



Adaptive Learning : Learning Design Training Differentiated AI -based for Elementary School Teachers

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ABSTRACT

This Community Service Program (PkM) aims to enhance the pedagogical capacity of elementary school teachers in Dusun Kepetingan in implementing adaptive and differentiated instruction supported by Artificial Intelligence (AI). The training employed a Participatory Action Research (PAR) framework, consisting of conceptual strengthening, analysis of students' learning needs, and hands-on practice using Quizizz AI for differentiating content, process, and product. Findings indicate substantial improvements in teachers' ability to design instructional scenarios that are responsive to classroom heterogeneity. Evaluation results show a satisfaction rate of 92%, demonstrating the relevance and effectiveness of the program. This PkM underscores the strategic potential of AI integration in supporting systematic, efficient, and data driven implementation of differentiated learning.

KEYWORDS

Adaptive Learning; Differentiated Learning; Artificial Intelligence

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INTRODUCTION

According to Ki Hadjar Dewantara, the goal of education is to teach children about everything in the world so that each individual can achieve the highest level of safety and happiness, both as a human being and as a member of society (Sri Yanti et al ., 2022) . Teachers can create learning strategies that suit students' needs and enable students to participate more actively in their own learning process (*Caesarea* ,2024) . It is undeniable that every student is unique and diverse, such as differences in learning styles, academic abilities, speed of understanding material, learning orientation, motivation, *self-efficacy* , interests, personality, and socioeconomic background. In one class, this diversity requires teachers to avoid using a uniform learning approach, as it cannot accommodate the needs of all students. Therefore, an approach that is responsive to individual differences is needed, one of which is through differentiated learning, namely a systematic process to recognize student characteristics and adjust learning to suit their needs (Nursulis & Muspawi , 2023) .

Differentiated learning is an approach designed to adapt the learning process to the individual styles and needs of each student in the classroom. This approach focuses on meeting students' learning needs and how teachers respond to these differences through appropriate strategies. Thus, differentiated learning is a method that allows teachers to accommodate the diverse characteristics and needs of students (Suwartiningsih , 2021) .

Ni Made Ayu Sukma Dewi has proven in her research that differentiated learning can improve student learning outcomes in all three domains: Psychomotor, Affective, and Cognitive, thus becoming an effective solution to address the low interest and motivation in learning mathematics in the school (Dewi et al ., 2023) . Furthermore, Andriyani's research findings indicate that community service activities have successfully improved the digital literacy of teachers and students at the Kuala Lumpur Guidance Center. Teachers are better able to design and implement digital learning tools, while students become more skilled and critical in using technology for learning. The integration of technology into learning has also increased, enabling holistic differentiated learning to be implemented effectively even in environments with limited digital facilities (Handiyani & Muhtar, 2022) . Both studies confirm that the integration of differentiated learning can improve the quality of learning in various educational contexts. The role of teachers in differentiated learning is very strategic because teachers who are able to adapt learning strategies to students' needs, abilities, and interests are proven to be able to create more relevant and interesting learning experiences (Lisnawati et al ., 2023a) . Teachers can apply four main components of differentiated learning, namely 1) Content Differentiation, teachers deliver material according to students' needs during the learning process 2) Process Differentiation, teachers develop learning in an interesting way, including providing examples to help understanding 3) Product Differentiation, teachers give students the freedom to create assignments according to their interests and creativity 4) Learning Environment Differentiation, teachers give students the opportunity to choose the learning environment that is most comfortable for them (Yulia & Mareza, 2024) .

Artificial Intelligence (AI) as a tool to support teachers in analyzing student learning needs. AI technologies such as ChatGPT and various *machine learning- based platforms* can be utilized to adapt to students' learning styles, provide adaptive feedback, and design truly personalized learning paths. The use of AI in learning not only supports student competency achievement but also aligns with the principles of differentiated learning, which emphasize meeting the learning needs of each individual (Iswanto). et al ., 2025) .

Therefore, teachers need new skills to utilize AI in learning design, while simultaneously enhancing their capacity to make learning more adaptive and effective. The combination of artificial intelligence and a human approach can deliver optimal learning outcomes. AI has advantages in presenting personalized materials and supporting differentiated learning (Ridwansyah et al ., tt) .

