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Effectiveness of WAVIBLOG for Mastering Trigonometry during the COVID-19 Pandemic

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ABSTRACT

This classroom action research examined the effectiveness of WAVIBLOG—an integrated learning strategy combining WhatsApp (WA), videoconferencing (VICON), and a teacher blog—for supporting Grade XI science students' mastery of trigonometry during COVID-19 distance learning at SMA Negeri 3 Salatiga in the 2020/2021 academic year. The intervention was implemented in two cycles, with two meetings in each cycle. WhatsApp was used for communication and links, Microsoft Teams videoconferencing for synchronous explanation and interaction, and the blog for recorded lessons, learning materials, exercises, and asynchronous review. Student activity, process skills, and achievement were monitored. The initial classical mean was 66.70, below the minimum mastery criterion of 70. The mean increased to 90.28 in Cycle I and was 70.23 in Cycle II, which addressed more difficult higher-order trigonometric equations. Thus, the final mean remained 3.53 points above the initial condition. Observations also indicated improvement from low to active participation. The findings suggest that WAVIBLOG was practically useful for maintaining continuity, interaction, and access to repeated explanations during emergency remote mathematics learning. Because this was a single-class action-research study without a comparison group, the results should be interpreted as evidence of classroom improvement rather than causal effectiveness.

Keywords: WAVIBLOG; trigonometry; online mathematics learning; WhatsApp; videoconferencing; learning achievement

INTRODUCTION

The COVID-19 pandemic forced schools to reorganize teaching rapidly, often replacing face-to-face interaction with emergency remote teaching rather than fully designed online education (Hodges et al., 2020; Bozkurt & Sharma, 2020; Bond et al., 2021; Carrillo & Flores, 2020). Research during school closures documented unequal access, reduced interaction, motivational difficulties, and substantial variation in students' engagement with digital learning environments (Engzell et al., 2021; Hammerstein et al., 2021; Spitzer et al., 2021; Adedoyin & Soykan, 2023). These problems are particularly consequential in mathematics, where students need sustained explanation, worked examples, feedback, and opportunities to articulate solution processes (Borba et al., 2021; Bakker et al., 2021; Engelbrecht et al., 2020).

At SMA Negeri 3 Salatiga, the initial mean mathematics achievement of Grade XI science students was 66.70, below the school's minimum mastery criterion of 70. The source study also reports that students

were relatively inactive and that early pandemic instruction was insufficiently varied. To respond to this classroom problem, the teacher developed WAVIBLOG, a locally named combination of WhatsApp, videoconferencing, and a blog. The design reflects evidence that familiar mobile messaging can sustain teacher–student connectedness (Mulyono et al., 2021; Durgungoz & Durgungoz, 2022), synchronous video can support immediate interaction and mathematical problem solving (Marhami et al., 2020; Martin et al., 2020), and asynchronous resources can provide flexible opportunities to revisit explanations (Rapanta et al., 2020; Trust & Whalen, 2020).

The study therefore asked whether WAVIBLOG could be used effectively to improve students' participation and mastery of trigonometry during pandemic distance learning. Rather than treating one platform as sufficient, WAVIBLOG combined synchronous and asynchronous affordances so that students who missed a videoconference because of connectivity or data limitations could access recorded explanations and materials later through the blog. This multimodal redundancy is pedagogically relevant because online participation is shaped not only by content quality but also by access, social presence, teacher support, and the usability of the learning environment (Bond et al., 2020; Rasheed et al., 2020; Müller et al., 2021; Ferri et al., 2020).

LITERATURE REVIEW

Online Mathematics Learning and Student Engagement

Online mathematics learning requires orchestration of representation, explanation, interaction, and feedback. Studies conducted during the pandemic show that online mathematics can support continuity but may be constrained by connectivity, reduced immediacy, and difficulties in monitoring students' reasoning (Kusumaningrum & Wijayanto, 2020; Mailizar et al., 2020; Borba et al., 2021; Radha et al., 2020). Student engagement in digital settings is multidimensional, involving behavioral participation, emotional involvement, and cognitive investment (Bond et al., 2020; Chiu, 2021; Xu et al., 2020). Teacher presence and structured communication are therefore important for sustaining participation and helping students persist through complex tasks (Rapanta et al., 2020; Martin et al., 2020; König et al., 2020).

