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Enhancing Student Learning Activity Through Zoom, WhatsApp, and Google Applications

Prihartini
SMA Negeri 20 Surabaya, Surabaya, Indonesia

Email: prihartini151@pendidik.kesetaraan.belajar.id

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ABSTRACT

Online learning during the COVID-19 period created persistent challenges for sustaining students' active participation, particularly when instruction remained teacher-centered. This classroom action research examined whether a combination of PowerPoint presentations, Zoom, WhatsApp, and Google applications, implemented through Project-Based Learning and Discovery Learning, could improve learning activity in Grade XII Social Sciences at SMA Negeri 20 Surabaya. The study involved 34 students (15 male and 19 female) and followed the Kurt Lewin action-research cycle across three cycles: planning, action, observation, and reflection. Learning activity was observed through five indicators: observing, questioning, conducting activities/experiments, reasoning, and presenting discussion results. Cycle I showed that several indicators had not reached the target. Cycle II produced gains in most indicators but a decline in presentation activity, prompting redesign of worksheets and the inclusion of higher-order-thinking tasks. By Cycle III, the observed counts reached 34 students for observing, 32 for questioning, 34 for conducting activities, 32 for reasoning, and 34 for presenting. The findings indicate that iterative instructional refinement supported increasingly active online mathematics learning. Because the study used classroom action research without a comparison group, the findings should be interpreted as evidence of improvement within this classroom context rather than as a causal estimate of platform effectiveness.

Keywords: classroom action research; online learning; student activity; Zoom; WhatsApp; Google applications

INTRODUCTION

Active learning requires students to do more than receive information: they observe, ask questions, reason, solve problems, communicate, and reflect on their understanding. Extensive research links structured active-learning environments with stronger academic performance and reduced failure rates, while engagement research emphasizes behavioral, emotional, cognitive, and social participation as central to meaningful learning (Freeman et al., 2014; Prince, 2004; Theobald et al., 2020; Bond et al., 2020; Kahu & Nelson, 2018; Redmond et al., 2018). These principles became especially important when schools moved rapidly to online and emergency remote instruction, where interaction, access, self-regulation, and instructional design strongly shaped students' opportunities to participate (Hodges et al., 2020; Bozkurt & Sharma, 2020; Rapanta et al., 2020; König et al., 2020; Trust & Whalen, 2020).

The original classroom problem in this study was low participation among Grade XII Social Sciences students during online mathematics lessons at SMA Negeri 20 Surabaya. Students tended to listen passively, participation in discussion was uneven, and some students did not submit worksheets or individual assignments. The intervention therefore combined synchronous communication through Zoom with asynchronous coordination through WhatsApp and Google applications, supported by PowerPoint materials. Research on videoconferencing, messaging, and learning-management ecosystems suggests that digital tools can support interaction when they are deliberately aligned with pedagogy, task structure, feedback, and social presence rather than used as delivery channels alone (Martin et al., 2020; Moorhouse, 2020; Lowenthal et al., 2020; Mpungose, 2020; Manca, 2020; Greenhow et al., 2020).

The pedagogical design also drew on Project-Based Learning (PjBL) and Discovery Learning. PjBL can organize inquiry around authentic tasks, collaborative products, and sustained problem solving, whereas discovery-oriented approaches encourage students to investigate patterns and construct explanations with appropriate guidance (Kokotsaki et al., 2016; Chen & Yang, 2019; Guo et al., 2020; Almulla, 2020; Lazonder & Harmsen, 2016; Alfieri et al., 2011). In mathematics, such approaches can be productive when tasks require students to explain reasoning, work with representations, and communicate solutions rather than merely reproduce procedures (Liljedahl, 2021; Borba et al., 2016; Engelbrecht et al., 2020).

Accordingly, this study aimed to improve students' online learning activity in statistics through iterative classroom action research. The research question was: How did student learning activity change across three cycles when PowerPoint-supported PjBL and Discovery Learning were implemented through Zoom, WhatsApp, and Google applications? The study focused on five observable dimensions: observing, questioning, conducting activities/experiments, reasoning, and presenting discussion results.

LITERATURE REVIEW

Student Learning Activity and Online Engagement

Student engagement is multidimensional and context-dependent. Behavioral participation is visible in attendance, task completion, discussion, and contribution; cognitive engagement concerns strategic effort and sense-making; emotional engagement concerns interest and belonging; and social engagement concerns interaction with peers and teachers (Fredricks et al., 2004; Kahu, 2013; Bond et al., 2020; Redmond et al., 2018). In online settings, engagement depends on clear structure, interaction, feedback, and opportunities to act on content. Synchronous sessions can provide immediacy and dialogue, whereas asynchronous spaces can extend time for reflection and task completion (Martin et al., 2020; Broadbent & Poon, 2015; Wong et al., 2019; Rasheed et al., 2020).

