

UTILIZATION OF FREE APPS IN INTERACTIVE LEARNING IN ELEMENTARY SCHOOLS

Muhammad Tamrin*¹, Syafni Gustina Sari², Yulfia Nora³, Siska Angreni⁴,
Rieke Alyusfitri⁵, Ira Rahmayuni Jusar⁶, Rona Taula Sari⁷

^{1,2}Teacher Professional Education Study Program, Faculty of Teacher Training and Education, Bung Hatta University Padang

^{3,5,6}Elementary School Teacher Education Study Program, Faculty of Teacher Training and Education, Bung Hatta University Padang

^{4,7}Biology Education Study Program, Faculty of Teacher Training and Education, Bung Hatta University Padang

*Penulis korespondensi: Muhammad Tamrin, m.tamrin@bunghatta.ac.id

Abstrak

Kemampuan mengajar guru di sekolah dasar harus sejalan dengan perkembangan teknologi dalam pembelajaran. Mereka harus dilatih untuk dapat menggunakan berbagai bentuk media pembelajaran berbasis digital. Tujuannya adalah agar belajar menjadi hidup dan siswa termotivasi untuk mengikuti pelajaran. Para guru ini harus dibekali cara mengajar yang baik, sehingga kreatif dalam menggunakan berbagai bentuk media pembelajaran. Program ini bertujuan untuk menghasilkan pengetahuan dan pemahaman tentang kemampuan menggunakan berbagai media pembelajaran digital yang disesuaikan dengan kondisi pembelajaran. Karena pembelajaran yang ideal adalah pembelajaran yang selalu berubah sesuai dengan kondisi yang sedang berlangsung. Sehingga apapun bentuk kondisi yang dihadapi guru dan siswa saat belajar, mereka akan tetap memiliki daya tarik untuk belajar. Hasil akhir yang dapat diperoleh dari program ini adalah peningkatan kreativitas guru dalam mengajar. Terutama dalam penggunaan dan penerapan berbagai media pembelajaran digital, seperti Wordwall, Canva for Education, dan Kahoot. Pelatihan ini diharapkan dapat menumbuhkan komunitas belajar profesional di kalangan guru, di mana mereka berbagi pengalaman, hasil, dan tantangan yang dihadapi dalam implementasi aplikasi digital. Hal ini akan menciptakan ekosistem pembelajaran yang berkelanjutan, kolaboratif, dan inovatif, sejalan dengan semangat Merdeka Belajar dan Kurikulum Merdeka yang sedang dikembangkan di Indonesia.

Kata Kunci: Pelatihan, Guru, Media Pembelajaran, Digital

Abstract

The teaching ability of teachers in elementary schools must be in line with technological developments in learning. They must be trained to be able to use various forms of digital-based learning media. The goal is for learning to come alive and students motivated to follow the lessons. These teachers must be provided with a good way to teach, so that they are creative in using various forms of learning media. This program aims to generate knowledge and understanding of the ability to use various digital learning media that are tailored to learning conditions. Because ideal learning is learning that always changes according to ongoing conditions. So that no matter what form of conditions that teachers and students face when learning, they will still have an attraction for learning. The final result that can be obtained from this program is an increase in teachers' creativity in teaching. Especially in the use and application of various digital learning media, such as Wordwall Canva for Education, and Kahoot. This training is expected to foster a professional learning community among teachers, where they share experiences, results, and challenges faced in the implementation of digital applications. This will create a sustainable, collaborative, and innovative learning ecosystem, in line with the spirit of Independent Learning and the Independent Curriculum that is being developed in Indonesia.