Elementary School (SD) Teachers in Kepetingan Hamlet still face challenges in leveraging artificial





intelligence (AI) technologies, including ChatGPT and other AI platforms, to support differentiated learning practices in the classroom. Limited understanding of how AI works and limited experience in integrating these technologies to meet students' learning needs make training a pressing need. This situation is further complicated by teachers having to address the diverse characteristics of students. In classes of 20 to 30 students, teachers often struggle to map individual learning needs. As a result, learning strategies tend to be uniform and unable to accommodate the diversity of student learning styles, academic abilities, and motivation levels. AI training is crucial to help teachers create more adaptive learning experiences tailored to each student's needs.

Based on these conditions, it is necessary to formulate problems that focus on the urgency of improving the ability of elementary school teachers in Kepetingan Hamlet in utilizing artificial intelligence (AI) technology to design and implement differentiated learning that suits the diverse learning needs of students.

MATERIALS AND METHODS

The need for implementing Community Service (PkM) activities was identified and formulated through a Participatory Action Research (PAR) approach, which involved the active participation of stakeholders.¹ This PAR method used in a way participatory For give education and training of elementary school teachers for increase quality classroom teaching through adaptive learning with approach differentiated AI- based . This service process includes providing human resource support through education and training for schools to understand, adapt, and improve the quality of classroom teaching through the use of AI and a differentiated approach. as teacher's efforts in understand student needs in learning . This activity also directly involved education practitioners in the implementation process. The theme of this training was "Transforming a new approach to learning: integrating *adaptive learning* , differentiation, and the use of AI." This PkM was held over two days, May 3 and 4, 2025 . devotion started with planning , implementation , and evaluation results PkM . Target Community Service Program This are 12 elementary school teachers in Kepetingan Hamlet . The Community Service Program (PKM) activities were carried out by the Community Service Program (PKM) Team from various private universities in East Java, namely STIT Muhammadiyah Lumajang, STIT Raden Santri Gresik, Institut Bahri Asyiq Galis Bangkalan and 2 PTKIN, namely IAIN Sorong Papua Indonesia and UIN Sunan Ampel Surabaya.

As for the series activity Community Service Program started with preparation , implementation , closing , and reporting activity to Stakeholders as order steps activity from beginning until end following This :

Stage beginning , preparation Activity PkM :

1. Determination theme devotion , preparation team and materials
2. Application permission For carry out activity Community Service Program to principal of elementary school/madrasah in Kepetingan Hamlet
3. Prepare completeness letter correspondence
4. Preparation location For activity Community Service Program

Stage implementation , activities PkM :

1. Opening ceremony , welcome and introduction with participant
2. Delivery material about Utilizing AI to produce adaptive and differentiated learning materials use approach lectures , discussions and questions answer .
3. After source person finish session material , participants requested For tell experience them and their problems meet during the teaching process .





4. After participant tell their experiences and the difficulties they faced meet the resource person provide suggestions for help teachers overcome problems later day .
5. All participant fill in questionnaire For evaluate the process during PkM and knowing the benefits based on experience they during follow activity PkM .

Stage lastly , closing

1. Give door prize to participating participants active in discussion and questions answer during activity PkM .
2. Give certificate to participant .
3. Session Photo together .

RESULTS AND DISCUSSION

Transformation learning No Again can depend on One approach single . Teachers are required For capable integrating adaptive learning , which adapts channel Study based on ability students , learning differentiated , which accommodates difference interest , style learning , and readiness students , and utilization intelligence artificial intelligence (AI) as tool help For process data, produce material , up to give support more personalized learning . Integration all three expected capable give solution concrete on challenge increasingly classroom learning diverse . So the activities Community Service Program This done For help open outlook new , growing attitude reflective , as well as bring up practices learning innovative that can implemented in each school .

This PKM shared become a number of stage . Stage preparation before PkM , stage next implementation PkM , and stages end evaluation PkM .

Preparation Before start PkM , namely compile a rundown of activities , including distribution tasks , and the planned output targets that will be achieved from activity PkM . Preapring done through meeting held on Friday , March 7, 2025 with objective coordination between team PkM and mature activities that will be held on May 3 and 4, 2025 in the room Kepetingan Hamlet Elementary School . Activities opened with welcome team Community Service Program from STIT Raden Santri Gresik, continued with welcome by the school SDN partners in the hamlet, and continued with prayer as marked core activities right started .