Zoom, WhatsApp, and Google Applications as a Learning Ecosystem

Videoconferencing platforms can approximate classroom interaction through screen sharing, questioning, and real-time discussion, but sustained participation requires purposeful facilitation and manageable cognitive load (Lowenthal et al., 2020; Moorhouse, 2020; Serhan, 2020). Messaging applications such as WhatsApp can support rapid communication, peer exchange, reminders, and distribution of learning materials, although boundaries, distraction, and unequal participation require attention (Bouhnik & Deshen, 2014; Tang & Hew, 2017; Cetinkaya, 2017). Google Classroom and related Google applications can organize materials, assignments, feedback, and submission workflows, helping connect synchronous and asynchronous learning (Al-Maroof & Al-Emran, 2018; Kumar et al., 2020; Heggart & Yoo, 2018).

Project-Based Learning, Discovery Learning, and Mathematics

PjBL positions students as active problem solvers who investigate meaningful questions and produce observable outcomes. Meta-analytic and review evidence reports positive effects on achievement, motivation, collaboration, and higher-order learning when projects are supported by clear goals, scaffolding, feedback, and assessment criteria (Chen & Yang, 2019; Kokotsaki et al., 2016; Guo et al., 2020; Almulla, 2020). Discovery learning likewise benefits from guidance: minimally guided discovery can overload learners, while guided discovery can promote conceptual understanding and transfer (Alfieri et al., 2011; Lazonder & Harmsen, 2016). For mathematics education, digital environments can expand opportunities for representation, experimentation, communication, and collaborative reasoning (Borba et al., 2016; Engelbrecht et al., 2020; Mailizar et al., 2020).

Classroom Action Research for Iterative Improvement

Classroom action research is particularly appropriate when the goal is to improve a local teaching practice through repeated cycles of planning, action, observation, and reflection. Rather than estimating a population-level treatment effect, action research uses systematic classroom evidence to identify problems, implement changes, and refine practice (Burns, 2010; Mertler, 2020; Stringer, 2014; Kemmis et al., 2014). This logic matches the present study, where worksheets, task orientation, and instructional procedures were revised after each cycle in response to observed student activity.

METHODS

Research Design and Participants

The study employed classroom action research based on the Kurt Lewin cycle. It was conducted during pandemic-era online learning in Grade XII Social Sciences at SMA Negeri 20 Surabaya. The participants were 34 students, consisting of 15 male and 19 female students. The class was selected because

the average mathematics performance was below the school minimum mastery criterion and preliminary information indicated limited activity during online instruction.

Action Cycles and Instructional Intervention

Three cycles were implemented. Each cycle included planning, action, observation, and reflection. Cycle I used Project-Based Learning; Cycle II used Discovery Learning; and Cycle III returned to Project-Based Learning after reflection and redesign. Across the cycles, PowerPoint presentations were delivered through Zoom, while WhatsApp and Google applications supported communication, material distribution, worksheets, assignments, and follow-up. Reflection after Cycles I and II informed revisions to the student worksheet (LKPD), reasoning prompts, and higher-order-thinking tasks.

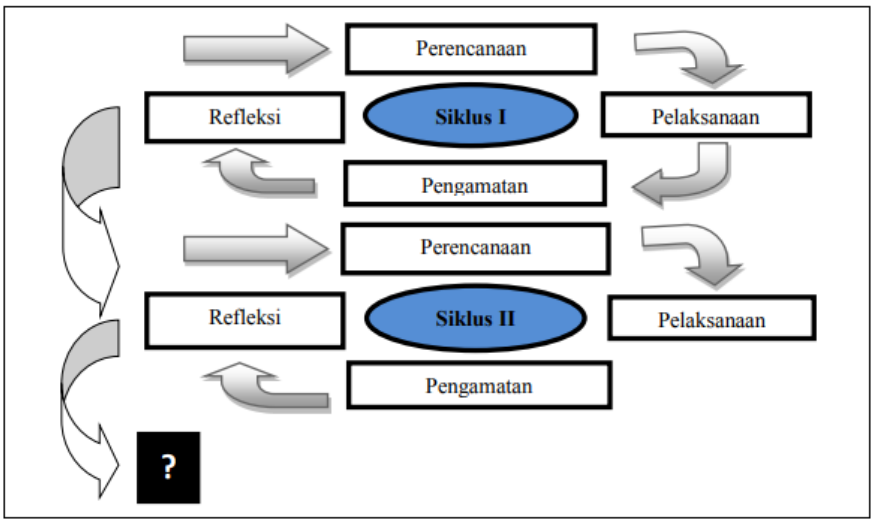


Figure 1. Classroom action research cycle used in the study

Measures and Data Analysis

Observation focused on five dimensions of learning activity: (1) observing information provided by the teacher or peers, (2) asking questions, (3) conducting activities/experiments or solving tasks independently or collaboratively, (4) reasoning and recording new information, and (5) presenting discussion results online. The analysis was descriptive and cycle-based. Counts of students demonstrating each indicator were compared with the predetermined targets and used as evidence for reflection and subsequent instructional modification. No inferential statistical test was reported in the source manuscript; therefore, this revision does not introduce inferential claims.

