

The Effect of Social Media Use in Learning on the Higher-Order Thinking Skills of Vocational High School Students

Marsono ^{1*}, Nabela Ariana ¹, Widiyanti ¹, Yoto ¹

¹ Universitas Negeri Malang, Indonesia



marsono.ft@um.ac.id*

ABSTRACT

The shift to online learning created a distinct challenge in training students' higher-order thinking skills (HOTS), given that vocational competencies have long relied on direct face-to-face interaction. This study examined how far the use of social media in learning (WhatsApp feedback and Google Meet (G-Meet) synchronous sessions) applied through the Small Group Discussion method, contributed to the higher-order thinking skills of students in the Basic Mechanical Engineering Design (Dasar Perancangan Teknik Mesin, DPTM) course. A quantitative experimental design with a pretest-posttest format was used across two groups: experimental class 1 received WhatsApp feedback, while experimental class 2 received G-Meet synchronous sessions. Data were gathered through a HOTS test instrument and a student response questionnaire, then analyzed with an independent samples t-test once the normality and homogeneity assumptions were satisfied. The posttest mean for experimental class 1 reached 68 (gain score 47), while experimental class 2 reached 79 (gain score 66.14). The hypothesis test produced a significance value below 0.05, confirming a significant difference between the two treatments; G-Meet synchronous learning proved superior to WhatsApp feedback in raising students' higher-order thinking skills. These findings offer vocational teachers empirical guidance for choosing and designing social-media-based Small Group Discussion strategies that most effectively cultivate higher-order thinking skills under limited-bandwidth, post-pandemic conditions, and contribute new comparative evidence on the instructional value of synchronous versus asynchronous social media use for technical and vocational education.

Keywords: WhatsApp feedback, G-Meet Synchronous Learning, Higher-Order Thinking Skill, Small Group Discussion

ARTICLE INFO

Article history:

Received

December 11, 2025

Revised

February 13, 2026

Accepted

March 29, 2026

Journal Homepage

<https://attractivejournal.com/index.php/aj/>

This is an open access article under the CC BY SA license

<https://creativecommons.org/licenses/by-sa/4.0/>

@ 2026 by the authors

Published by

CV. Creative Tugu Pena

INTRODUCTION

The rapid spread of Covid-19 across many countries, including Indonesia, prompted the government to issue a series of policies aimed at containing transmission. In education, this took the form of Study From Home (SFH), as mandated by Circular Letter No. 4 of 2020 from the Indonesian Ministry of Education and Culture on the Implementation of Education Policy during the Covid-19 Emergency Period. Online learning was adopted not only to curb the rise in cases but also because the supporting devices were already in the hands of most of the population. This mode also gave students the freedom to access learning materials anytime and anywhere, without the constraints of space and time (Sukardi & Rozi, 2019).

SMKN 3 Boyolangu was one of the schools affected by this policy. It offers nine vocational competency programs, including Machining Engineering, with a total student population of 2,256 based on 2020 Ministry of Education and Culture data. Its students come from various sub-districts across Tulungagung Regency, which, according to official Bappeda

Tulungagung data (2019), is divided into 19 sub-districts with varied topography, some in the highlands, others in the lowlands.

Birawan (2021) noted that Tulungagung Regency was still classified as a red zone with a high risk of Covid-19 transmission at the time, so the SFH policy was fully enforced and all learning activities at SMKN 3 Boyolangu moved online. This created an access gap: students living in the highlands found it far harder to get an internet connection than those living closer to the city center.

The Head of the Tulungagung Regency Communication and Information Office (harianjawatimur.com, 2020) reported that free data quota and wifi provided by the local government still couldn't create strong or accessible enough internet to reach some remote villages. It also stated that the weak internet coverage has created more problems for students to continue their studies at home. This situation has prompted the local government to provide other alternatives to support online learning.

Some mobile apps have been used to support online learning and teaching, including Zoom, Google Classroom, WhatsApp, and Google Meet. WhatsApp has been integrated into the daily life of Indonesian citizens. Its ease of use and low system requirement are the main reasons citizens always prefer to use it. However, WhatsApp's group chat feature is the most notable. It supports online discussions and interactions for distance learning (Wariyati et al., 2020).

