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Improving Teacher Competence in Plant Identification and Preservation through Training on Google Lens and Herbarium Techniques for Elementary School Teachers

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ABSTRACT
Background: Plant diversity material is one of the biology materials studied with the aim that students are able to identify, distinguish, and communicate the characteristics of the plant world division. However, students are often faced with challenges in recognizing and distinguishing different types of plants due to the complexity and variation of plant morphological characteristics so that the material is found difficult by most students in school. The solution to this problem is the use of learning media such as Google Lens and plant preservation.
Purpose of the Study: This activity aims to increase teachers' knowledge and ability to use plant identification applications (Google Lens) and plant preservation for learning plant diversity.
Methods: The method of the activity includes pre-tests, material enrichment, mentoring, post-test, and evaluation. This community service activity was attended by 46 MIS teachers in Sleman Regency.
Results: Pre-test results showed 84.78% of participants in the Less criteria, which decreased to 50% in the post-test. As many as 10.87% - 50% of participants obtained a post score that was in the criteria of Sufficient (C) to Good (B). As many as 97.83% of participants were able to use the application well and 52% were in the Good (B) criteria for the preparation of LKPD. The results of the questionnaire showed that 63.64% of teachers strongly agreed that this community service activity can increase knowledge and competence in the effective and efficient use of learning media and 72.73% were motivated to develop LKPD (Student Worksheets) that can improve students' abilities in learning. (maximum 250 words) (Garamond, size 11 font)

Keywords
Google Lens; LKPD; Plant Preservation

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Introduction

Plant diversity material is one of the biology materials studied with the aim that students are able to identify, distinguish, and communicate the characteristics of the plant world division and provide examples of each member in the plant world (Eriawati, 2016). Understanding biodiversity and the ability to identify plant species is an important and fundamental aspect of studying science. However, students are often faced with challenges in recognizing and distinguishing different types of plants due to the complexity and variation of plant morphological characteristics so that the material is found difficult by most students in school. Research conducted by Zarisma et al. (2016) shows that the highest learning difficulties faced by students are found in the indicator of compiling classifications in the plant world with a percentage of 62.63%. Christanty et al. (2021) also said that students have difficulties in the material of the plant world in terms of compiling classifications and identifying the general characteristics of the plant world.

The students' difficulties in understanding plant diversity material are also triggered because students do not interact directly with various plant species. This is because the learning process takes place more in the classroom centered on the teacher (the teacher as the main source of knowledge). The learning method carried out by teachers is limited to lectures, dictation, and questions and answers. Teachers rarely associate subject matter with real problems in daily life. This makes students saturated, bored, and unmotivated in learning. Teachers only provide materials according to the study materials obtained from package books (Eriawati, 2016). According to Juhanda (2014), learning is only oriented to books without inviting students to see objects directly. In fact, biology learning can be easily understood by students if in the learning process experience is provided directly, not transferred from teacher to student just like that. In addition, learning that is carried out rigidly and full of burdens will make the learning process unpleasant and make students depressed, uncreative, and difficult to understand the material. This causes learning goals to not be achieved optimally.

The learning process in schools needs to be updated in accordance with the development of education in the world, which is not only learning using conventional methods but requires the design of various learning strategies and media to be applied to students according to their characteristics. Learning media in the learning process plays a role in accelerating the teaching and learning process, instilling a spirit of learning, providing opportunities for students to interact directly with the environment and field realities, and providing independent learning opportunities based on students' learning abilities and interests (Nuriansyah, 2020). The use of ICT-based learning media, such as multimedia with text, images, audio, and video, can increase student motivation and learning outcomes (Alfansyur, 2019). In identifying plant diversity, students can use a mobile phone digital camera to photograph the plants to be identified. The use of mobile phone digital cameras makes the process of plant identification easier. Students do not need to linger in front of the plant to observe the morphological characteristics of the plant to be identified. They just need to photograph the plant and be able to identify it elsewhere. Students can identify photos of plants using plant identification apps. A recent development that can help in the identification of plant species is Google Lens.

Google Lens is one of the advanced applications developed by Google that utilizes image recognition technology and artificial intelligence to identify various things, one of which is objects and information in images. One of the interesting features of Google Lens is the ability to recognize plants from images taken with a mobile camera (Sofian, et al., 2022). There are a few basic reasons to use Google Lens for plant species identification studies. First, Google Lens is equipped with advanced image recognition technology that can accurately identify various plant species. This provides students with information about the plants they observe and allows them to better understand the characteristics and differences between species. Secondly, Google Lens is

very easy to access and use. Since it is an app that is integrated into a smartphone, its accessibility is very high for most students. This ease of use allows students to access information about plants quickly and in real time without significant technical constraints.