Keywords: Training, Teachers, Learning Media, Digital

INTRODUCTION

The development of digital technology in the 21st century has had a major impact on various aspects of life, including the world of education. Digital transformation has changed the way teachers teach and the way students learn. Educational transformation through digital media training has been proven to increase students' digital literacy, as described in Latifah's research (Latifah, 2025). In the midst of this digitalization flow, conventional learning that is still dominant in many elementary schools in Indonesia is starting to show its limitations. Today's digital generation students need a more interactive, creative approach and utilize technology that suits their characteristics. (Adillah et al. 2023) emphasized the importance of choosing digital learning media that is in accordance with the characteristics of the Alpha generation. Interactive learning media does not only help students in achieving what they need.

However, the facts on the ground show that most elementary school teachers have not fully utilized technology in the learning process. This is not solely due to a lack of willpower, but rather due to limitations in terms of knowledge, training, and access to appropriate and user-friendly technology. In fact, there are many free applications that can be used by teachers to create more interesting and meaningful learning. Some of these applications include Wordwall, Canva for Education, and Kahoot.

Wordwall is a digital platform that allows teachers to create various interactive activities such as quizzes, matching pairs, crossword puzzles, and the wheel of fortune. Wordwall digital learning media is a significant technological innovation in an effort to improve the quality of the learning process in elementary schools. Wordwall, as a web-based application, provides a variety of interactive game formats, quizzes, and learning activities designed to suit the characteristics of students in the digital age. The use of this Wordwall not only increases the effectiveness of knowledge transfer but also provides a more engaging learning experience and motivates students to actively participate (Hadi et al., 2024), Suryowati & Aini, 2024).

Canva for Education provides a variety of design templates that teachers can use to create engaging visual materials, such as posters, infographics, and presentations. According to the multimedia learning theory put forward by Mayer (2009), the use of attractive visual materials can improve information processing and increase learning effectiveness. Thus, the implementation of Canva for Education can be seen as an effort to realize these principles in the classroom, whether through the creation of infographics, presentations and others.

Meanwhile, Kahoot offers a game-based quiz format that students love because it's fun and competitive. Kahoot is a game-based learning platform that allows teachers or facilitators to create and conduct interactive quizzes in real-time or self-paced through each participant's device. Designed to increase participants' learning engagement and motivation through competition elements. (Salfadilah et al., 2023)

These three applications have an important similarity, namely that they can be accessed for free and have a user-friendly interface, making them very suitable for use by elementary school teachers. With the right training, teachers can leverage these apps to increase students' motivation to learn, strengthen material understanding, and build a more active and participatory learning atmosphere.

Hatta University as a higher education institution that has a commitment to community development through Tri Dharma of Higher Education activities, considers it important to initiate training on the use of the free application for elementary school



teachers at partner schools. Through this community service activity, it is hoped that teachers can gain technical skills as well as pedagogical understanding in integrating digital applications into daily learning activities.

In addition, this training is expected to foster a professional learning community among teachers, where they share experiences, outputs, and challenges faced in the implementation of digital applications. This will create a sustainable, collaborative, and innovative learning ecosystem, in line with the spirit of Independent Learning and the Independent Curriculum that is being developed in Indonesia.

Thus, this free application utilization training not only answers the practical needs of teachers in using technology, but also becomes a strategic strategy in improving the quality of learning at the elementary school level. Through an applicable and sustainable approach, this activity is expected to have a long-term positive impact on teachers, students, and educational institutions as a whole.

The condition of the partners who are the target of this community service program are teachers at SDN 03 Batung, Bungus Teluk Kabung District who have been teaching for decades. Among these teachers, there are still those who have DII educational qualifications. In carrying out daily teaching tasks, some of them teach conventionally, and are not used to using various digital-based learning media, even though various learning media are available on various digital platforms on the internet. Teaching is a routine job from day to day without any change for the better. Not many are able to make variations in applying these learning media.

