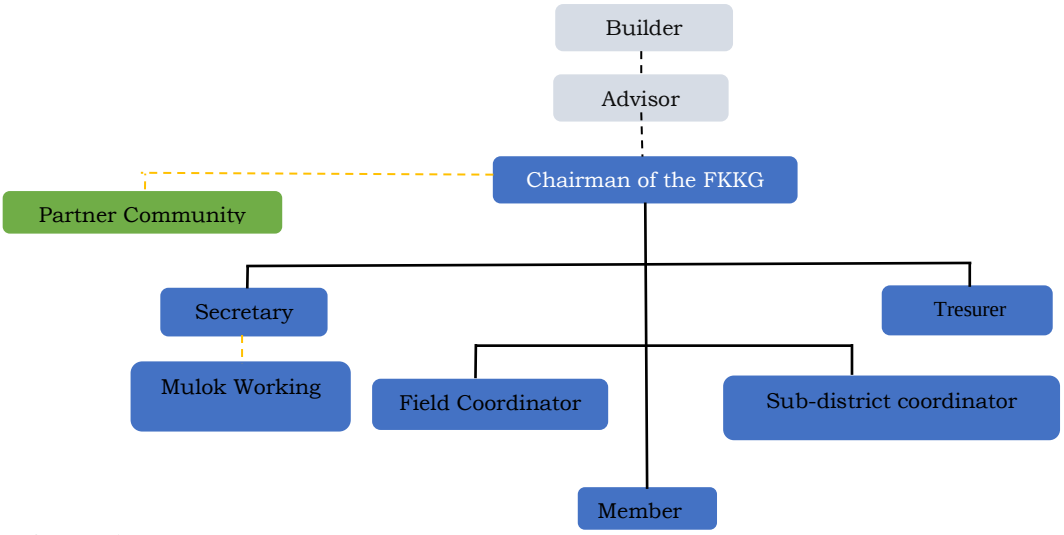
Introduction

The central role of education as one of the pillars of a nation's progress is inseparable from the existence of adequate human resources (Hendra et al., 2023). The educational process implemented through learning requires teachers as one of the important components of success in achieving ideal educational goals. Teachers who have superior competence in Indonesia today are proven through a certification after taking a professional program (Rif'iyati et al., 2024)(Rif'iyati et al., 2024; Yasin, 2023). However, in reality, this has not reached the expected standard, for example, there are still many teachers who have not mastered technology as one of the skills that must be possessed in the current digital economy era (Abidin, 2023). The role of technology in the world of education has been suggested by the Ministry of Education and Culture with various programs that have been urged in various educational units, including elementary schools. Elementary school teachers are currently required to have digital literacy skills (Prabowo et al., 2023). This is not only proven through certification, but one of the things that can be done as a form of sustainability in the development of creativity and the role of teachers is Forum Kelompok Kerja Guru (FKKG) in a certain area as a forum to share knowledge in mastering and implementing the latest technology-based learning ranging from coaches, FKKG chairmen, administrators, members, to

partner communities who can work together. For example, as in the following chart image which is data from FKKG Cirebon City.



Information:
- - - - - Coordination line
——— Command line
------- Partnership line

Figure 1. *Cirebon City FKKG Profile Management Chart*

Based on the distribution of data, the members of the Cirebon City FKKG are currently dominated by young teachers who have a high enthusiasm for designing and running various innovative and creative learning programs. This is a favorable existing condition as an acceleration to support the Ministry of Education and Culture's program in encouraging the digital economy in the field of education. However, the results of observations and interviews in the field, and situation analysis stated that currently there are still many elementary school teachers in Cirebon City who have not used technology in teaching as shown in the following figure.

Figure 2. *Observation of Teacher Teaching in Elementary Units in Cirebon City*

Cirebon City as a city that is currently developing is often a stopover city for immigrants that connects big cities such as Jakarta, Bandung, and Semarang. As a city that also has a large port, Cirebon has the potential to advance shortly. This has been proven by the rapid development of many sectors. Thus, the rapid growth of the city must certainly be balanced with the existence of human resources who have qualified capabilities as Indigenous citizens, for example, one of the main solutions is to improve the quality of education. Through a quality education process, a competent next generation will be printed. Therefore, these preparations must be studied and solutions must be found from now on.