Google Meet (G-Meet) is the second most popular video conferencing application among school and university learners. This app has enough capacity to host 100 participants with no discomfort to the learners. Sawitri (2020) in her research, "The Use of Google Meet for Work from Home during the Coronavirus Disease 2019 (Covid-19) Pandemic", explained that integrating G-Meet into G-Suite implies learners can join the meeting from a calendar invitations by just clicking the shared link (Nalurita, 2021).

The online learning system studied here incorporates SGD (Small Group Discussion). Convenience of use was the primary reason for selecting WhatsApp as the means for communication. Once participants in a WhatsApp group are identified, there is no need for repeated group login, and this supports the discussion process. In terms of methodology, SGD puts learners in small groups to help them acquire problem-solving skills to help resolve issues not only about learning, but also about daily life (Sulistiyowati, 2017).

The teaching staff acted as facilitators, allowing students considerable freedom as they discussed topics. It proved more effective into the long term for learning to continue in the Covid-19 environment, in comparison with the traditional method of teaching and learning, which results more learners being passive, with one directional teaching, and learners struggling to comprehend the teaching content.

Both the students and teaching staff highly valued the teaching methodology, resulting in the students' greater understanding of the teaching content. In the absence of face-to-face sessions, students struggled more to understand the content. Article 3 of Law No. 20 of 2003 on the National Education System states that national education functions to develop capabilities and shape the character and dignified civilization of the nation, aiming to nurture students potential so they become knowledgeable, skillful, creative, independent and democratic and responsible citizens.

Building potential can be focused by integrating Higher-Order Thinking Skills (HOTS) into the learning process. HOTS mean the application of knowledge through cognitive actions of analyzing, evaluating, and developing actions to address a problem.

Addressing HOTS will be a good answer to the shift in 21st-century learning because of the increased importance of reasoning skills. The Ministry of Education and Culture (2019) explained that by improving the 21st-century learning characteristics, the government focuses on training teachers so they can, at the same time, teach and evaluate the outcome of learning processes based on higher-order reasoning skills. This is especially pertinent in the age of Industry 4.0, whose labor market is in need of graduates who possess higher-order thinking skills (Prahani et al., 2020).

Higher-order thinking skills demand learning processes that integrate levels of complexity where students are allowed to ponder ideas and convert them into new meaningful knowledge, combine existing ideas, and reflectively think about the benefits of their mental efforts (Brookhart, 2010). Prioritizing research that incorporates the use of WhatsApp, along with G-Meet within the context of 21st-century learning, and the impact they have on students' higher-order thinking skills, is warranted. This will provide learners with the skills needed to effectively address 21st-century challenges and will enable them to be continually innovative and creative.

METHOD

The present study employed the quasi-experimental method to investigate the use of WhatsApp feedback and G-Meet synchronous sessions in Small Group Discussion to strengthen higher-order thinking skills of vocational high school students. This study was conducted at SMKN 3 Boyolangu Tulungagung, in the Machining Engineering program, whereby experimental class 1 (X TPM 3) received WhatsApp feedback and experimental class 2 (X TPM 2) received G-Meet synchronous sessions. The research design is outlined in Table 1.

Table 1. Research Design

Class	Pretest	Treatment	Posttest
Experiment 1	O1	X1	O3
Experiment 2	O2	X2	O4

Notes: O1 = initial ability measurement, experimental class 1; O2 = initial ability measurement, experimental class 2; O3 = final ability measurement, experimental class 1; O4 = final ability measurement, experimental class 2; X1 = treatment using WhatsApp feedback in Small Group Discussion learning; X2 = treatment using G-Meet synchronous learning in Small Group Discussion learning.

The subject matter for this study was Basic Mechanical Engineering Design (Dasar Perancangan Teknik Mesin, DPTM), Basic Competency 3.12. Students' higher-order thinking skills were measured with a test instrument containing 20 multiple-choice items and 5 essay items. Both experimental classes completed a pretest to capture their initial ability, then a posttest once the learning treatment had been delivered.