Next , the activities Community Service Program to be continued with presentation material from the sources . The rundown of activities as table following This .

Day 1 – Saturday, May 3, 2025

Time	Activity	Filler	Information
08.00– 08.30	Registration Participant	-	—
08.30– 08.45	Opening & Welcome	Committee / SD SDA Interests	Mr. Ghufron, S.Pd
08.45– 09.30	Material 1: Adaptive Learning Concept	Machfud Bachtiyar	Exposure material
09.30– 10.15	Material 2: Learning Differentiated	Machfud Bachtiyar	Presentation & Discussion
10.15– 10.30	Rest	-	—
10:30– 11:15	Material 3: Integration of AI in Learning	Muksin	Workshop
11.15– 13.00	Session Discussion	All over Source person	Open Discussion
	Reflection	-	Discussion





Time	Activity	Filler	Information
08.30–09.30	Workshop: Designing Learning Adaptive	Muhammadiyah Islamic Institute of Lumajang	Practice direct
09.30–10.00	Discussion	All over Source person	—
10.00–11.00	Practice Independent Participant	-	Practice direct
11.00–11.30	Presentation of Results	-	Participant
11.30–11.45	Evaluation	-	—
11.45–12.00	Closing & Photos	-	—

Day 2 – Sunday , May 4, 2025



Figure 1: Presentation of Material

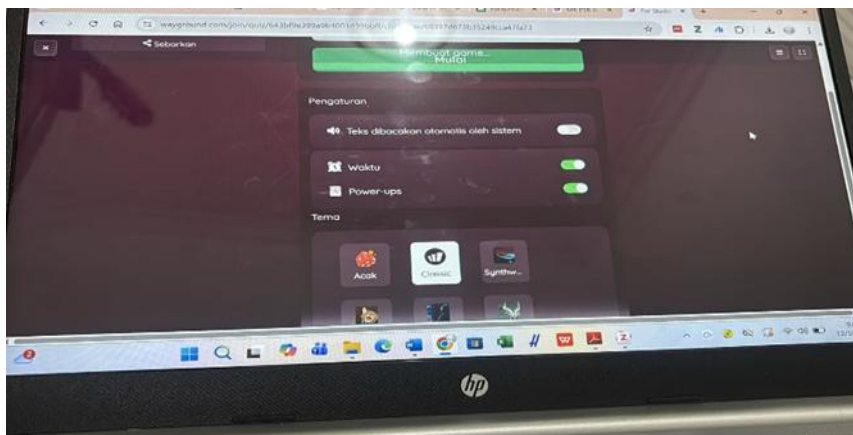




Figure 2: One Example Educational Game Creation For eye Indonesian Language Lessons in AI-Assisted Differentiated Learning

In the Independent Practice session, participants were given the opportunity to directly apply the material they had learned regarding AI-based differentiated learning design. During the independent practice, each participant was asked to develop a learning plan that encompassed three key aspects of differentiation: content, process, and product, and was supported by the use of AI technology such as Quizizz AI.

The results of the independent practice showed that all participants were able to produce varied, more creative, and less monotonous learning designs. First, teachers used the AI Question Generator and AI Question Bank features in Quizizz to create materials with different levels of complexity based on student learning needs, such as basic, intermediate, and advanced level questions. Next, AI helped adjust the level of difficulty based on *the learning objectives* entered by the teacher. *Second*, students were facilitated with quizzes that included images and illustrations. *Third*, students were asked to complete quizzes and create summaries of the material.

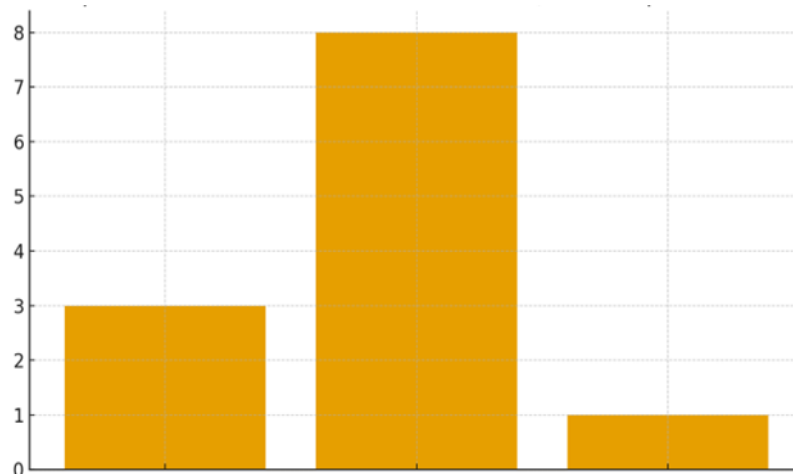
This Community Service Program (PKM) activity is expected to have a number of positive impacts for participants, partner institutions, and improve the quality of learning. The material provided includes an understanding of adaptive learning, differentiated learning, and the use of AI in teacher-led instruction. This will enable teachers to recognize and understand the diverse potential of their students. This will prevent monotony in teaching, but instead enable teachers to deliver more varied learning, responsive to student needs, and relevant to technological developments.