The thing that needs to be seriously considered is that the teachers at the school have never implemented learning using various learning media. The use of learning media should be one of the supporting tasks. Teachers should need to use various digital-based learning media in order to increase teaching creativity. This is in line with the following opinion "digital-based learning media is an important innovation in the world of education that is able to provide an interactive, flexible, and interesting learning experience for students. Along with technological advancements, the use of digital media has been proven to be able to increase the effectiveness of the learning process by integrating visual, audio, and interactivity aspects so that the subject matter can be presented in a more attractive and easy-to-understand manner". (Issabella et al., 2023; (Wiratmaja & Widayana, 2023).

On the other hand, using various digital-based learning media can also arouse the passion and motivation of students in participating in learning. The students will not get bored quickly in the classroom because the learning atmosphere that is carried out always varies. According to Wiratmaja and Widayana, in practice, the use of digital learning media is not only limited to static delivery of material, but also accommodates various learning modes such as mobile learning that allows flexible access to learning through Android-based devices (Wiratmaja & Widayana, 2023), as well as the use of interactive multimedia applications such as digital comics, learning videos, and educational games that also boost learning motivation students (Zulfa et al., 2022), Nirwana, 2021; , Ulfah et al., 2023).

The use of digital learning media is usually followed by a learning atmosphere that creates students more active. Because these learning demands do provide opportunities for students to be more active. This is because digital learning media is usually accompanied by games in delivering subject matter. Several research results prove that the use of digital learning media can have a positive impact on students. For example, the development of digital comic media on chemical bonding materials has shown a

positive response from students in improving understanding of concepts through attractive visual presentations (Zulfa et al., 2022). On the other hand, Instagram-based applications have been used as a learning medium to improve the learning outcomes of elementary grade students, showing how social media platforms can be effectively integrated into the learning process (Pertiwi & Wahyudi, 2022).

That is what causes students to always be happy and motivated in learning, because the delivery of material goes hand in hand with games that children like. Meanwhile, the teacher functions as a supervisor in every activity that students participate in. The teacher is in charge of directing the students in all the learning that is followed. What is no less important is that using various digital learning media appropriately will have a positive impact on learning outcomes. The results of the study show that the use of digital learning media shows a significant positive impact on improving student learning outcomes. Various studies have confirmed that the integration of digital media in the teaching and learning process can improve concept understanding, increase motivation, and encourage students' active participation in learning activities Iskandar et al. (2023).

If the students participate in learning with high motivation and enthusiasm, of course the learning results achieved will also be great. Because the advantages of digital learning media always apply games that cause student participation in learning to be high. Because elementary school students are still in the stage of playing a lot, it is very appropriate to use various digital learning media in elementary schools. It is proven that the use of digital media not only improves cognitive aspects, but also improves digital literacy and classroom interaction. Aspari (2020) showed a significant contribution from the use of digital media with an increase of 12.67% in student learning outcomes.

Research by Putra et al. Putra et al. (2023) emphasized that digital media contributes to a better understanding of material, increased learning motivation, and more active participation of students through contextual and audiovisual approaches. However, the reality in the field is found that teachers are not able to use various digital learning media. Not used to learning by changing variations and learning atmospheres.

Learning conditions seem to be monotonous from day to day and have not been followed by the use of interesting digital learning media. So that the negative effect of this condition is that students participate in learning are not so passionate and less motivated to be active in learning. Meanwhile, teachers will of course experience boredom because the activities carried out are just that every day. As a result, students are instructed to work on exercises after which the teacher leaves the classroom, perhaps going to the cafeteria or chatting with friends in the office.

The total number of teachers at State Elementary School 03 Batung, Bungus Teluk Kabung District is 13 people. These teachers have different educational backgrounds and teaching experiences. More details can be seen in table 1.