The lack of learning resources in schools is also an obstacle in learning plant diversity materials. The use of learning resources is very important in the context of teaching and learning, because learning resources can help and provide learning opportunities and provide concrete learning experiences, and can expand students' horizons, so that learning goals can be achieved according to what is planned (Eriawati, 2016). Learning by utilizing plants in the school environment, both by observing plant objects directly in the environment, preserving plants, and preparing plant objects is enough to support the achievement of optimal learning competencies and goals, especially in plant diversity materials. One form of environment-based learning media is with plant preservation techniques or so-called herbariums (Murni et al., 2015). Dry herbarium is plant material that has been preserved by drying or also called dried herbarium specimens (Mertha et al., 2018). These specimens can be used as learning and research support materials, for example as a source of information on biological materials that discuss plant flora and ecology (Tjitrosoepomo, 1998; Partomihardjo and Rahajoe, 2004; Rugayah et al., 2004). According to Murni et al. (2015), learning by utilizing herbarium specimens from the school environment will greatly help students' understanding of biology and students will be interested and focused on learning. In addition, through herbarium observations, students can analyze the morphological variations of the plants discussed in the learning so that the description of a plant taxon can be determined easily.

Method

Community Service activities for the Lecturer Activities Outside Campus (PkM-DLK) scheme were held on June 18 and July 22, 2025 at the FMIPA Complex, State University of Yogyakarta and MI Daarul Ulum 1 Sinar Melati Pakem Yogyakarta. This activity was attended by 46 participants with the participants of the activity being MIS teachers in Sleman Regency. The implementation of the activity consists of five stages which include pre-test, material enrichment, mentoring, post-test, and evaluation.

The first stage in this activity is the initial ability testing of participants regarding the activity material that will be given through pre-tests. The pre-test activity aims to find out the teacher's initial knowledge regarding the use of plant identification applications (Google Lens) and plant preservation (leaf bone crafts). The assessment criteria used include: > 80: Very Good (VG); 71 - 80: Good (G); 60 - 70: Sufficient (S); and <60: Less (L) (https://ie.uad.ac.id/wp-content/uploads/Rubrik-Penilaian-KP-Teknik-Industri.pdf).

The next stage is material enrichment. At this stage, teachers are given insight into what the Google Lens application is, its features, advantages and disadvantages, and how to use the application. Likewise in the next session, namely on the material "plant preservation." The plant preservation techniques introduced to the teachers are herbarium and leaf sceleton crafts. The teachers were given an explanation of the concept, benefits, and process of making leaf sceleton crafts. In addition, examples of dry herbariums, wet herbariums, and finished leaf sceleton crafts were also shown. This activity lasted a total duration of two hours.

The third stage is the activity of assisting teachers in practicing what has been conveyed at the time of material enrichment. In the first session, teachers were accompanied in using the Google Lens application. In this activity, teachers were directed how to take pictures of the right plants using a mobile phone camera to be identified by the application. Observations were also carried out to find out the percentage of teachers, both incapable and able, in using the application. The next session continued with practicing making leaf sceleton crafts. Teachers practice the

process of making leaf sceleton crafts which include boiling water, boiling leaves, adding NaOH, soaking leaves in tap water, cleaning leaf tissue, bleaching leaf sceleton, and staining leaf sceleton. This activity lasted for two hours. At the end of the activity, teachers were assigned to compile a Student Worksheet (LKPD) regarding Leaf Morphology Characteristics. During the assignment, teachers were also given structured guidance related to the preparation of LKPD outside the hours of the implementation of activities. The grace period for working on the assignment is approximately two weeks before the implementation of the next activity.

The fourth stage is post-test activities. This activity aims to increase teachers' insight after the implementation of material enrichment and practice regarding the use of plant identification applications (Google Lens) and plant preservation (leaf sceleton crafts). The assessment criteria used are the same as the pre-test.

