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Cloud-Based Math Problem Analysis Workshop for Improving Junior High School Teachers' Understanding of Cloud-Based Test Item Analysis

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Abstract

An interview conducted by the community service team with Junior High School Mathematics teachers in Barito Kuala Regency showed that many teachers struggle to carry out evaluation activities efficiently due to the complex evaluation processes involved. These processes could be made more efficient with the support of technology, particularly in the question analysis phase. However, teachers still face challenges in using technology, especially when evaluating cloud-based learning outcomes, which makes it difficult to store and analyze question data effectively. Thus, it is necessary to conduct training for mathematics teachers on cloud-based question analysis to address this issue. This training aims to help teachers create cloud-based mathematics questions and enhance their understanding of cloud-based question analysis. This training, aimed at junior high school and Islamic junior high school mathematics teachers in Barito Kuala Regency, was organized through the Junior High School/Islamic Junior High School Mathematics Subject Teacher Deliberation (MGMP). The training took place in August 2024 and used offline and online modes. The offline meeting was held at a junior high school in Barito Kuala Regency, with participants drawn from mathematics teachers in the area. As a result of the training, participants are expected to gain a deeper understanding of cloud-based question analysis. Additionally, they would have access to tools to analyze questions through an account on the Cloud-Based Test Instrument Analysis website.

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INTRODUCTION

The development of technology alongside the progress of the times has created opportunities for advancing many aspects of human life. One aspect that has been impacted by technological development is education. The rise of technology has led to significant progress in access to education. According to Haleem et al. (2022), education today has adapted various technological advancements to facilitate ease in education, allowing various segments of society to experience greater access to education.

As a form of education, learning activities also benefit from technological advancements. The role of technology in learning can be seen in various forms, such as

the use of electronic devices to access and store knowledge sources (Anas & Salim, 2022); the use of the internet and web networks to create virtual classrooms; the use of computer and Android-based devices as learning media (Akbar et al., 2023; Ansori et al., 2023; Augustin et al., 2021); and even now, the learning evaluation process can be carried out using computers or Android devices through CBT (Computer-Based Test) (Abdul et al., 2021; Dewi & Abdul, 2019).

One of the benefits of applying technological advancements to the learning process is the ease of access and the efficiency it brings to the learning process. Efficient learning processes make it easier for teachers to document their learning activities, allowing them to gain deeper insights into their teaching practices. The application of technology also helps teachers evaluate their teaching processes and assess students' progress after the lessons (Dwi et al., 2022; Purnasari & Sadewo, 2020). Additionally, assessment results can be viewed and provided instantly, the evaluation schedule can be more easily adjusted, opportunities for incorporating innovative item formats are available, and test production costs can be reduced (Hendriani & Gusteti, 2021).

Evaluation of the learning process is the final stage of the learning cycle. This stage is crucial for teachers as it determines whether all stages of lesson planning and implementation have been carried out effectively, or if there is room for improvement to achieve more optimal results from the learning process (Magdalena et al., 2020). Given the importance of this activity, teachers must be able to conduct it as efficiently and effectively as possible. Therefore, the learning process evaluation should also benefit from technological assistance to ease the process for teachers.

One technological aid in evaluating the learning process can be applied during the analysis of evaluation questions. Analysis is necessary to determine whether the questions used in the evaluation are valid and reliable. Furthermore, question analysis is also needed to assess how students' abilities have developed in relation to the material tested. Question analysis becomes easier when assisted by technology, enabling real-time evaluations so that once students finish their evaluations, the results and a general analysis can be immediately visible (Anggraini et al., 2021; Dwi et al., 2022; Rizal et al., 2019).

Cloud technology (cloud storage) can assist in the question analysis process. It facilitates data storage and real-time access, helping teachers analyze questions more effectively. Cloud technology also allows teachers to develop applications based on tools already provided within the cloud system. Moreover, cloud technology provides teachers new opportunities to enhance their competencies in developing engaging and innovative web-based learning (Susanti & Putri, 2020).

Cloud technology in question analysis can be applied through the integration of CBT. Students who answer questions via CBT store their answers in computers or Android devices, which are then directed to cloud storage via the Internet. The students' responses are analyzed using an application integrated into the cloud, simplifying the teacher's task of evaluating the questions, assessing student learning outcomes, and summarizing the overall success of the teaching process.