Table 1. Data of Teachers at SDN 03 Batung, Bungus Teluk Kabung District

No.	N a m a	Position
1	Suhaimi, S.Pd	Principal
2	Reni Angraini, S.Pd	Classroom Teacher
3	Ricca Riadi, S.Pd	Classroom Teacher
4	Melinda, S.PdI	Good Teacher
5	Deri Erisnal, S.Pd	Teacher of Health Sciences
6	Yohanes Febriandi, S.Pd	Classroom Teacher



7	Neci Almani Sari, S.Pd	Classroom Teacher
8	Silva Valencia Sopyan, S.Pd	Classroom Teacher
9	Asnidar, S.Pd	Classroom Teacher
10	Ermawati, Ama.Pd	Elementary School Teacher
11	Novrita Br, S.Pd	Classroom Teacher
12	Darmawita, S.Pd	Classroom Teacher
13	Firm Fitri Yanti, S.Pd	Teacher of Health Sciences

The teaching ability of teachers in elementary schools should not be allowed to drag on as it is today. They must be trained to be able to use digital-based learning media. The goal is for learning to come alive and students motivated to follow the lessons. These teachers must be provided with a good way to teach, so that they are creative using various digital-based learning media.

If this is left unchecked, it will affect the decline in motivation to teach, students will not be dealt with properly. As a result, the learning process is not taken seriously. The students learn without being supported by high learning motivation, so that the learning results are not optimal. Of course, if this happens, it will affect the results of achieving educational goals.

In the classroom learning they handle, it needs to be improved by creating by developing teaching variations. One way is to integrate the use of digital-based learning media. Various forms of digital-based learning media need to be applied in learning. Teachers must have the ability to apply digital-based learning media that is tailored to learning conditions. Because ideal learning is learning that always changes according to ongoing conditions. So that no matter what form of conditions that teachers and students face when learning, they will still have an attraction for learning.

PROCEDURE

The implementation of this program is carried out by holding *workshops* and training using various digital-based learning media. In this case, teachers are trained to apply digital-based learning media as well as its application. The training was carried out by discussing and providing individual guidance according to their respective fields of study, considering that the trained participants consisted of teachers who were none other than mothers who were no longer young. To more optimally achieve the results of the activities that will be achieved, the implementation of this program will go through several stages, namely planning, initial observation, training implementation and reports.

At the planning stage, there are several important things that are done to prepare the activity so that it runs smoothly and achieves the expected goals. The following is illustrated in the planning table.

Table 2. Activities carried out at the planning stage

Yes	Planning Steps	Activity Description	Purpose
1	Analyzing the needs and situation of prospective partners (SDN 03 Batung)	Assess the conditions, resources and potential partners involved.	Know what potential partners need to make the activity realistic.

2	Forming an implementation team (Lecturer Team)	Establish the structure and duties of each member.	Divide responsibilities to make work more organized.
3	Draw up a cost budget	Detail the need for funds, sources of funds, and their use.	Knowing financial capabilities and avoiding lack of funds.
4	Prepare a work plan (activity schedule)	Make stages of activities from start to finish.	It becomes a guideline for the implementation of activities.
5	Setting up equipment and logistics	Determine the needs of tools, transportation, consumption, and others.	Ensure the readiness of supporting facilities for activities.

The next stage is the implementation of field observations to the location of potential partners. Some of the things that were done at the observation stage were conveying the intention of the arrival of the implementation team to prospective partners (SD Negeri 03 Batung, Bungus District, Teluk Kabung Padang). Furthermore, an agreement was made regarding the time of the implementation of the activity, as well as determining the number of training participants. After that, all participants are expected to bring supporting equipment such as laptops, smartphones and others. Prospective partners are also asked to prepare a room for the implementation of the planned activities. At this observation stage, data of prospective trainees was also requested for the administrative needs of the activity.

Furthermore, at the stage of implementing the activity, at a predetermined time, training was held using digital-based learning media carried out by the PKM implementing lecturer team. Activities are carried out systematically in accordance with the plan that has been prepared, starting from the opening of the protocol, remarks, material exposure to simulation by students. The activity was attended by all teachers who taught according to their respective classes.