Beyond the test instrument, a non-test instrument (a Likert-scale checklist questionnaire) was used to measure the effectiveness of WhatsApp feedback, the effectiveness of G-Meet sessions, and the implementation of the Small Group Discussion method. The study population covered all 109 Grade X Machining Engineering students at SMKN 3 Boyolangu Tulungagung; of these, 37 students served as the instrument try-out sample and 72 students formed the research sample, broken down as follows:

Table 2. Research Subjects

No.	Class	Number of Students	Number of Subjects
1	X TPMI 2	36	36
2	X TPMI 3	36	36
	Total		72

Posttest data from both experimental classes were then processed with Microsoft Excel and JASP, through the following steps: (a) calculating the mean and standard deviation; (b) testing the normality and homogeneity of the sample data; and (c) running an independent samples t-test.

RESULT AND DISCUSSION

To support the online implementation of Small Group Discussion, each class was divided into three groups: Small Class (SC), Leader Class (LC), and Big Class (BC). Each experimental class went through two sessions, opening with a pretest and closing with a posttest to measure students' higher-order thinking skills in both classes.

Pretest and Posttest Results for Experimental Class 1 and Experimental Class 2

The pretest and posttest findings for experimental class 1 and experimental class 2 are presented in Table 3.

Table 3. Description of Pretest and Posttest Data for Students' Higher-Order Thinking Skills

Data	Exp. 1 Pretest	Exp. 1 Posttest	Exp. 2 Pretest	Exp. 2 Posttest
N	36	36	36	36
Max	51	98	53	98
Min	28	42	24	50
Mean	39.44	68.08	36.22	78.97
Mode	41	57	41	55
SD	6.249	14.042	7.039	13.615

According to this table, the highest score in experimental class 1 (X TPM 3) reached 51, while experimental class 2 (X TPM 2) reached 53. The pretest mean of experimental class 1 also sat below that of experimental class 2, the group that would go on to receive the Google Meet treatment. The pretest data were then grouped from very low to very high following the ideal score categorization guideline (Sudijono, 2011, p. 329).

Based on this grouping, most students in experimental class 1 (75%) fell into the very low category, while most students in experimental class 2 (27.8%) fell into the low category.

The highest posttest score in both experimental classes reached 98, with means of 68.08 for experimental class 1 and 78.97 for experimental class 2. Grouping the posttest results showed that most students in experimental class 1 (33.3%) fell into the low category, while most students in experimental class 2 (50%) fell into the moderate category, as shown in Table 4:

Table 4. Posttest Categorization for Experimental Class 1 and Experimental Class 2

Category	Exp.1 Interval	Exp.1 f	Exp.1 %	Exp.2 Interval	Exp.2 f	Exp.2 %
Very High	90-100	2	5.56	99.5-100	0	0
High	76-89	11	30.56	87-99.4	9	25
Moderate	62-75	10	27.8	73-86	18	50
Low	48-61	12	33.33	60-72	6	16.67
Very Low	0-47	1	2.78	0-59	3	8.33
Total		36	100		36	100.0

Source: Research results

The pretest and posttest data from both experimental classes were then analyzed by calculating the gain score to see the difference in the improvement of students' higher-order thinking skills. The result of this analysis is shown in Figure 1.

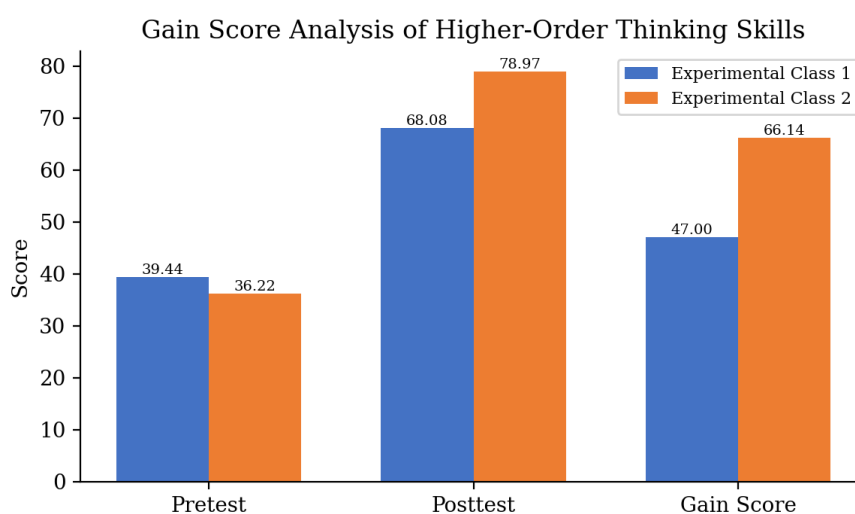


Figure 1. Gain Score Analysis of Higher-Order Thinking Skills

The gain score chart shows that the increase in higher-order thinking skills in experimental class 2 (with the G-Meet treatment) outpaced experimental class 1 (with the WhatsApp feedback treatment), with gain scores of 66.14 and 47, respectively