Unfortunately, the use of cloud technology to assist teachers in analyzing questions as part of the learning evaluation process has not been fully optimized. This is also the case for Mathematics teachers in Junior High Schools (SMP) in Barito Kuala Regency. Through communication with the chairperson of the Mathematics Teacher Subject Council (MGMP) of SMP Barito Kuala, it was discovered that teachers face difficulties in carrying out question analysis as part of the learning evaluation process. Additionally, based on discussions, it was found that all MGMP members still conducted analyses manually using Microsoft Excel and input student answer data manually, one by one. As

a result, teachers still face difficulties in using technology in schools, particularly when evaluating cloud-based learning outcomes, so that the data and analysis can be properly stored.

As a partner, the SMP Mathematics MGMP of Barito Kuala Regency feels the need for training that allows Junior High School teachers in Barito Kuala Regency to streamline the question analysis process. According to the partner, quick question analysis is necessary to meet the demands for filling out the learning implementation reports. These reports are needed for the institution's accreditation (school) and the completeness of teacher documentation as part of the learning process evaluation. Additionally, reports are required for the collection of teacher performance reports. Therefore, a community service activity in the form of a Cloud-based Mathematics Question Analysis Workshop for SMP teachers in Barito Kuala Regency is necessary. This training aims to guide teachers on cloud-based question analysis and enhance their understanding.

METHODS

This community service activity used the Participatory Action Research (PAR) method. The PAR method is an approach whose process aims to address problems, meet the community's practical needs, and produce knowledge (Afandi et al., 2022). This method has five stages, starting with the "knowing" stage and then the "understanding the problem" stage. The third stage is planning a solution, followed by the fourth stage of implementing the plan (to action), and the cycle ends with the evaluation stage (to reflection). The diagram of the PAR cycle is shown in Figure 1 (Rahmat & Mirnawati, 2019).

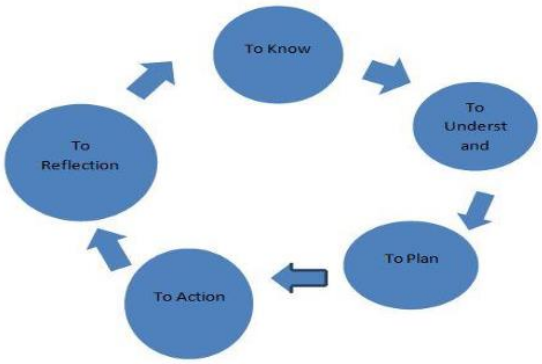

Figure 1 Diagram of the PAR community service implementation cycle

The community service activity using the PAR approach began with the "knowing" stage, where the community's condition was assessed. This activity was conducted through discussions and interviews with the community service partner. In the second stage, the problem experienced by the partner was understood. The community service team carried this out as a follow-up to the discussions with the partner. After the problem was understood, the third stage, planning a solution to the problem, took place. In this case, the community service team proposed a solution in the form of the Anbuso Pendidikan Matematika website application and then organized training on how to use the application.

After the solution was planned, the fourth stage, the implementation of the solution plan, took place. This involved training for the SMP Mathematics MGMP teachers in Barito Kuala Regency, which was held on Saturday, August 24, 2024, at SMP Global Islamic Boarding School (GIBS) in Barito Kuala Regency. In addition to the in-person

training, participants were also asked to conduct a self-test on the use of the Anbuso Pendidikan Matematika website application for 7 weeks, from August 25, 2024, to October 12, 2024, and its implementation was monitored online via a WhatsApp (WA) group. The final stage, which aims to build awareness for change and sustainability, involved evaluating the Anbuso Pendidikan Matematika website application and understanding the mathematics question evaluation analysis.

Understanding was evaluated through a pre-test and post-test, given at the beginning and end of the training. An N-Gain analysis was performed to analyze the participants' improvement in understanding. The training is successful if the average N-Gain score reaches a minimum of 50% of the participants' training scores. The N-Gain score is calculated using the formula developed by Meltzer (Meltzer, 2002). The criteria for low, medium, and high N-Gain values are based on Hake's criteria (Hake, 1999).

RESULTS AND DISCUSSION

Implementing the community service activity titled "Cloud-Based Mathematics Question Analysis Workshop for Junior High School Teachers in Barito Kuala Regency" has been carried out in several stages. The stages completed in this community service activity are as follows.