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The condition of the Cirebon City area and the facts in the field related to adequate human resources make Cirebon City have very good potential. For example, in the world of education, the existence of FKKG can be used as the main reason for teachers to appeal to other colleagues to carry out a creative and innovative learning process. To realize this, teachers must at least have creativity in designing technology-based learning in answering the era of the Industrial Revolution 4.0 towards the current era of society 5.0.

The role of teachers is very relied on in the learning process to present an interesting atmosphere. In addition, teachers' creativity is needed as the main skill to design a variety of fun learning processes (Machali et al., 2021). But in reality, currently, many teachers are still carrying out the learning process in a conservative way and have not prioritized technology as the main basis in teaching and learning activities. Thus, the role of the KKG as the main axis of the working group for teachers needs to be a model for other teachers who can present a creative and innovative teaching and learning process.

In this case, based on the presentation of an overview related to the Cirebon City area, the role of teachers in KKG, and an innovative learning process, it is necessary to have training related to technology-based learning to develop the creativity of teachers, for example focusing on making a teaching medium using Augmented Reality (AR) as one of the interesting outputs for students, especially at the elementary school level. Augmented reality is a technology used in the learning process to present the real world in the virtual world packaged in an interesting presentation related to the concept of knowledge (Herman et al., 2023). This is very much to the needs of learning at the elementary school level because elementary school children are still at the concrete operational stage and need media to understand teaching material (Marchand, 2012). Therefore, the target of this program is teachers at the elementary school level.

The benefits of AR-based learning media in this activity are used as a tool in the learning process for elementary school students based on Piaget's theory, elementary school students are still in the concrete operational stage (age 6-12 years), namely not able to think abstractly and need teaching media as an intermediary in understanding a concept of knowledge (Fauzia, 2023; Rohani, 2020). Therefore, the usefulness of the use of technology in making a learning medium is very necessary apart from the current elementary school students who are the age of the alpha generation who are close to technology in daily life (Mita & Widjayatri, 2023; Tanjung et al., 2021). The alpha generation is the youngest generation today who was born in the 2011-2025 range and is close to the use of gadgets in the learning process (Saman & Hidayati, 2023). In addition, the overall implementation of science and technology through this training is expected to be a provision for elementary school teachers in developing knowledge, for example, sharing knowledge with peers from representatives of each FKKG management teacher who has participated in training in various ways such as becoming a facilitator and implementing coaching clinics for other elementary school teachers in Cirebon City who have not had the opportunity to participate in this training activity.

The Institut Pendidikan dan Bahasa Invada (IPB Cirebon) as one of the campuses in Cirebon City has the tagline "High Quality and Digital Campus" and has qualified lecturer resources in their fields so that it is possible to carry out an activity in the form of training in compiling technology-based teaching media to carry out Community Service. Thus, the objectives of the training activity on the use of AR-based learning media are as follows: (1) developing

the role of teachers in the digital economy era to better master technology in the learning process; (2) provide opportunities for elementary school teachers in Cirebon City to develop creativity in making interesting teaching materials; (3) facilitating teachers in creating digital augmented reality-based teaching materials; (4) utilizing AR technology to present interactive teaching media; and (5) supporting the Independent Learning-Independent Campus (MBKM) program in its implementation for the students involved, namely converting as many as 6 credits by the scientific field.

The training program can be an alternative solution for teachers to master digital literacy today. In addition, based on the Main Performance Indicators (KPIs) of Higher Education facilitating student activities to have off-campus experiences, lecturers can implement the Tri Dharma of Higher Education by conducting activities outside the campus, as well as the results of lecturers' performance in the form of Community Service between the IPB Cirebon in collaboration with FKKG Cirebon City as many as 40 elementary school teachers can be implemented in designing interesting learning.