Analysis of Higher-Order Thinking Skills in Experimental Class 1 and Experimental Class 2

The data collected made it possible to map students' higher-order thinking skills in both experimental classes, with the percentage for each indicator shown in Table 5:

Table 5. Percentage of Students' Higher-Order Thinking Skills

Indicator	Description	Exp. 1 (%)	Exp. 2 (%)
Analyzing (C4)	Analyzing information in stress-and-moment problems; recognizing cause-and-effect factors in a given scenario; identifying questions	63	74
Evaluating (C5)	Judging solutions or ideas against set criteria; forming hypotheses, critiquing, and testing; accepting or rejecting a statement based on criteria	58	71
Creating (C6)	Generalizing an idea or perspective; designing a way to solve a problem; organizing elements into a new structure that did not exist before	67	81

The data obtained were then turned into a chart to make the findings easier to read. The higher-order thinking skills chart for both experimental groups is shown in Figure 2.

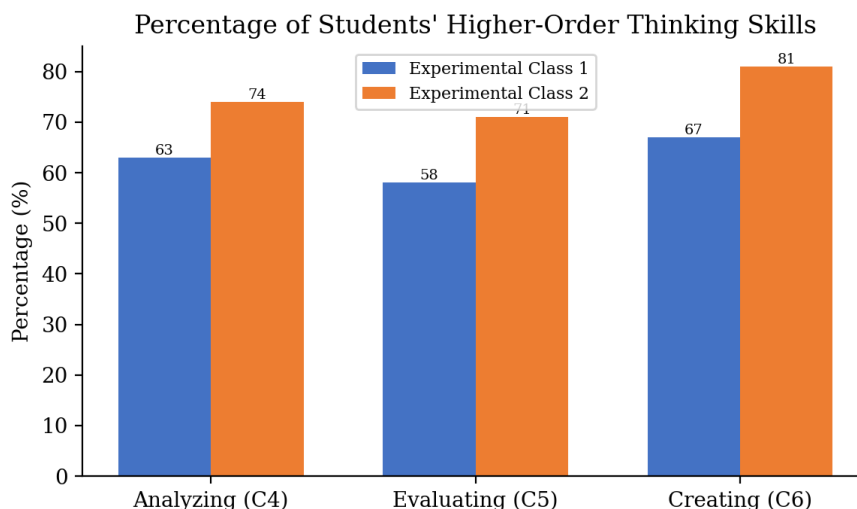


Figure 2. Percentage of Students' Higher-Order Thinking Skills

The analysis shows that students in the WhatsApp feedback group fell into the moderate category on all three indicators analyzing (C4), evaluating (C5), and creating (C6). Experimental class 2, in contrast, reached the high category on the analyzing (C4) and creating (C6) indicators, though its evaluating indicator remained in the moderate category.

Use of WhatsApp Feedback and G-Meet Synchronous Sessions in Small Group Discussion Learning

A questionnaire was used to gauge students' responses to using WhatsApp and G-Meet during online Small Group Discussion learning. The results of this analysis are shown in Tables 6 through 8.

Table 6. Percentage of Student Responses per Item on the Use of WhatsApp Feedback

Item	SA (f)	SA %	A (f)	A %	N (f)	N %	D (f)	D %	SD (f)	SD %
1	23	63.9	13	36.1						
2	28	77.8	8	22.2						
3	30	83.3	6	16.7						
4	21	58.3	14	38.9	1	2.8				
5	22	61.1	12	33.3	2	5.6				

Item	SA (f)	SA %	A (f)	A %	N (f)	N %	D (f)	D %	SD (f)	SD %
6	23	63.9	12	33.3	1	2.8				
7	13	36.1	20	55.6	3	8.3				
8	16	44.4	16	44.4	3	8.3	1	2.8		
9	11	30.6	18	50	7	19.4				
10	17	47.2	16	44.4	3	8.3				
11	18	50	15	41.7	2	5.6	1	2.8		
12	22	61.1	12	33.3	2	5.6				
Total	244	56.481	162	37.5	24	5.56	2	0.463		

Note: SA = strongly agree; A = agree; N = neutral; D = disagree; SD = strongly disagree.