Socialization

Socialization was carried out by the community service team in collaboration with the partner for Junior High School Mathematics teachers in Barito Kuala Regency. Socialization was done through communication with the partner, who then disseminated information regarding the training implementation via regular MGMP Mathematics meetings. In addition, the partner also shared information about the training with teachers through the partner's social media platforms. The socialization with the partner took place in a Zoom meeting. The use of social media for socialization was considered a solution to the time limitations between the community service team and the partner, ensuring the activity could be conducted effectively.

Training

The training activity began with preparing materials on cloud-based question analysis, which involved creating a Cloud-based Question Analysis module. Figure 2 shows the implementation of the community service with partners.

Figure 2 Implementation of PKM with the partner

The community service team developed the module consisting of Dr. Hidayah Ansori, M.Si., Asdini Sari, M.Pd., and Rizki Amalia, M.Pd. Additionally, the team also prepared a standard website as a prototype and as a resource for teacher adaptation and development, which was designed by Juhairiah, M.Pd., Muhammad Sa'duddien Khair,

M.Pd., and students involved in the community service activity. Once the materials were ready, the training content was delivered by the community service team leader and members in face-to-face sessions at the designated time and location, which had been communicated and discussed with the partner. The partners' responsibilities were to select the venue and the layout of the training space.

Technology Implementation

After the materials were provided, training participants could adapt the content they had learned by applying Cloud-based Question Analysis technology. This aligns with technological advancements that have led to significant educational access developments (Haleem et al., 2022).

Participants were also asked to design and integrate their created questions, conduct a CBT trial with students, and perform question analysis. They applied technology to view the analysis results on the website and download them for use in evaluation reports of the learning process. This demonstrates that technological advancements in learning can be seen in various forms, such as using electronic devices to access and store knowledge sources (Anas & Salim, 2022). The implementation of technology by participants is shown in Figure 3.

Figure 3 Technology implementation by participants

During the technology implementation phase, training participants can engage in discussions with the PKM team, which can be conducted online through social media platforms facilitated by the partner. The product produced from this PKM activity is a cloud-based mathematics question package and analysis results for Junior High School teachers in Barito Kuala Regency. Figure 4 shows the implementation of technology in developing the Anbuso website.

Figure 4 Technology implementation in the development of the anbuso website

Mentoring and Evaluation

After the technology implementation phase is completed, the training results will be evaluated. The evaluation aims to assess the improvement in the participants' understanding of the material presented, which is in line with the expected outcomes of the PKM activity.

From the various activities conducted, it was found that learning activities, as a form of education, also benefit from technological developments; using the internet and web networks to create virtual classrooms; utilizing computers and Android-based devices as learning media (Akbar et al., 2023; Ansori et al., 2023; Augustin et al., 2021); and even now, the learning evaluation process can be conducted with computers or Android devices through CBT (Abdul et al., 2021; Dewi & Abdul, 2019).

One of the benefits of applying technological advancements to the learning process is the ease of accessing and streamlining it. An efficient learning process makes it easier for teachers to document their learning activities, allowing them to gain a deeper insight into it. The application of technology also helps teachers evaluate their teaching process and see how much students have progressed after going through the learning activities (Dwi et al., 2022; Purnasari & Sadewo, 2020).

One form of technological assistance can be seen in the learning evaluation process, which was applied during the question analysis phase in this community service activity. Question analysis is easier to conduct with the help of technology. It can be done in real-time, so when students finish the evaluation, the results and an overview of the question analysis can be immediately visible (Dwi et al., 2022; Rizal et al., 2019).

The form of technology used in this activity has proven very helpful in the question analysis process through the use of cloud technology (cloud storage or online storage). Cloud technology simplifies data storage and real-time access, which helps teachers conduct question analysis. Cloud technology also allows teachers to develop the necessary applications based on the applications already provided in the cloud. Additionally, cloud technology offers new opportunities for teachers to enhance their competencies in developing engaging and innovative web-based learning (Susanti & Putri, 2020). As a result of this PKM activity, there are two main outcomes: the Anbuso Mathematics Education Website Application, as shown in Figure 5.

Figure 5 Anbuso mathematics education website application

The second output is the user guide for the Anbuso Mathematics Education Website Application, as shown in Figure 6. Both outputs from this PKM activity have been registered for intellectual property rights with the Directorate General of State Assets.

In addition to the technological outputs, N-Gain analysis results were also obtained from the participants' understanding of the PKM activity regarding the materials related to learning evaluation and using Anbuso technology in the learning evaluation process. The average N-Gain score of all Respondents was 0.64, which is categorized as high. Therefore, this training activity can be successful as the average participant showed more than 50% improved understanding.