WhatsApp, Videoconferencing, and Asynchronous Resources

WhatsApp is widely used in education because it is familiar, mobile, and comparatively lightweight. Indonesian evidence indicates that WhatsApp can strengthen connectedness and access to learning support, although outcomes depend on instructional design and network conditions (Mulyono et al., 2021; Sulisworo et al., 2021; Suharti et al., 2021; Ikhlas, 2021). In secondary mathematics, WhatsApp can extend teacher–student interaction beyond scheduled lessons and support informal communication around mathematical work (Durgungoz & Durgungoz, 2022). However, messaging alone may be insufficient for explaining

multi-step symbolic procedures, making synchronous videoconferencing and reusable asynchronous explanations valuable complements (Marhami et al., 2020; Lowenthal et al., 2020; Peper et al., 2021).

Recorded video and web-based materials can help students revisit explanations at their own pace. Effective multimedia learning depends on coherent presentation, manageable cognitive load, and opportunities for active processing rather than passive viewing (Mayer, 2021; Noetel et al., 2021; Fiorella, 2023). The WAVIBLOG approach is consistent with blended online designs that distribute functions across communication, synchronous interaction, and asynchronous review instead of requiring one platform to perform every instructional role (Hrastinski, 2019; Philipsen et al., 2019; Trust & Whalen, 2020).

Classroom Action Research and Learning Improvement

Classroom action research is designed to improve practice through iterative planning, action, observation, and reflection. In pandemic teaching, this iterative logic is especially useful because teachers need to identify barriers, adjust media use, and respond to students' participation patterns as conditions change (Burns et al., 2022; Mertler, 2020). Evidence from online learning also cautions that achievement changes should be interpreted in relation to task difficulty, assessment form, and contextual constraints rather than attributed automatically to technology (Means & Neisler, 2021; Hodges et al., 2020; Adedoyin & Soykan, 2023).

METHODS

Research Design, Setting, and Participants

The study used classroom action research conducted at SMA Negeri 3 Salatiga during the first semester of the 2020/2021 academic year. The research period extended from June to early November 2020. The participants were students in Grade XI IPA 1. The source manuscript does not report the exact number of participants; therefore, no sample size is inferred here. The study consisted of two cycles, with two meetings in each cycle. Distance learning included both online and offline components, while WAVIBLOG was the principal online strategy.

Intervention and Data Collection

WAVIBLOG integrated three functions. First, WhatsApp was used to distribute information, videoconference links, blog links, and follow-up messages. Second, Microsoft Teams videoconferencing was used for synchronous explanation, face-to-face online interaction, questioning, and step-by-step discussion of trigonometric problem solving. Third, the teacher blog provided recorded videoconference sessions, modules, exercises, reference materials, and opportunities to revisit content when students experienced connectivity, quota, or attendance problems. The monitored indicators were student activity

and process skills, while learning achievement was assessed through a daily assessment in Cycle I and a joint daily assessment in Cycle II.

The initial condition and each cycle were compared descriptively using minimum score, maximum score, and classical mean. The school's minimum mastery criterion was 70. The original study defined effectiveness operationally as cycle means meeting or exceeding this criterion, accompanied by improved activity. Because the assessments differed across cycles and Cycle II covered more difficult material, the cycle means are presented descriptively rather than treated as directly equivalent repeated measures.

RESULTS AND DISCUSSION

Implementation of WAVIBLOG

In Cycle I, WhatsApp was used to announce synchronous sessions on basic trigonometric equations, while Microsoft Teams supported direct explanation and interaction. Students who were late or unable to join because of network or data-quota constraints were directed to the blog to view recordings and review materials. Reflection after Cycle I identified continued lateness and access problems, but also greater willingness to answer questions during videoconferencing. Cycle II retained the same architecture while addressing quadratic-form trigonometric equations and equations of the form $A \sin x + B \cos x = C$, which the source manuscript explicitly describes as more difficult and more oriented toward higher-order thinking.