The table shows student responses to the use of WhatsApp feedback in Small Group Discussion learning. A total of 93.98% of students agreed that WhatsApp feedback was effective for the DPTM Basic Competency 3.12 course and helped raise their higher-order thinking skills. This figure was then compared with the response from experimental class 2, which used G-Meet synchronous sessions.

Table 7. Percentage of Student Responses per Item on the Use of G-Meet Synchronous Sessions

Item	SA (f)	SA %	A (f)	A %	N (f)	N %	D (f)	D %	SD (f)	SD %
1	25	69.4	9	25	2	5.6				
2	6	16.7	20	55.6	10	27.8				
3	27	75	8	22.2	1	2.8				
4	4	11.1	21	58.3	11	30.6				
5	11	30.6	20	55.6	5	13.9				
6	3	8.3	22	61.1	10	27.8	1	2.8		
7	9	25	18	50	9	25				
8	8	22.2	14	38.9	11	30.6	3	8.3		
9	13	36.1	17	47.2	4	11.1	2	5.6		
10	6	16.7	21	58.3	9	25				
11	12	33.3	16	44.4	8	22.2				
12	18	50	17	47.2	1	2.8				
Total	142	32.87	203	46.991	81	18.75	6	1.389		

This table shows the G-Meet responses for the DPTM Basic Competency 3.12 course. Of the 425 responses, 142 (32.87%) strongly agreed, 203 (47.991%) agreed, 81 (18.75%) were neutral, and 6 (1.389%) disagreed. Hence, approximately 79.861% of the participants agreed that G-Meet sessions helped to develop higher-order thinking skills. As this figure is less than what was obtained in experimental class 1, it shows that participants preferred WhatsApp feedback over G-Meet sessions within the context of the SGD implementation. Both experimental classes used the Small Group Discussion method. The results of the analysis on the use of this method are presented in Table 8.

Table 8. Frequency Distribution of Small Group Discussion Use

Category	Interval	Exp.1 f	Exp.1 %	Exp.2 f	Exp.2 %
Very Low	17-29	0	0	0	0
Low	30-41	0	0	0	0
Moderate	42-54	2	5.6	1	2.8
High	55-67	33	91.7	35	97.2
Very High	68-80	1	2.8	0	0
Total		36	100	36	100

Table 8 confirms that the Small Group Discussion method drew a positive response from both experimental classes, with experimental class 2 (G-Meet) recording a higher response than experimental class 1 (WhatsApp feedback).

Prerequisite Tests

The hypothesis prerequisite testing covered normality and homogeneity. The normality test was meant to confirm whether the data were normally distributed, using the posttest scores of both treatment groups. It was carried out with the Shapiro-Wilk method through a statistical software application, with the output shown in Table 9:

Table 9. Normality Test Results

Data	Statistic	df	Sig.
Posttest, Experimental Class 1	0.975	36	0.576
Posttest, Experimental Class 2	0.964	36	0.283

The significance value from the normality test was above 0.05, indicating that the data were normally distributed. Next, the homogeneity test was run to check whether the WhatsApp feedback group and the G-Meet group were homogeneous, using Levene's test, with the result shown in Table 10:

Table 10. Homogeneity Test Results

Levene Statistic	df1	df2	Sig.
3.119	1	70	0.082

The homogeneity calculation on the posttest data of both treatment groups produced a significance value of 0.082, above the 0.05 threshold, so the data were declared homogeneous.

Hypothesis Testing

An independent samples t-test was used to answer the study's hypothesis, with the results presented in Table 11.

Table 11. Independent Samples T-Test Results

Variable	Class	t	Sig. (2-tailed)	Mean
Posttest higher-order thinking skills	Experimental Class 1	-3.434	0.001	68.08
	Experimental Class 2			78.97

Based on Table 11, the significance value from the posttest of both experimental classes fell below 0.05, indicating a significant difference in higher-order thinking skills between students who received WhatsApp feedback and those who received G-Meet synchronous sessions in Small Group Discussion learning.