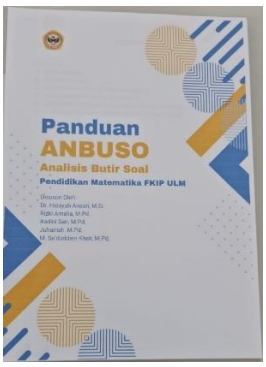

Figure 5 User Guide for the Anbuso Mathematics Education Website Application

The improvement in understanding among the 42 participants can be seen in Table 2.

Table 2 Pretest-posttest results and n-gain of training participants in community service

Name	Pre-test	Post-test	N-Gain
Respondent-1	10	16	0.60
Respondent-2	12	18	0.75
Respondent-3	10	14	0.40
Respondent-4	8	16	0.67
Respondent-5	12	18	0.75
Respondent-6	10	18	0.80
Respondent-7	8	18	0.83
Respondent-8	12	18	0.75
Respondent-9	12	18	0.75
Respondent-10	12	14	0.25
Respondent-11	8	12	0.33
Respondent-12	12	18	0.75
Respondent-13	12	18	0.75
Respondent-14	8	18	0.83
Respondent-15	12	18	0.75
Respondent-16	6	18	0.86
Respondent-17	8	18	0.83
Respondent-18	10	18	0.80
Respondent-19	8	16	0.67
Respondent-20	6	16	0.71
Respondent-21	10	16	0.60
Respondent-22	6	16	0.71
Respondent-23	10	10	0.00
Respondent-24	10	16	0.60
Respondent-25	10	16	0.60
Respondent-26	12	16	0.50
Respondent-27	10	14	0.40
Respondent-28	10	16	0.60
Respondent-29	10	20	1.00
Respondent-30	12	18	0.75

Name	Pre-test	Post-test	N-Gain
Respondent-31	8	18	0.83
Respondent-32	12	18	0.75
Respondent-33	12	18	0.75
Respondent-34	12	16	0.50
Respondent-35	12	18	0.75
Respondent-36	10	18	0.80
Respondent-37	8	12	0.33
Respondent-38	8	10	0.17
Respondent-39	8	18	0.83
Respondent-40	6	14	0.57
Respondent-41	8	12	0.33
Respondent-42	12	18	0.75
Average	9.80	16.33	0.64

This also aligns with what the participants felt after attending the training held in the Community Service activity. This was conveyed by the head of the MGMP Mathematics SMP of Barito Kuala, Mr. Suwarto, S.Pd., who stated that the activity provided a deeper understanding of the question analysis used to evaluate the mathematics learning he had conducted. The developed application also made it easier to carry out learning evaluations. In addition, one of the teachers participating in the MGMP and the training, Mrs. Desnalia Sari, S.Pd., a mathematics teacher at SMP Global Islamic Boarding School (GIBS) in Barito Kuala, also shared that the use of technology in supporting school administration greatly assisted teachers in completing school administration, especially in learning evaluation. Furthermore, the school where she teaches plans to adapt the technology developed into the system for reporting learning evaluations for all subjects at the school.

Throughout the implementation of the community service activity, all elements, including the implementers, partners, and participants, worked well in synergy and collaboration, ensuring the activity was successfully carried out. However, an issue temporarily disrupted the Community Service activity, which was a problem with the server (provider) for the Anbuso Mathematics Education application, causing a temporary disruption during the activity. During the trial and implementation process, over one week, some features were affected. On the first and second days, there were complaints from participants regarding certain features of the Anbuso application. However, after the third day and onwards, these features were accessible to participants after the necessary fixes were applied.

CONCLUSION

In conclusion, based on the community service activity conducted, the Community Service activity in the form of training on the Anbuso Mathematics Education Website Application increased the understanding of the participating MGMP Mathematics teachers from Barito Kuala regarding cloud-based question analysis. This community service activity resulted in the participants producing cloud-based mathematics questions and their analysis for junior high school teachers in Barito Kuala.

CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest.

AUTHOR CONTRIBUTIONS STATEMENT

Conceptualization, HA, RA, AS, J and MSK; methodology, MSK, AS and J; formal analysis, MSK.; writing—preparation of the original draft, MSK, AS and J; and others. Authorship should be limited to those who have contributed substantially to the reported work.

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