In the final stage, an activity report is prepared as evidence of activity. The things that are done at the report preparation stage are to collect all documents obtained during the activity, select and group data and documentation, and create a systematic report structure. The stages of the training activities can be seen in the following diagram.

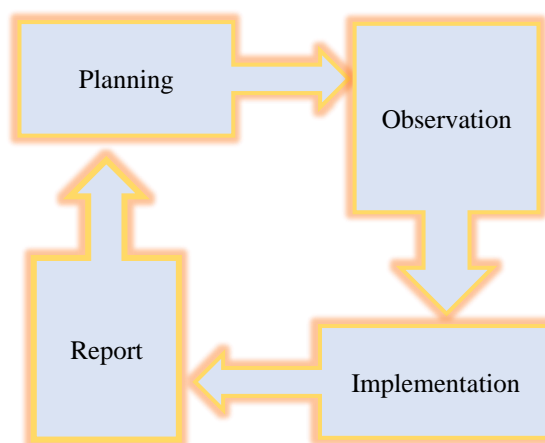


Figure 1. Diagram of Service Activities

By applying this method, teachers still get guidance in carrying out every stage they go through. So it is hoped that the results achieved in this program will be better. All

teachers who participate in this program are encouraged to bring supporting equipment such as laptops and so on.

RESULTS AND DISCUSSION

The implementation of this community service was carried out independently by a team of PGSD lecturers at Hatta University. The form of PKM that is carried out is a *workshop* or training on the use of digital-based learning media in elementary schools. This community service activity was attended by teachers of SDN 03 Batung, Bungus Teluk Kabung District, Padang City. They totaled 17 people, including school administration staff. Meanwhile, the lecturer team consisted of 7 members who participated in this community service activity and 2 students.

The activity began with the opening of the event by protocol, followed by the delivery of remarks by the head of the lecturer team and the principal. After that, it was continued with the delivery of material by lecturers regarding digital-based learning media using the Wordwall, Canva for Education, and Kahoot applications. Then it was followed by a discussion between participants. Training activities can improve teachers' competence in teaching. As done by Rusandi et al., who focus on guidance and counseling, it is proven that teacher competence can increase up to 80% after participating in the training program (Rusandi et al., 2023).

This suggests that improving teachers' insight into certain areas can have a direct impact on the effectiveness of their teaching. Furthermore, the practice of using digital-based learning media simulated by students was carried out. The participants consisting of teachers directly practiced the use of digital-based learning media in teaching. They were given the widest opportunity to ask questions. The simulation activity on the use of digital-based learning media was enthusiastically attended by the teachers.



Figure 2. Opening Event by Protocol

PKM activities at SD Negeri 03 Batung, Bungus Teluk Kabung District started at 13.00 WIB.



Figure 3. Principal's Speech

The principal's welcome speech expressed the gratitude and joy felt by his party when the PKM lecturer team carried out the activity. He hopes that this activity can be used as much as possible by all teachers. In addition, the principal hopes that this activity can be carried out regularly at his school. The principal also said that his friends at other schools also hoped that the lecturer team would want to carry out activities like this in their school. Finally, the principal expressed his infinite gratitude to the PKM lecturer team who have been willing to take the time to share their experiences in using digital-based learning media in their schools.



Figure 4. Remarks by the PKM Team Leader

The PKM team leader delivered a speech on how teachers can master the use of digital-based learning media. This is important for all teachers to understand so that it can be implemented when teaching. Because so far, teachers in general have not used digital-based learning media when teaching every day. In terms of the use of digital learning media when teaching, it is very helpful for teachers when delivering material.

In addition to easing teachers' duties, the application of digital-based learning media can also increase students' motivation and enthusiasm in participating in learning.



Figure 5. Material Display

The lecturer team delivered PKM material on how teachers can master the use and application of digital-based learning media. The digital learning media applied are Wordwall, Canva for Education and Kahoot. This is important for all teachers to understand so that it can be implemented when teaching. Because so far, most teachers in general have not used digital-based learning media when teaching every day. In terms of the use of digital-based learning media when teaching, it is very helpful for teachers when delivering material. In addition to easing teachers' duties, the application of digital-based learning media can also increase students' motivation and enthusiasm in participating in learning.