The last stage is the implementation of activity evaluation. The evaluation was carried out through filling out questionnaires by teachers to find out the level of success and response of teachers regarding the service activities that had been carried out. The indicators used to assess the success of this activity are:

1. There was an increase in the post-achievement score of understanding the use of plant identification applications (Google Lens) and plant preservation (leaf bone crafts).
2. At least 50% of teachers can use the plant identification application (Google Lens) and preserve plants assessed from practical activities and LKPD Leaf Morphological Characteristics from plant preservation activities (herbarium and leaf bone crafts).
3. At least 50% of teachers give a positive assessment of the service activities that have been carried out.

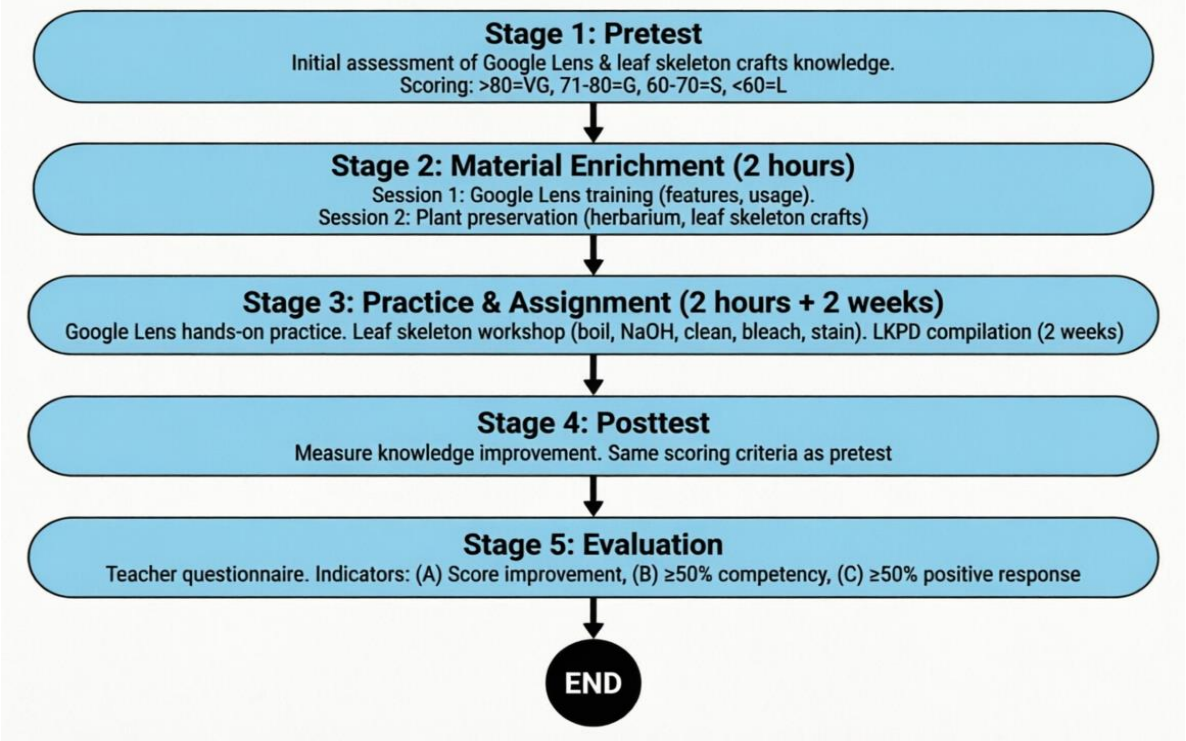

Figure 1: Community Service Methodology Flowchart

Result

Based on the community service activities that have been carried out, the results of pre-tests and posters were obtained from the participants of the activity during the activity. The results of the pre-test and pos-test of the participants are presented in Figure 2.

Figure 2: Percentage Chart of Pre-test and Post-test Assessment Results of Participants

Figure 2 shows that the participants' pre-test scores before being given practice questions and discussions were dominated by the Less (L) assessment criteria of 84.78%. After being given training and discussion of questions, there was a decrease in the percentage in the criterion of less (L) by 50%, which means that the scores of some participants have increased. The scores of participants who were in the less (L) criteria decreased so that they were included in the Sufficient (S) to Good (G) criteria. This is evident from the large percentage of post-test score of 50% which is higher than the pre-test score of 13.04% in the Sufficient criterion (S), as well as in the Good criterion (G) with a percentage of post-test score of 10.87% which is higher than the pre-test value of 0%. In the Very Good (VG) criterion, there was a slight increase of 2.18%.