This experimental study focused on the effect of WhatsApp feedback and G-Meet synchronous sessions in Small Group Discussion learning on students' higher-order thinking skills. Two experimental groups took part as subjects: X TPM 3 as the first group and X TPM 2 as the second, each receiving a different treatment according to the study variables.

Higher-Order Thinking Skills of Students Using WhatsApp Feedback in Small Group Discussion Learning

Using WhatsApp in online learning is a common option teachers turn to for the sake of effective learning activities. Analysis of the WhatsApp effectiveness questionnaire showed that 93.98% of students agreed with its use during online learning in the pandemic period. This finding closely resembles that of Yulianto et al. (2020), who noted students preferred WhatsApp Group during online learning as text messages could be passed around any time and any place, simplifying the learning process.

WhatsApp Group was most notably used to facilitate discussions using text messages, and this is visible in the survey output. For item 1, 63.9% of respondents strongly agreed that WhatsApp was simple to get a hold of, and for item 2, 77.8% of respondents appreciated the simplicity of WhatsApp's interface. Using WhatsApp also let students get direct feedback from teachers and encouraged the confidence to ask questions, more so than conventional face-to-face learning. Ellison (as cited in Pratama, 2019) noted that social media benefits users with lower confidence in asking questions directly, which then has a positive effect on academic achievement. A similar pattern showed up in this study, where students were observed actively asking questions and sharing opinions through WhatsApp Group, both with the teacher and among peers, to deepen their grasp of the material.

WhatsApp-based learning began by forming small groups of four students each, to make the material easier to understand and clarify the problems at hand. Each group's leader joined a Leader Group on WhatsApp to keep coordination with the teacher running smoothly. A number of obstacles marked the learning process in experimental class 1, chief among them low student activity in responding to teacher questions. Teachers also could not directly monitor student activity, one likely cause of that low response rate. Even so, this obstacle did not disrupt the measurement of students' higher-order thinking skills, which could still be carried out through posttest results based on Bloom's taxonomy criteria.

The posttest consisted of 20 multiple-choice items and 5 essay items, administered outside DPTM class hours after students went through two treatment sessions. Earlier, a pretest had been administered to map students' initial ability, with experimental class 1 recording a mean of 39.44 and a highest score of 51. The posttest mean for higher-order thinking skills in experimental class 1 reached 68.08. Of the 20 multiple-choice items, only 3 of 36 students answered every item correctly; on the 5 essay items, only 2 students reached the highest score of 58. This confirms that most students in experimental class 1 still struggled with HOTS items.

Students' higher-order thinking skills, initially in the low category, rose to moderate and even high after the treatment. Nine students in experimental class 1 reached the high category, and five more reached the very high category after treatment. Experimental class 1's results owe much to WhatsApp Group's ability to keep a long-running conversation history and support small-group discussion. Forming small groups gave students who were reluctant to ask questions in the Big Class the confidence to ask within a smaller circle of peers. Vygotsky (as cited in Kurniawan, 2019) likewise argued that higher-order thinking skills develop best when students receive guidance from someone more skilled, whether an expert or a peer with stronger competence.

Higher-Order Thinking Skills of Students Using G-Meet Synchronous Sessions in Small Group Discussion Learning

Google Meet is a tool that facilitates communication and interaction, making it a popular choice among alternative learning media. An analysis of the questionnaires of 79.861% of students from experimental class 2 demonstrated that they found Google Meet adequate for use in online learning. This suggests synchronous collaboration offers two-way teacher-student interaction in real time, as observed in the work of Firman et al. (2021).

G-Meet also encouraged small groups containing 4 students. Since small group discussions assist in understanding, participants of experimental class 2 approved of the method with roughly 97.2% figure of effectiveness. One of the pre-arranged G-Meet links was provided by the teacher. Other setbacks included data caps, communication drops due to poor signal, and communal device use. Students from experimental class 2 engaged in other activities during online learning sessions, including using the phone, eating, and keeping their cameras on. This became another major distraction. Since the brain tends to fail to focus on multiple tasks enough, as explained by Schmidt (in Firman, 2021), students in class may not pay attention, and may, in the end, learn the wrong thing.