Figure 6. Trainees

The teacher assembly of SD Negeri 03 Batung, Bungus Teluk Kabung District consisted of mothers and only 1 male teacher. These teachers have been instructed in advance to bring laptops or smartphones. This is deliberately done because the application of digital learning media must be done online. The teachers were very

enthusiastic and excited to follow the presentation of the material delivered by the lecturer team.



Figure 7. Media Simulation

Two students who are part of the PKM team at SD Negeri 03Batung, Bungus Teluk Kabung District while simulating digital learning media, namely Wordwall, Canva for Education and Kahoot. It seemed that the teachers were very serious about participating in the simulation given by the PGSD lecturer team of Hatta University.



Figure 8. Group Photo after the Activity

After the material presentation, simulation and discussion of the participants from the teachers and the lecturer team of PKM PGSD FKIP Hatta Padang University closed the activity with a group photo as documentation.

CONCLUSION

This training is expected to be a practical and applicable solution to improve the quality of learning in elementary schools. The use of free applications that are easily accessible will provide a more interesting and meaningful learning experience for students. This training activity was followed by high motivation and enthusiasm by the partner teachers. The collaboration between the PGSD lecturer team of Hatta University and partner schools is the key to the success of this activity.

BIBLIOGRAPHY

- Adam, M. F., Wahyudi, A., Abdullah, M., Pratiwi, A., & Widuhung, S. D. (2024). *Socialization of Entrepreneurial Literacy and Digital Utilization in Students of SD Al Fityan School Tangerang*. Proceedings of the National Seminar on Community Empowerment (SENDAMAS), 3(1), 10. <https://doi.org/10.36722/psn.v3i1.2427>
- Adillah, R., Arfika, N., Purba, F. P. Y., & Yus, A. (2023). *Analysis of Digital Learning Media in the Alpha Era Society 5.0 Generation Supports the Independent Curriculum*. Journal of Generasi Ceria Indonesia, 1(2), 84-88. <https://doi.org/10.47709/geci.v1i2.3177>
- Aspari, A. A. (2020). *The Effect of the Use of Digital Media and Literacy Classes Together on Student Learning Outcomes*. Scientific Journal of Language Development, 13(01), 47-59. <https://doi.org/10.33557/binabahasa.v13i01.934>
- Azkiya, H., & Tamrin, M. (2018). Upaya Mengoptimalisasikan Pendidikan Berbasis Karakter Siswa TPQ/TQA Masjid Darul Mukhlisin Padang. *Gervasi: Jurnal Pengabdian Kepada Masyarakat*, 2(1), 47-56. <https://doi.org/10.31571/Gervasi.V2i1.812>
- Hadi, W., Sari, Y., & Pasha, N. M. (2024). *Analysis of the Use of Wordwall Interactive Media on Improving Science Learning Outcomes in Elementary Schools*. Journal of Mathematics and Natural Sciences Education, 14(2), 466-473. <https://doi.org/10.37630/jpm.v14i2.1570>
- Iskandar, S., Rosmana, P. S., Prayogo, R. S., & Ulhaq, S. (2023). *The Influence of Digital Learning Media on Improving the Learning Outcomes of Grade VI Students of SDN 1 Tegal Munjul in Science Content*. Journal on Education, 5(2), 2821-2829. <https://doi.org/10.31004/joe.v5i2.930>
- Issabella, B. T. A. S., Afifah, L., & Titaley, A. G. (2023). *Development of Klicks Deutsch Digital Audiovisual Media Based on Articulate Storyline on Rund Ums Essen Material in German Language Learning*. JoLLA: Journal of Language, Literature, and Arts, 3(5), 707-723. <https://doi.org/10.17977/um064v3i52023p707-723>
- Istarani. 2013. *Innovative Learning*. Medan: Media Persada.
- Latifah, R. (2025). *Training on Flowchart Making to Improve Digital Literacy of Amanah Ummah Elementary School Students*. Society: Journal of Service, 2(2), 198-204. <https://doi.org/10.58740/m-jp.v2i2.423>
- Mayer, R.E. (2009). *Multimedia Learning* (2nd edition). Cambridge University Press
- Nirwana, E. S. (2021). *Development of Android Game-Based Learning Media for Children Aged 5-6 Years*. Journal of Obsession: Journal of Early Childhood Education, 6(3), 1811-1818. <https://doi.org/10.31004/obsesi.v6i3.1684>