In the practical activity of using the plant identification application (Google Lens), as many as 97.83% of the 46 participants (teachers) could use the application well while 2.17% of teachers could not use the application properly because they were constrained by the android version that was not compatible with Google Lens (Figure 3).

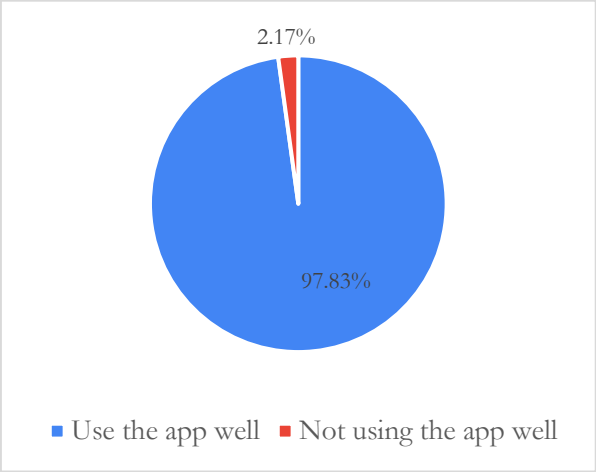

Figure 3: Percentage Chart of Participants' Practice Assessment Results

In the mentoring activity, the teachers practiced making leaf bone crafts. During the practical activities, the teachers also document their work. The results of leaf bone craftsmanship (Leaf Sceleton) are shown in Figure 4.

Figure 4: Leaf Sceleton Crafts Made by MIS Teachers in Sleman Regency

The follow-up to the leaf sceleton craft practice activity is the preparation of the Student Worksheet. The assessment criteria used for the Student Worksheet (LKPD) are the same as pre-tests and post-test. Determination of LKPD value based on content that includes suitability of topics, formats, and interesting content and display. The results of the LKPD assessment showed that as many as 38% of the scores were in the Sufficient criterion (S) and 52% of the scores were in the Good (G) criterion. The value that is in the Less (L) criterion is only 10% (Figure 5).

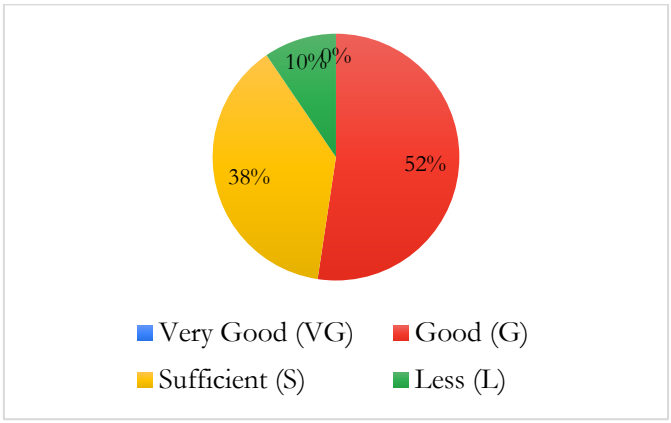

Figure 5: Percentage Chart of Participant LKPD Assessment Results

After a series of community service activities were carried out, participants filled out a questionnaire as a form of evaluation of the activities that had been carried out. Based on community service activities, the results were obtained as Table 1.

Table 1: Questionnaire on the Implementation of Community Service Activities

No	Statement	Strongly agree	Agree	Disagree	Strongly Disagree
1	This training activity was held according to my expectations.	40,91%	59,09%	0%	0%
2	The activity material is well organized and easy to understand.	45,45%	54,55%	0%	0%
3	The duration of time for the activity is sufficient.	27,27%	63,63%	9,10%	0%
4	The material presented made it easier for me to provide understanding to students.	31,82%	59,09%	9,09%	0%
5	This training activity can increase my knowledge and competence as a teacher, especially in the use of effective and efficient learning media to facilitate the teaching and learning process at school.	63,64%	36,36%	0%	0%
6	After this activity, I became motivated to develop LKPD (Student Worksheet) that can improve students' ability in learning.	27,27%	72,73%	0%	0%
7	The presenter gave the opportunity to ask questions to the participants.	59,09%	40,91%	0%	0%
8	The presenter gave a good answer to each participant's question.	54,55%	45,45%	0%	0%
9	The time allocation for Q&A/discussion is sufficient.	22,73%	68,18%	9,09%	0%
10	The facilitator facilitated the practical activities well.	63,64%	36,36%	0%	0%
11	The service team (from UNY) can facilitate all activities well.	63,64%	36,36%	0%	0%

Assistance Process Data

The assistance process was implemented in several structured stages, each with its own duration, participation level, and challenges.