Based on the analysis of the problems and objectives of the Community Service program activities related to training for elementary school teachers, the main focus and urgency of this activity is expected to be a contribution to IPB Cirebon as one of the universities in Cirebon to provide training in increasing the creativity of elementary school teachers in Cirebon City. In addition, the role of teachers in learning technology is one of the reasons for the implementation of these activities.

One of the priority problems in community service activities in the form of training on the use of AR-based learning media is the lack of digital literation for teachers, especially teachers at the elementary school level. The level of basic education is the main level before students enter the middle and upper levels, so students need to understand concepts in every learning process (Simanjuntak et al., 2022). The role of elementary school teachers is also often a benchmark for the output of students who will continue at the next level of education (Ananda et al., 2023; Suprapto et al., 2023). Thus, elementary school teachers must have creativity in developing the ability to create interesting learning media so that learning goals can be achieved and improve the quality of education.

Implementation Method

The method used in this service activity is the Participatory Action Research (PAR) method, which is an approach in service whose process and purpose are for learning in overcoming problems and as a form of meeting the practical needs of the community, as well as a means for the production of knowledge (Faizah et al., 2023; Morales, 2016). The PAR method is very appropriate in the approach of service activities in the form of training in the use of learning media because it is a form of collective critical awareness, namely the Cirebon City FKKG and the IPB Cirebon campus in building efforts to improve the quality of education so that it can encourage SGDs 4 points (good quality of education).

Through the PAR approach, namely by empowering the community, in this case, the Cirebon City FKKG as the target is expected to be able to build knowledge independently, especially in compiling interesting technology-based learning media. This is one of the main characteristics of the approach using PAR, namely if a community can build independence, then a social change can occur by itself (Wilkinson & Wilkinson, 2024). The way of working in the

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implementation of Community Service with the PAR approach includes activities that will be carried out ranging from identifying problems (to know), understanding (to understand), acting (to act), doing change is described as follows:

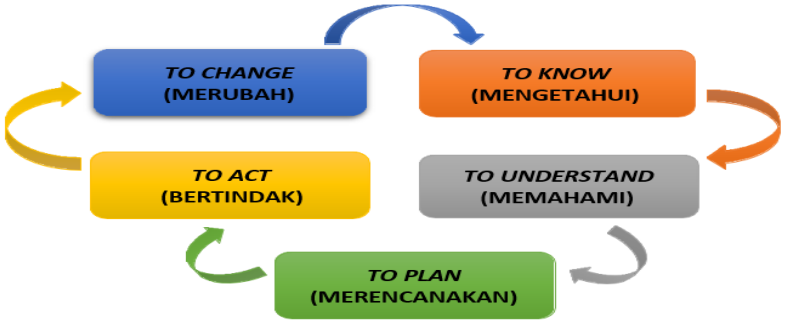

Figure 3. *The cycle of Community Service Work Steps PAR Approach*

Based on the cycle of work steps listed in Figure 5, the presentation in more detail in the Community Service training activities for the use of learning media for KKG teachers in Cirebon City is as follows:

1. The stage to know (knowing the real condition of the community), in this case IPB Cirebon tries to find out more about all work programs and overall related to the Cirebon City KKG at the elementary school teacher level. The location of IPB Cirebon campus and the Cirebon City FKKG office are located in Pekalipan District, Cirebon City, which is not far apart so geographically it can establish good cooperation, especially in the academic world. IPB Cirebon, one of the campuses that has a PGSD study program, approaches and collaborates with teachers in the Cirebon area, especially at the elementary school level, and has the same vision and mission in the world of education, which is to advance the world of education. In addition, IPB Cirebon has the tagline "High Quality and Digital Campus", of course, in the learning process, the lecturers have applied technology. One of the things that has not been achieved comprehensively in the Cirebon City KKG for elementary school teachers is still many who do learning without using learning media as stated in the introduction. However, there are still many learning media that have not utilized technology such as the following, for example:

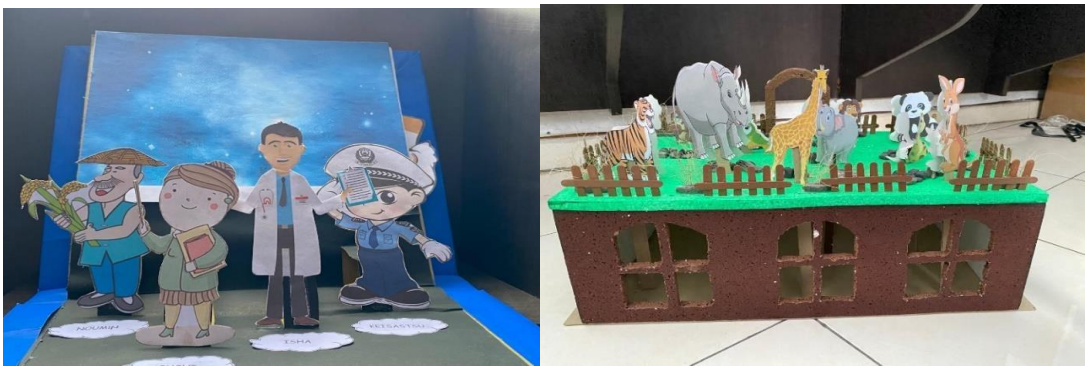

Figure 4. *Variety of Learning Media Used by Elementary School Teachers in Cirebon City*

Limitations in making technology-based teaching media are based on the lack of socialization and training that provides means to explore knowledge related to digital-based learning media.

2. Stage to understand, in this stage, the IPB Cirebon campus and FKKG Cirebon City try to conduct further studies related to the needs of elementary school teachers in Cirebon City. After discussing with several elementary school teachers in Cirebon City, the picture is summarized in the following problem analysis techniques:

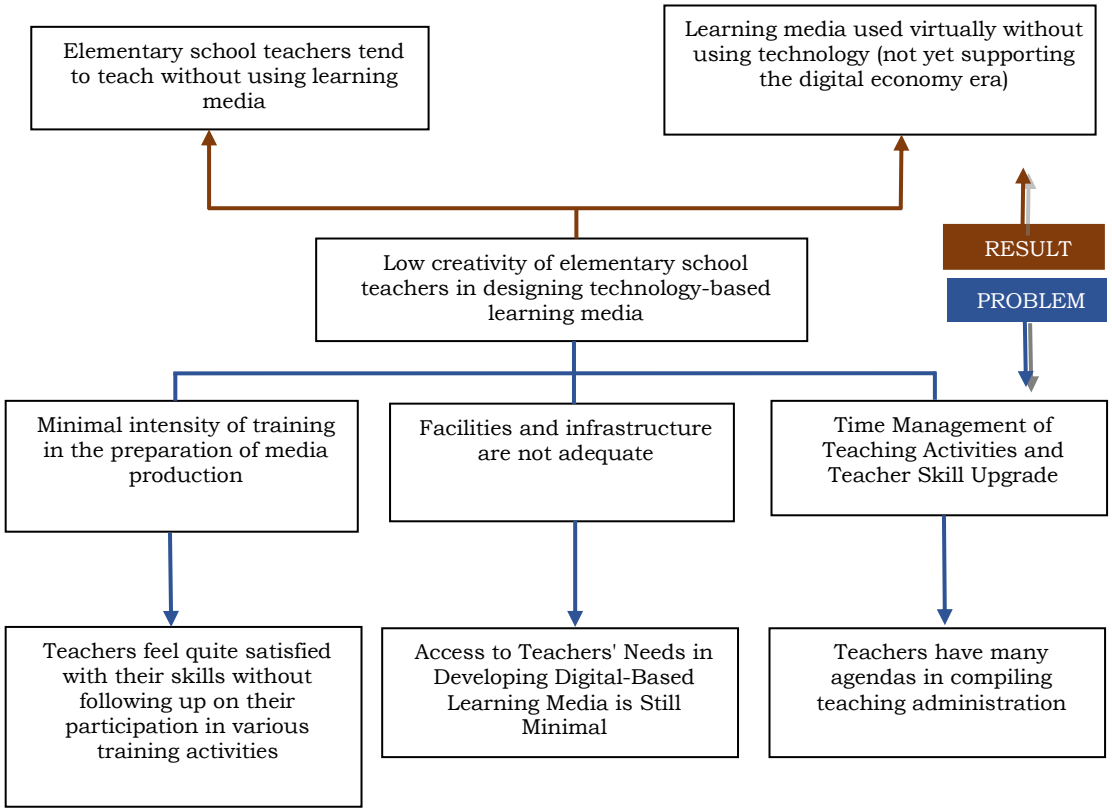

Figure 5. *Problem Analysis Chart*

3. During the planning stage, at this stage, there will be problem-solving in the Cirebon KKG, namely training on the use of technology-based learning media using augmented reality. The planning of this service program will be carried out by the agreement that has been made. The selection of the theme in creating technology-based teaching media is based on the goal of quality education through the good education quality program (SDGs 4) so that it can reduce inequality (SDGs 10) in answering the challenges of the digital economy era. In addition, the form of seeking cooperation between IPB Cirebon and the Cirebon City KKG as a form of revitalization of global partnerships (SDGs 17).
4. The stage to act, in this stage is the process of training and mentoring activities for elementary school teachers, especially for the management of the Cirebon City KKG at the elementary level to create augmented reality-based learning media totaling 40 elementary school teachers.
5. Stage to change, if this service program is implemented, it will make changes in the form of increasing the knowledge and skills of elementary school teachers in Cirebon City in compiling and making technology-based media and teaching materials, as well as the sustainability that will be achieved is the downstream of technology-based learning media.

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By the Community Service work cycle using the PAR approach, the following is a table of stages regarding the process of implementing training activities that will be carried out in this service activity:

Table 1. *Stages of Training Activities*

No.	Stages	Description
1	Socialization and FGD	The Community Service program team identified in detail related to the needs of the community, namely in this case the Cirebon City KKG by conducting observations and data collection so that the final thing that will be done is the procurement of a special training for the Cirebon City KKG administrators for elementary school teachers as a form of representation of elementary school teachers throughout Cirebon City.
2	Training	Training activities will be carried out during a predetermined timeline and have clear outputs in the form of IPR teaching media that have been compiled from each elementary school teacher and the creation of ISBN books from Community Service activities carried out.
3	Application of Technology	Teachers are able to apply or implement media results learning or teaching materials that have been prepared from training and mentoring during the Community Service process.
4	Mentoring and Evaluation	IPB Cirebon and Cirebon City KKG together evaluate program activities through FGD together for the sustainability of future programs.
5	Program Sustainability	This service program provides a wide opportunity for teachers who have received training to be able to share in the form of coaching clicks and sharing knowledge with peers as a form of downstreaming teaching media that has been made during mentoring.

The stages of these activities will be carried out within 8 months form April-November 2024. The participation of partners during the implementation of the program is to provide opportunities for FKKG administrators to take part in training in the use of AR learning media. The service program involving the Cirebon City FKKG will be sustainable as a form of cooperative activity that will be evaluated in each activity. This is specifically in this learning media training activity has an evaluation of the implementation of the program, namely if successful, it will be followed up more widely for the downstream of AR learning media, and teachers who take part in the training can hold coaching for other elementary school teachers in Cirebon City.

This service activity is assisted by the team that has been formed, namely lecturers from IPB Cirebon as the chief proposer and members, as well as students who are involved. The students involved in this Community Service activity are students of the Primary School Teacher Education program who, based on their respective roles, have the right to recognize two courses of 6 credits, namely ICT Learning (3 credits) and Graphic Design (3 credits). The campus must support the Merdeka Belajar-Kampus Merdeka (MBKM) program by providing opportunities for students to gain knowledge outside the classroom and have direct experience by involving the community so that the knowledge gained is more relevant to full involvement.