- Novelina, R., Herlinda, H., Vebrianto, R., Aramudin, A., & Berlian, M. (2023). *Assessment and Evaluation of Digital Flipbook Media Based on STEAM Approach with ADDIE Instructional on Ecosystem Balance Materials*. *Journal of Mathematics and Natural Sciences Education*, 13(3), 701-707. <https://doi.org/10.37630/jpm.v13i3.1099>
- Pertiwi, N. P. N. and Wahyudi, W. (2022). *Instagram-Based Digital Learning Media to Improve Learning Outcomes of Grade IV Elementary School Students*. *Journal of Imiah Education and Learning*, 6(2), 402-414. <https://doi.org/10.23887/jipp.v6i2.51805>
- Putra, L. D., Fitriyani, D. A., Fatimah, S. F., & Berlianti, D. S. S. (2023). *The Influence of the Use of Digital Media Technology in Contextual and Audio-Visual Student Learning in Elementary School*. *Journal of Basic Science*, 7(4), 2672-2678. <https://doi.org/10.31004/basicedu.v7i4.5921>
- Salfadilah, F. Prastowo, A., & Wibowo, Y. R. (2023). *Kahoot Application as a Hots-Based Cognitive Assessment Media in Elementary Schools*. *Journal of Basic Education Research* 06 (1), (2023) 36-45 <https://doi.org/10.26618/jrpd.v6i1.9791>
- Sardiman, A., M. 1986. *Interaction and Motivation in Teaching and Learning*. Jakarta: Rajawali Press.
- Sudjana, N. 1988. *Fundamentals of the teaching and learning process*. Bandung: Sinar Baru.
- Tamrin, M., & Azkiya, H. (2020). Penerapan Model-Model Pembelajaran Kooperatif di Sekolah Dasar. *Gervasi: Jurnal Pengabdian Kepada Masyarakat*, 3(2), 289–298. <https://doi.org/10.31571/Gervasi.V3i2.911>
- Wiratmdja, R. 2012. *Classroom Action Research Methods (To Improve*
- Suprijono. 2010. *Cooperative Learning*. Yogyakarta: Pustaka Belajar.
- Suryowati, E. and Aini, N. (2024). *Training on Making Learning Media with Wordwall at SDN Jombatan Kesamben*. *Journal of Indonesian Abdimas*, 4(2), 590-596. <https://doi.org/10.53769/jai.v4i2.767>
- Wiratmaja, I. G. and Widayana, G. (2023). *Development of Android-Based Mobile Learning as Digital Media in Refrigeration Engineering Courses*. *Journal of Mechanical Engineering Education Undiksha*, 11(1), 111-123. <https://doi.org/10.23887/jptm.v11i1.59963>
- Yudhistira, Dadang. 2013. *Writing a Slick Classroom Action Research*. Jakarta: Grasindo.
- Zulfa, Z., Yunita, L., & Ramli, M. (2022). *Development of Digital Comic Learning Media on Chemical Bonding Materials for Class X Science Students*. *Journal of Chemical Education Innovation*, 16(2), 123-130. <https://doi.org/10.15294/jipk.v16i2.32351>