In the initial stage (pre-test), attendance was generally high as this session marked the beginning of the program and introduced participants to the overall activities. The pre-test was conducted in a relatively short duration and aimed to measure teachers' prior knowledge. A key challenge at this stage was the varied baseline ability of participants, many teachers were still unfamiliar with the use of the Google Lens application and plant preservation concepts, which resulted in a dominance of lower assessment criterion (Less/L).

The second stage (material enrichment) lasted approximately two hours with strong attendance, as participants were actively engaged in gaining new knowledge. This stage covered both the introduction to Google Lens and plant preservation techniques such as herbarium and leaf skeleton crafts. Despite the smooth delivery, challenges included limited time to cover fairly dense material and differences in participants' ability to immediately grasp both technological and practical concepts.

In the third stage (assistance and practice), which also lasted about two hours, attendance remained stable, although some minor fluctuations occurred due to the more intensive, hands-on nature of the activities. Teachers practiced using Google Lens and conducted leaf skeleton craft procedures. Challenges in this stage were more evident, including technical issues such as incompatible or outdated Android devices, difficulty in capturing clear plant images, and the complexity of the leaf skeleton process (e.g., chemical handling and multiple procedural steps). Additionally, time constraints made it difficult for all participants to fully master each step. The follow-up assignment (LKPD) over two weeks also revealed differences in commitment and independent working ability among participants.

During the fourth stage (posttest), attendance was slightly lower compared to earlier sessions, which is common in closing activities. The duration was relatively short, focusing on measuring improvement after training. The main challenge here was ensuring that the posttest accurately reflected participants' understanding, as some teachers still required more time to fully internalize the material.

Finally, in the evaluation stage, participation was adequate, though not all teachers consistently completed the questionnaire. This stage did not require a long duration but depended on participants' willingness to provide feedback. Challenges included varying levels of response quality and subjectivity in self-reported evaluations.

Overall, while attendance across stages was generally good and the planned durations were implemented as scheduled, the main challenges throughout the assistance process included differences in initial competence, limited training time, technical constraints (especially related to Android compatibility), and varying levels of participant engagement and consistency.

Discussion

Figure 2 shows that before training, 84.78% of participants were in the Less (L) criterion. After practice and discussion, this decreased by 50%, indicating improved scores. Many participants moved into Sufficient (S) and Good (G), with S rising from 13.04% to 50% and G from 0% to 10.87%. The Very Good (VG) criterion also increased slightly by 2.18%. The 97.83% of participants can use the Google Lens app well (Figure 3). That result shows that the training and discussion of the questions given to teachers is able to increase teachers' knowledge about the use of plant identification applications (*Google Lens*) and plant preservation for learning Plant Diversity as well as add insight in developing LKPD so that the learning process of Plant Diversity with students can achieved to the maximum. According to Sutikno (2021), the enrichment program aims to increase understanding and insight into the material that is being studied or has been studied so that students are able to learn optimally both in terms of utilizing their abilities and in terms of obtaining their learning results. In addition, this enrichment activity can also increase teachers' positive perceptions of the use of technology in learning. This is reinforced by the statement of Rini et al. (2024) that teachers' perceptions, which are closely related to their level of confidence, show the belief that the use of technology in learning can improve learning performance and make the learning process more effective and efficient. This positive attitude of teachers towards technology plays a key supporting factor in the efficient application of technology in the classroom.

Some participants remained in the Sufficient (S) to Good (G) range likely because of differences in prior knowledge, learning pace, and engagement during the training. Participants who started with weaker foundational understanding may have improved, but not enough to reach higher performance levels within the limited time. In addition, the training methods or duration might not have fully addressed individual learning needs, and some participants may have required more practice, feedback, or personalized guidance. To improve future programs, several steps can

be taken. First, conduct an initial assessment to group participants based on ability so instruction can be better targeted. Second, extend the duration or provide follow-up sessions to reinforce learning. Third, incorporate more interactive and varied learning methods, such as hands-on practice, peer discussion, and real-time feedback. Finally, provide additional support materials or mentoring for participants who need extra help, ensuring more of them can progress to higher performance criteria.