The evaluation phase was conducted twice, on the first and second days. The first-day evaluation focused on assessing participants' initial understanding of the concepts of adaptive learning and differentiated learning, as well as their readiness for the practical sessions. Participants were asked to provide feedback on the clarity of the material, the speaker's delivery method, and its relevance to classroom learning needs. The first-day evaluation results indicated that participants found the basic material provided to be very helpful as a foundation for the practical activities the following day.

On the second day, an evaluation was conducted to assess the participants' competency improvement after participating in the entire series of activities, including practical use of AI in lesson planning. This evaluation included reflection on the participants' ability to integrate adaptive and differentiated approaches with the support of AI technology. Participants also provided feedback regarding the effectiveness of the practice, supporting facilities, and the usefulness of the activities for their professional development. Overall, the evaluation on the second day showed that participants experienced significant improvements in their skills and felt more confident in implementing more varied and innovative learning strategies in the classroom.

The results of the first and second day's evaluation recap are as shown in graphic 1 below:





Based on the evaluation results of the activities on the first and second days, a total of 12 respondents provided an assessment of the implementation of the training. Of these, 8 participants (67%) stated that *they were very satisfied* with the material, delivery methods, and the relevance of the training to the participants' needs. 3 participants (25%) stated that *they were satisfied* and felt that this activity provided practical benefits in improving the ability to design adaptive and differentiated learning. Meanwhile, only 1 participant (8%) stated that *they were dissatisfied*, noting that there was a limited time for practice which was considered to need to be extended. Thus, the evaluation results concluded that the majority of participants felt a positive impact from this PkM activity, especially in the aspect of increasing their understanding and skills in utilizing AI in learning. This high level of satisfaction is an indicator that the implementation of the training was in accordance with the needs of the participants and was able to contribute to the development of teacher professional competence.



Figure 2: Session Photo together after evaluation activity Community Service Program

Learning differentiated is approach effective teaching that allows various method For convey knowledge new to all student in community room its diverse classes (Safarati & Zuhra, 2023). With Another understanding is that differentiated learning is a learning model that aims to provide opportunities for efficient learning and demonstrate understanding in ways that students prefer (Astria & Kusuma, 2023)





. At the same time, it minimizes students' learning experiences and frustration in understanding knowledge (Fauzia & Hadikusuma Ramadan, 2023) . As known , the majority Classes in formal schools in Indonesia are heterogeneous . All student unique , including type gender , motivation learning , interests , background behind social , knowledge beginning , style learning , and needs Study (Marantika et al ., 2023) . With Thus , this PkM activity not only strengthens theoretical understanding of learning differentiation, but also provides practical tools so that it can be implemented without additional workload for teachers in the classroom.

The objectives of differentiated learning include 1) to help all student in learning . So that teachers can increase awareness to ability students . So that all student can reach objective expected learning 2) for increase motivation and results Study students . So that students get results appropriate learning with level difficulty material given by the teacher. If the student taught in accordance with his ability , then motivation Study student will increased 3) Learning differentiated increase strong relationship between teachers and students so that student become Spirit For learn 4) to help student become independent learners . If students taught in a way independent , they will learn and appreciate various potential 5) For increase teacher satisfaction , if the teacher applies learning differentiated , they will feel challenged For increase ability they , who will push they For become creative (Herwina , 2021) .

So that through training Community Service Program This become the foundation in supporting the implementation of PkM this time and provide teachers with the ability to differentiate content, processes, and products more effectively with the help of AI. So that student Can Study in accordance needs , motivation and results Study increasing , teacher and student relations the more strong , independent Study the more growth , creativity and professionalism of teachers increase .