The following are the roles and duties of each member:

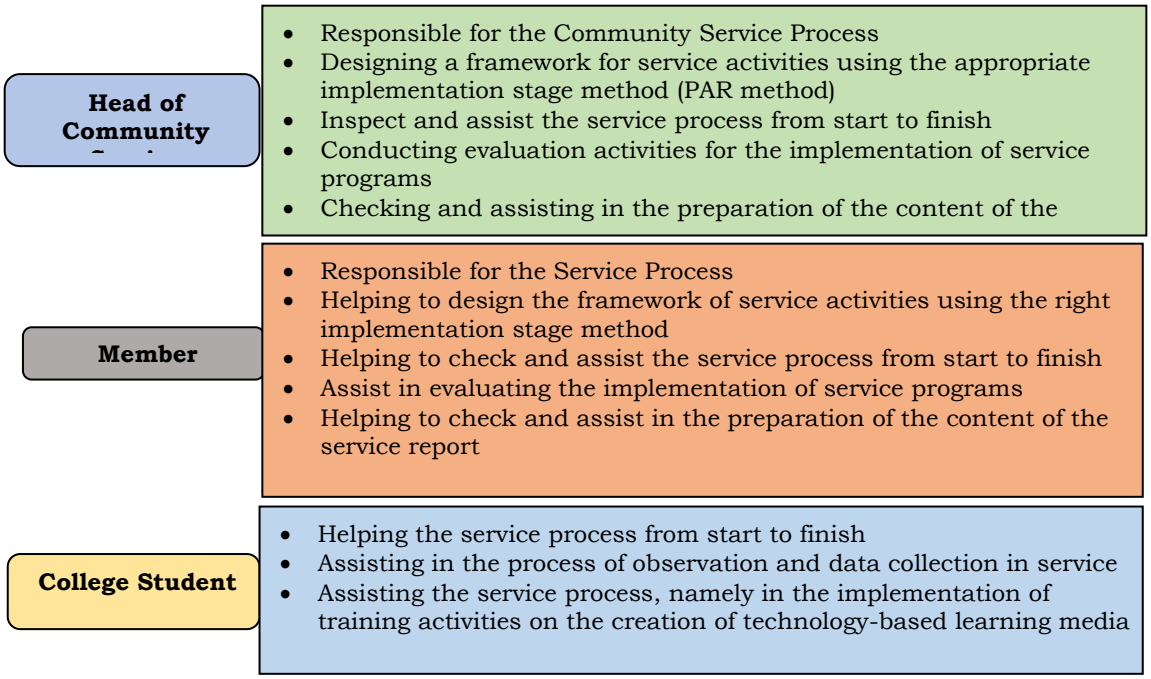

Figure 6. *Roles and Duties of the Community Service Team*

Results and Discussion

This Community Service activity is in accordance with the stages ranging from socialization to program sustainability. Based on the timeline of activities that have been designed, the achievement of the implementation of activities has been 100% carried out according to the stages. In the process of implementing this service activity, which is calculated from the beginning to the end of the activity, it is as follows:

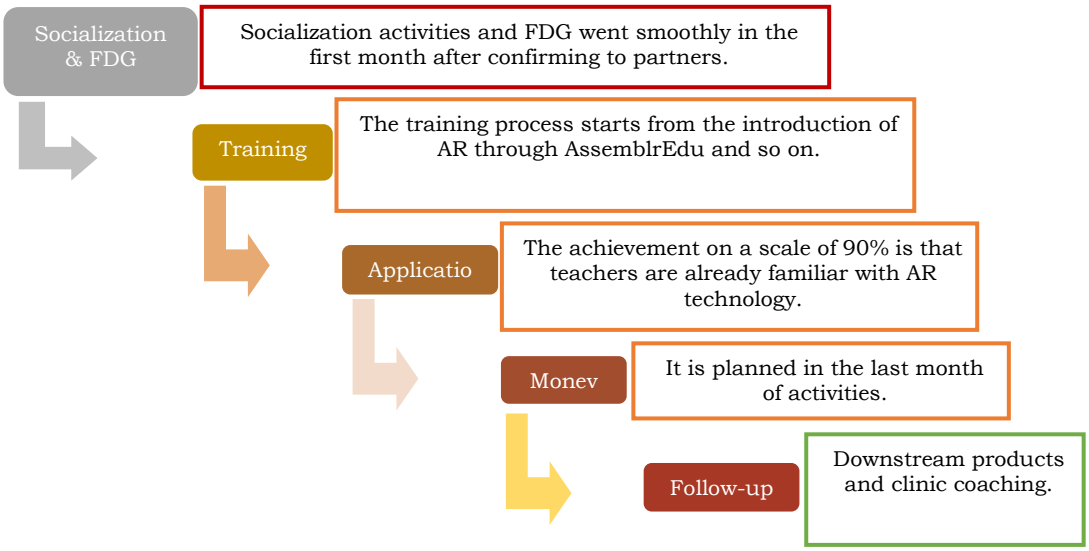

Figure 7. *Process and Results of Activity Implementation*

After confirming with partners and approval, the FGD activity process is carried out as an initial form of readiness for the training process. The FGD activity was carried out by the IPB Cirebon Community Service team and was attended by representatives of the Cirebon City FKKG as partners. The following is one of the documentation of FGD activities that were carried out offline and online.

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Figure 8. *FGD Documentation of Community Service Team and Partner Representatives*

As a form of follow-up to discussion activities with partner teams in the field, the IPB Cirebon Community Service team then held an internal FGD as a form of preparation for Community Service activities that will be carried out over the next few months. The following is the documentation from the internal FG that has been carried out.

Figure 9. *Internal FGD Documentation*

Furthermore, at the training stage, an introduction to material about augmented reality was carried out using AssemblrEdu and other platforms that support AR technology. Some documentation of training activities is as follows:

Figure 10. *Training Documentation*

After the training process with several meetings, the next stage is the application of technology. At this stage, teachers are expected to be able to apply AR technology in the learning process. The results obtained are a variety of augmented reality-based learning media from teaching materials in elementary schools. Furthermore, a monitoring and evaluation process is carried out as a consideration for input and criticism of the activities that have been carried out in the service process. The following is documentation of several activities in the form of technology application and evaluation monitoring activities.

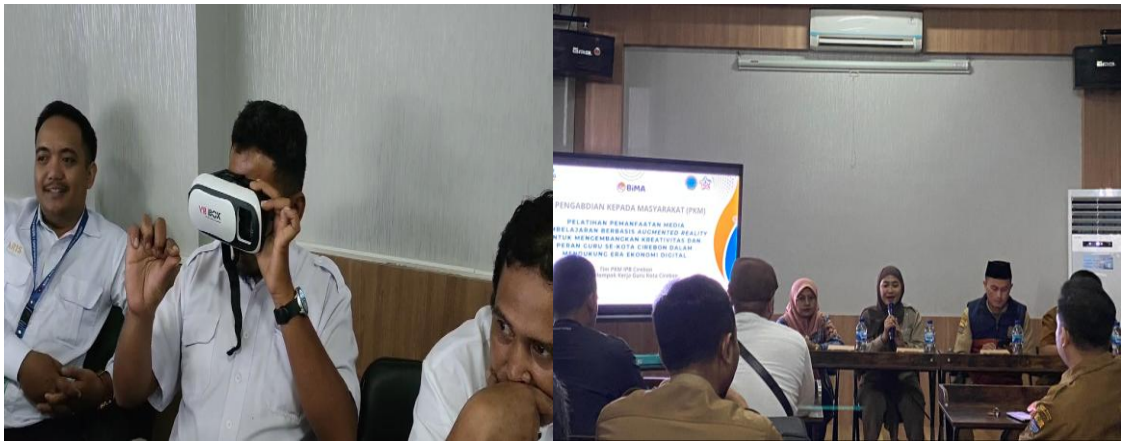

Figure 11. *Documentation of Technology Implementation and Monitoring & Evaluation*

The final stage of this service program is the sustainability of the program, namely teachers who have participated in this service activity are expected to be able to share knowledge with peers in their respective schools. Here is some documentation of the sustainability of the program that has been carried out.