Less conducive home study environments led to boredom and fatigue, making students more distractible. Sklar (2020) mentioned Zoom Fatigue, which is the tiredness characterised by the effort of maintaining concentration and constant eye contact with a screen through video conferencing. Even still, G-Meet became a preferred option for many, due to its ease of use, low storage requirement, and its accessibility through the students' email. This was evidenced in the experimental class 2 survey, which indicated a general agreement that G-Meet is easier to use than other synchronous applications.

In the second session, group discussion presentations, students were able to ask questions and share their opinions, and the teachers were able to provide their feedback, therefore achieving a two-way interaction. G-Meet's raise hand feature, made teachers aware of which students wanted to speak, and maintained a level of order in the communication system and avoided disruption to the class. The second session posttest was conducted with 20 multiple choice items. One of the 36 students answered all the items correctly, with a score of

40. On the other hand, only 2 students answered the essay items correctly. This indicates that students in experimental class 2 struggled to answer HOTS items.

The posttest mean for experimental class 2 was 78.97, and 11 students scored in the very high range and 10 students scored in the high range, after the G-Meet treatment in Small Group Discussion learning. Running G-Meet for online learning required a set of rules to keep the process smooth and reach its learning goals. The rules applied during learning included: (1) students had to join the G-Meet room no more than 30 minutes before the session started, with attendance-point penalties for lateness; (2) students had to change their display name to the format Class_Attendance Number_Full Name; (3) students had to dress and present themselves properly and choose a comfortable position throughout the session, with point penalties for violations; (4) students had to keep their camera on throughout the session, with point penalties and a requirement to summarize the material if they turned it off without the teacher's permission; (5) students had to mute their microphone except when needed, with additional assignments and point penalties for violations; and (6) students had to attend the full session and use the raise-hand feature when they wanted to interact, with point penalties for violations.

Differences between WhatsApp Feedback and G-Meet Synchronous Sessions in Small Group Discussion Learning on Vocational High School Students' Higher-Order Thinking Skills

Choosing between WhatsApp Group and Google Meet as an online learning medium means weighing alternatives that each carry their own strengths and weaknesses. Weighing both is important in deciding which medium best serves the learning goals, including developing students' higher-order thinking skills.

The posttest was administered outside DPTM class hours after students went through two Small Group Discussion sessions. The earlier pretest produced a mean of 39.44 (highest score 51) for the WhatsApp feedback group, and a mean of 36.22 (highest score 53) for the G-Meet group. The WhatsApp feedback group recorded a posttest mean of 68.08. Of the 20 multiple-choice items, only 3 of 36 students answered everything correctly, while on the essay items only 2 students reached the highest score of 58, confirming that this group still struggled with HOTS items.

Syamsuddin et al. (2020) found that online learning media had a significant effect on students' higher-order thinking skills. Consistent with that, the WhatsApp feedback treatment in experimental group 1 was shown to affect HOTS: students' thinking ability, initially low, rose to moderate and even high, with 11 students reaching the high category and 2 reaching the very high category after treatment.

Experimental group 2 also underwent a posttest after the second session. Of the 20 multiple-choice items, only 1 of 36 students answered everything correctly, with the highest score of 40, while on the essay items only 2 of 36 students answered correctly, indicating that this group faced similar difficulty with HOTS items, not yet being used to questions above C3. Testing the effect of G-Meet synchronous sessions on experimental group 2 produced a significance value of 0.001, with a posttest mean of 78.97, where 11 students reached the very high category and 10 reached the high category after the G-Meet treatment in Small Group Discussion learning.

Nasution (2021) reported that the problem-solving ability of students taught with Google Meet was better than those taught through WhatsApp, a finding that lines up with this study's results. The comparison between the two treatments can be traced further through posttest score analysis.

Analysis of both groups' posttests shows that the G-Meet group's mean was higher than the WhatsApp feedback group's. This suggests that the synchronous interaction made it easier for students to understand the material, while also pushing them to actively seek out additional learning resources and interact more during G-Meet sessions.

Looking at each indicator, the WhatsApp feedback group recorded a mean of 63% for analyzing, 58% for evaluating, and 67% for creating (high). The G-Meet group, meanwhile, recorded 74% for analyzing, 81% for creating (both high), and 71% for evaluating (moderate).

The gap between the two groups, beyond the type of medium used, was also shaped by the habit of giving students low-order thinking questions, which kept their higher-order thinking skills from developing fully (Rochman & Hartoyo, 2018).