Teacher as facilitator hold a very important role in create experience relevant and meaningful learning for every student in effort For apply learning differentiated which can increase interest . ²In learning differentiated This is how teachers see it strength and need students are very important (Dwi Putriana Naibaho , 2023) . Improvement teacher's ability becomes very important . Optimization This covers Lots things , including training and development professional , availability source adequate power and support sustainable technical skills . Teachers have ability best For planning and implementing learning differentiated assisted technology (Wahyuni & Haryanti , 2024) . Because of this that teacher must understand right draft base in learning differentiated with AI- assisted . Based on review results evaluation show High satisfaction rates (92% satisfied and very satisfied). This indicates that this PkM successfully provides a strong understanding, especially because differentiated learning is presented in a practical manner and combined with the use of AI.

This is also in line with the research findings of Marfu'ah Nursulis, which shows that teachers with direct experience in managing student diversity can improve their competency through the implementation of differentiated learning. Differentiated learning provides an opportunity for teachers to actively engage in a responsive and adaptive learning process, namely by creating and implementing a variety of teaching approaches according to the needs and learning styles of each student. Through this process, teachers can develop interpersonal skills, including the ability to communicate effectively with various student characters and respond to individual differences between students. In addition, problem-solving

² (Lisnawati et al ., 2023b)





and self-adjustment skills needed in a dynamic classroom environment are also increasingly honed, so that teachers are better prepared to face the challenges of diverse learning (Muspawi, 2023) .

There are three learning strategies differentiated 1) Content , which takes into account mapping need Study students , which includes readiness learning , interests , and profile students , or combination from the third 2) Process, the teacher must know whether student will Study in a way group or independent in learning . The teacher decides How many Lots the assistance that will be given to students . Which students need help and who needs it question guide For Study in a way independent . In design scenario learning , things This must considered start from 3) and Product , the results of work or performance that must be shown to the teacher (Swandewi , 2021) . Understanding the required strategies is necessary. The results of participants' independent practice show that the three differentiated learning strategies of content, process, and product can be implemented well through the use of AI in the Quizizz platform. In the content aspect, teachers are able to generate a variety of graded questions (basic, intermediate, and advanced) with the help of the AI *Question Generator* and AI Question Bank features that adjust the level of difficulty based on learning objectives. In the process aspect, teachers facilitate students through quizzes equipped with images and illustrations and provide flexible learning paths so that students can learn at their own style and pace. Meanwhile, in the product aspect, teachers ask students to complete quizzes and create summaries of the material as a form of demonstration. The integration of these three strategies shows that the use of AI supports teachers in creating varied, creative, and non-monotonous learning, while strengthening the implementation of differentiated learning in heterogeneous classes.

Although there is various challenge in apply learning differentiated , teachers need to still optimistic that we can overcome it . One of the step important is Keep going learn and share experience with colleague colleagues who face difficulty similar , so that formed Community Mutual learning strengthen . Through community this , teachers can each other support , motivate , and provide encouragement positive One each other. Apart from that , teachers need take lesson from practices that have been run and utilize it , even though its implementation Not yet perfect or ideal. These efforts must followed with evaluation sustainable For improve the learning process . By Thus , the quality learning can increase and goals learning can achieved with more Good (Tiara et al ., 2021) .

CONCLUSION

This Community Service (PkM) activity has significantly contributed to improving the pedagogical competence and digital literacy of elementary school teachers in Kepetingan Hamlet. This training successfully strengthened participants' understanding and skills in implementing differentiated learning through content, process, and product strategies integrated with artificial intelligence technology, particularly through the use of Quizizz AI. Evaluation findings showed that the majority of participants (92%) expressed satisfaction or very satisfaction with the relevance, presentation of the material, and practical benefits of the training, as reflected in their ability to produce adaptive, creative learning designs that are appropriate to the diversity of student learning abilities. This PkM also contributed to increasing teacher confidence in designing responsive learning based on data and technology. Therefore, it is recommended that there be continued mentoring, provision of digital support facilities in





schools, the formation of teacher learning communities, and strengthening the integration between AI and differentiated learning modules on an ongoing basis. Furthermore, further research is needed to examine the impact of implementing AI-based differentiated learning on student motivation, learning outcomes, and independence to provide more comprehensive empirical evidence regarding the effectiveness of this approach.

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