Figure 12. *Application of AR Technology in the Learning Process*

This community service activity gave a positive response from the trainees, including according to one of the teachers from SDN Penggung I Cirebon City named Widiati Wahyuni, S.Pd. stated that this training was a new experience and a lot of useful knowledge was obtained, especially to compile learning media based on augmented reality technology so that the learning process was interesting for students. This training not only improves technical skills, but is also able to improve critical thinking skills for teachers

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to apply directly. In addition, the response from the secretary of the Cirebon City FKKG, Aris Syuhada, S.Pd., a teacher from SDN Kalitanjung 1 stated that this AR training activity was able to equip teachers in compiling AR teaching media that can be applied in the classroom so that they can increase the creativity of teachers who take part in the training.

In this activity, responses from teachers who have participated in the training are also collected. The response was focused on various kinds of questions in the form of material presented, presentation of the training process, and evaluation of program activities. The determination of categories is carried out based on the scale category according to Sugiyono (2013) as follows:

Table 2. *Scale Category*

Interval Scale	Category
1.00 – 1.80	Very not good
1.81 – 2.60	Bad
2.61 – 3.40	Not good
3.41 – 4.20	Good
4.21 – 5.00	Excellent

After collecting data in the form of a questionnaire to KKG teachers who participated in training activities, the following is the distribution of data and the determination of categories generated in Table 2.

Table 3. *Response of Training Participants on the Preparation of AR-Based Learning Media*

No.	Question	Average Score	Category
1	The purpose of the training was conveyed during the initial FGD and the implementation of the training	4.86	Excellent
2	The preparation of AR teaching media is adapted to the material of elementary school students	4.27	Excellent
3	The overall material is complete with instructions for various tools in the use of AR	4.32	Excellent
4	The material presented in the training process is in accordance with the needs of teachers in the era of society 5.0	4.45	Excellent
5	The material presented increases teachers' creativity in the preparation of teaching media	4.55	Excellent
6	The material presented can be used in the learning process in the classroom	4.50	Excellent
7	The training material was delivered attractively by the resource persons	4.64	Excellent
8	The implementation of the training is in accordance with the schedule in the initial agreement	4.14	Good
9	The presentation of material during the training was able to encourage teachers to develop sources for the preparation of teaching materials in the form of AR	4.41	Excellent
10	The presentation of material makes it easier for teachers to develop product outputs in the form of AR	4.36	Excellent
	Average	4.45	Excellent

Based on the distribution of the data questionnaire that has been prepared, the whole is in the "very good" category with an average score of 4.45, except for question point 8, which is related to the implementation of training is in the "good" category. This is because during the process there was a change in schedule for several training meetings, namely towards the end of the meeting there were several participants who were busy outside the implementation of this service training, and the service team agreed to replace the day. In addition, the schedule change is also due to the availability of rooms that have previously been confirmed to be available but are used for more urgent purposes so that a change in the training schedule is required.

Conclusion and Suggestion

Conclusion of Community Service activities by involving Cirebon City FKKG partners through the stages of planning, design, and implementation provide opportunities for teachers to develop their creativity and role in the learning process. The results of the initial data obtained by the IPB Cirebon Community Service team show that all public elementary schools in Cirebon City already have adequate facilities and infrastructure to carry out the technology-based learning process. This was summarized in the initial socialization process and Focus Group Discussion (FGD) of the Community Service team and representatives of the Cirebon FKKG management. Thus, the process of this service activity is able to increase the creativity and role of teachers, especially those who have participated in the training process, namely providing questionnaire responses with a score of 4.45 in the "very good" category.

Suggestions in the implementation of future service activities are the need for goals wider than the partners who are the subject of the activity. To realize the roadmap by the design then encourages the downstream of products resulting from this Community Service activity. Moreover, service activities in the field of education to support the digital economy era can carried out routinely with different location targets to obtain the results of the analysis and outputs that are also different from previous service activities.

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