The 2.17% of participants who could not use the Google Lens properly (Figure 3) are likely affected by limitations related to their Android versions. Older Android operating systems may not support the latest features or updates required for the app to function optimally. In some cases, Google Lens may not be fully compatible, leading to issues such as missing features, slow performance, or the app not running at all. Additionally, outdated systems often lack necessary security updates, libraries, or integration with newer Android services, which can disrupt app functionality. To improve this in future programs, participants should be encouraged to update their devices to a newer Android version if possible or be provided with alternative tools or guidance that are compatible with older devices. This ensures all participants can engage effectively regardless of their device limitations.

Figure 4 shows the results of good leaf sceleton because the shape of the leaf and the leaf sceleton remain intact and undamaged. This shows that participants can do each stage of activities well, especially at the stage of cleaning leaf tissue. At that stage, participants must clean using a brush carefully and slowly without tearing the leaf sceleton. Likewise, at the stage of coloring the leaf, participants can be creative in giving color so that leaf sceleton are produced with various colors such as red and blue as well as blue and purple color gradations.

The LKPD value that is in the Good (B) criterion of 52% shows that teachers can compile and develop LKPD based on the material that has been received in the community service activity. According to Kosasih (2020), teachers can choose and compile teaching materials from various existing sources by using these sources as an example in presenting material that will be given in teaching and learning activities (Figure 5).

Overall, this activity has a positive impact both from the cognitive, affective and psychomotor aspects of the trainees (teachers). From a cognitive aspect, this activity adds insight and knowledge to teachers about the use of the Google Lens application and plant preservation (herbarium and leaf sceleton crafts). From the psychomotor aspect, teachers become skilled in using applications and in doing the stages of making leaf sceleton crafts. From the affective aspect, teachers are motivated to develop varied learning media that are implemented in their LKPD for learning in schools. This is in line with the service activity carried out by Yuniati et al. (2011) that the activity "Creation of Interactive Learning Media for Natural Sciences at Kroyo 1 Sragen State Elementary School" can improve the skills of participants, namely participants have skills in each stage of making a herbarium such as cleaning plants, forming a good plant position when to be dried, and making herbarium creations. Similar activities carried out by Abrori et al. (2018) also showed a positive impact on knowledge aspects such as participants being able to understand the differences in plants according to their identification and also attitude aspects such as the formation of a mindset to create a herbarium with different types and variations.

From Table 1, it can be seen that most teachers agree that the implementation of community service activities is as expected, with well-organized, easy-to-understand materials, and makes it easier for teachers to provide understanding to students as shown by a percentage of 54.55% to 59.09%. In addition, more than 60% (63.64%) of teachers strongly agreed that this community service activity can increase knowledge and competence in the effective and efficient use of learning media and 72.73% of teachers also agreed that after participating in the activity, teachers become motivated to develop LKPD (Student Worksheets) that can improve students' ability in learning. The positive benefits obtained by the teacher from activities such as the service

activities carried out by Kartikawati et al. (2023) entitled "Training on Plant Identification and Herbarium Creation as a Development of Biology Learning." The results of the questionnaire showed that 100% of the trainees stated that the training activity was very fun and useful because they could know how to make it so that they were interested in making it themselves. In addition, the materials are also easy to obtain and have artistic value.

In terms of the implementation of activities, as many as 54.55% to 59.09% of teachers strongly agreed that the presenters in the community service activity provided the opportunity to ask questions and provide good answers to each participant's question and 68.18% of teachers also agreed that the time allocation for the question and answer/discussion was sufficient. The results also show that more than 60% (63.64%) of teachers strongly agree that the service team (from UNY) can facilitate all activities well.

Conclusion

Through this community service activity that has been carried out, as many as 10.87% - 50% of participants have understood the material provided well as shown from the post-test value which is in the criteria of Sufficient (C) to Good (B). As many as 97.83% of the 46 participants (teachers) were able to use the application well and 52% were also able to compile LKPD teaching materials well as shown from the LKPD score which was in the good criterion (B). In addition, all participants gave a positive response to the community service activities that had been carried out. More than 60% (63.64%) of teachers strongly agreed that this community service activity can increase knowledge and competence in the effective and efficient use of learning media and 72.73% of teachers also agreed that after participating in the activity, teachers became motivated to develop LKPD (Student Worksheets) that can improve students' abilities in learning.

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Conflicts of Interest

The authors declare no conflict of interest.

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