RESULTS AND DISCUSSION

Changes in Learning Activity Across Cycles

Table 1. Student learning activity across the three action-research cycles

Learning activity indicator	Target	Cycle I	Cycle II	Cycle III
Observing teacher/peer information	34	19	28	34
Observing peer activity/experiment	34	21	30	34
Asking questions	34	18	27	32
Conducting activity/experiment	34	34	34	34
Reasoning / making notes	30	22	28	32
Presenting discussion results	34	30	28	34

Cycle I produced uneven participation. Conducting activities reached the target (34 students), but observing, questioning, reasoning, and presenting remained below their respective targets. Reflection identified incomplete worksheet submission and insufficient explanation of solution steps as practical problems. These observations are consistent with online-engagement research showing that access to a platform does not automatically produce active learning; participation depends on task design, explicit expectations, feedback, and opportunities for interaction (Bond et al., 2020; Martin et al., 2020; Rapanta et al., 2020; Rasheed et al., 2020).

Cycle II showed improvement in observing (28 and 30 students), questioning (27), and reasoning (28), while conducting activities remained at 34. However, presentation activity declined from 30 to 28 students. The decline is important because it demonstrates that improvement was not linear across every indicator. The researcher therefore redesigned the LKPD, strengthened prompts requiring reasons for each solution step, varied questions toward higher-order thinking, and revised individual assignments. This reflective adaptation is central to action research, where evidence from one cycle is used to modify the next intervention (Kemmis et al., 2014; Mertler, 2020).

By Cycle III, both observing indicators and conducting activities reached 34 students; questioning and reasoning reached 32; and presentation returned to 34. The pattern supports the study's local conclusion that iterative use of synchronous and asynchronous tools, combined with structured active-learning models, was associated with stronger classroom participation. The result is pedagogically plausible because Zoom provided real-time interaction, WhatsApp supported communication and follow-up, and Google applications supported assignment workflows, while PjBL and Discovery Learning required students to act on the statistics content rather than only listen (Lowenthal et al., 2020; Bouhnik & Deshen, 2014; Al-Maroof & Al-Emran, 2018; Chen & Yang, 2019; Lazonder & Harmsen, 2016).

Interpretation for Online Mathematics Learning

The strongest result was not simply the presence of multiple technologies, but the way the technologies were embedded in an iterative instructional design. Research on emergency remote teaching repeatedly cautions against equating technology adoption with pedagogical transformation (Hodges et al., 2020; Bozkurt & Sharma, 2020; Trust & Whalen, 2020). The present findings similarly suggest that the instructional cycle—task design, observation, reflection, worksheet revision, and renewed facilitation—was a critical mechanism. In mathematics, where explanation and reasoning are essential, requiring students to articulate steps and present results can make participation more cognitively substantive (Engelbrecht et al., 2020; Borba et al., 2016).

Limitations

The study was conducted in one class with 34 students and used classroom action research without a control or comparison group. Consequently, changes across cycles cannot be attributed exclusively to Zoom, WhatsApp, Google applications, PjBL, or Discovery Learning. The cycles also differed in content and instructional model, making it difficult to isolate the contribution of each component. Activity was reported primarily as counts of students meeting observable indicators; the source manuscript did not report inter-rater reliability, validated engagement scales, inferential statistics, or long-term follow-up. Future studies should combine observation with validated engagement measures, learning outcomes, student interviews, and comparison designs where feasible.

CONCLUSION AND RECOMMENDATIONS

Student learning activity in Grade XII Social Sciences mathematics improved across the three classroom-action-research cycles, despite a temporary decline in presentation activity during Cycle II. By Cycle III, 34 students met both observing indicators, 32 asked questions, 34 conducted activities, 32 demonstrated reasoning, and 34 presented discussion results. The study therefore supports the practical use of a blended online-learning ecosystem—PowerPoint, Zoom, WhatsApp, and Google applications—when these tools are integrated with active-learning models and iterative reflection. Teachers are encouraged to use explicit participation indicators, redesign worksheets based on observed difficulties, include reasoning-oriented and higher-order tasks, and balance synchronous interaction with asynchronous support. Further research should test the approach across additional classes and schools and should distinguish the effects of platform use from the effects of instructional design.

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