Table 1. Learning achievement across the initial condition and action cycles

Indicator	Initial condition	Cycle I	Cycle II
Lowest score	43	31	39
Highest score	90	100	80
Classical mean	66.70	90.28	70.23

The initial mean of 66.70 was below the mastery criterion of 70. Cycle I increased to 90.28, while Cycle II produced a mean of 70.23. The lower Cycle II mean should not be read as evidence that WAVIBLOG suddenly became less useful: the source study states that Cycle II assessed more difficult content and used a different assessment format. The final mean nevertheless exceeded the initial mean by 3.53 points and remained above the mastery criterion. This pattern illustrates why classroom action research should interpret scores alongside changes in content, assessment, participation, and implementation rather than relying on a single numerical trajectory (Mertler, 2020; Means & Neisler, 2021).

Table 2. Reported changes in classroom indicators

Indicator	Before WAVIBLOG	After WAVIBLOG
Student activity	Low	Active
Student character/discipline	Low	Improved/active
Classical mean	66.70	70.23

The qualitative observations indicate that students became more active in asking and answering questions and could use the blog to recover missed content. This finding is consistent with studies showing that messaging platforms can sustain social presence and teacher support when they are embedded in purposeful instructional routines (Mulyono et al., 2021; Durgungoz & Durgungoz, 2022; Anjarwati & Sa'adah, 2021). It also aligns with research emphasizing the value of synchronous interaction for clarification and feedback (Lowenthal et al., 2020; Peper et al., 2021) and asynchronous resources for flexible review (Noetel et al., 2021; Mayer, 2021).

At the same time, the source study documented persistent barriers involving internet access, data quota, and late entry to videoconferences. Similar constraints were widely reported during pandemic schooling in Indonesia and internationally (Ferri et al., 2020; Mailizar et al., 2020; Rasheed et al., 2020; Adedoyin & Soykan, 2023). WAVIBLOG's main practical contribution was therefore not simply the use of technology, but the distribution of instructional functions across three channels: WhatsApp for low-friction communication, videoconferencing for synchronous mathematical explanation, and the blog for durable, repeatable access. This combination can be understood as a resilience-oriented instructional design that provides alternative routes to the same learning resources when one channel fails.

Limitations

Several limitations constrain interpretation. The study involved one class, lacked a control group, and did not report the exact participant count. The Cycle I and Cycle II assessments also differed in content difficulty and format, so the means should not be interpreted as strictly comparable measures of the same test construct. Activity and character changes were reported descriptively without a validated engagement scale or inferential analysis. Consequently, the study supports a classroom-level conclusion that WAVIBLOG was feasible and associated with improved participation and a final mean above the mastery threshold, but it does not establish causal effectiveness or generalizability to other schools.

CONCLUSION AND RECOMMENDATIONS

The two-cycle classroom action research indicates that WAVIBLOG—a combination of WhatsApp, Microsoft Teams videoconferencing, and a teacher blog—provided a workable structure for trigonometry learning during COVID-19 distance education at SMA Negeri 3 Salatiga. The classical mean increased from 66.70 in the initial condition to 70.23 in the final condition, while Cycle I reached 90.28. Student participation was also reported to improve from low to active. The integrated design was especially useful because synchronous explanations could be complemented by asynchronous recordings and materials when students faced network, quota, or attendance constraints.

Future implementation should retain the multi-channel design while using equivalent pre/post assessments, explicit engagement rubrics, and systematic records of attendance and platform use. Future

research should include larger samples or comparison groups and examine whether the approach remains effective outside emergency pandemic conditions. For mathematics teaching, recorded worked examples should be concise and segmented, synchronous sessions should prioritize reasoning and feedback, and WhatsApp should function primarily as a communication and support channel rather than as the sole learning environment.

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