WhatsApp Group's lower appeal for experimental class 1 students was also shaped by its long-message chat format, which made the material harder to follow for students who were less inclined to read. Even though both classes received comparable treatment small-group formation, Bloom's-taxonomy-based problems, and the same material students who skipped over the HOTS example questions the teacher explained tended to struggle more with HOTS-based problems, simply from lack of exposure.

The DPTM course, which emphasizes conceptual understanding, calls for examples and models that make the material accessible to students. G-Meet synchronous learning had an edge here, since teachers could present supporting examples in more detail and in more engaging ways through slides or animation, for instance helping students better understand and grow accustomed to HOTS-based questions.

To keep training students' higher-order thinking skills over the long run, blended learning that combines synchronous and asynchronous approaches could be a solution, especially given that G-Meet consumes more data than WhatsApp. Supporting media such as Google Forms or Google Classroom could serve as a space for collecting assignments and holding additional discussion outside the main G-Meet sessions, to keep sharpening students' higher-order thinking skills.

DISCUSSION

Taken together, these results confirm that both WhatsApp feedback and G-Meet synchronous sessions embedded in Small Group Discussion significantly improved the higher-order thinking skills of vocational high school students, with G-Meet synchronous learning producing the larger gain (posttest mean 78.97 versus 68.08, $p < 0.05$). This pattern indicates that structured, teacher-facilitated interaction through social media, rather than the platform itself, is what drives higher-order cognitive engagement during online learning, and it underscores the practical relevance of these findings for vocational teachers seeking accessible, low-cost alternatives to face-to-face instruction in technical subjects such as Basic Mechanical Engineering Design (DPTM).

These findings are consistent with a growing body of research on social-media- and video-conferencing-based learning. Baguma et al. (2019) similarly found that structured WhatsApp-enabled learning promotes higher-order skills such as critical reflection and dialogue, while Rabbianty et al. (2021) reported that maximizing WhatsApp's discussion features increased students' engagement in remote learning. In line with the superiority of G-Meet observed in the present study, Al Faruq et al. (2022) and Hasbullah et al. (2022) found that Google Meet's synchronous, face-visible format encourages more active participation than asynchronous, text-based platforms. Purwoko et al. (2022) likewise found that Google Meet supported more creative and better-controlled online learning specifically among vocational high school students, closely mirroring the DPTM setting studied here. At a broader level, Fabriz et al. (2021) demonstrated that synchronous online settings foster a more positive learning experience than asynchronous ones among higher education students, and Rachmawati et al. (2023) confirmed that well-designed learning activities are decisive in determining whether HOTS outcomes are achieved in Indonesian vocational high schools. Afikah et al. (2023) further showed that HOTS and collaboration skills can be jointly cultivated in online learning during the pandemic, reinforcing the plausibility of the gains obtained by both treatment groups in the present study.

Where the present findings diverge from prior work, the divergence is instructive. Unlike Zainol and Samingin (2022), who reported a negative relationship between WhatsApp engagement and achievement in a business-subject context, the WhatsApp feedback group in this study still recorded a significant HOTS gain; this discrepancy likely stems from differences in population (vocational technical-drawing students rather than business students), instructional design (structured Small Group Discussion with teacher-monitored feedback

rather than unstructured WhatsApp use), and outcome measure (a Bloom's-taxonomy-based HOTS test rather than general academic achievement). Likewise, although Dacillo et al. (2022) and Sklar (2020) documented that prolonged videoconferencing induces fatigue that can undermine learning, the G-Meet group in this study still outperformed the WhatsApp group; this can be attributed to methodological safeguards such as the fixed session structure, the mandatory camera-on and raise-hand rules, and the small-group breakout format, which reduced the passive multitasking behavior identified by Schmidt (as cited in Firman et al., 2021) as a driver of videoconferencing fatigue. These contextual and methodological differences suggest that the effectiveness of a given social media platform for HOTS development depends not merely on the technology itself but on how tightly the discussion structure, group size, and teacher facilitation are designed around it, a nuance not always addressed in the comparative literature (Boelens et al., 2017).

The principal contribution of this study lies in its direct, quantitative, within-course comparison of an asynchronous (WhatsApp feedback) and a synchronous (G-Meet) social-media-based intervention, both operationalized through the same Small Group Discussion method and measured with a validated HOTS instrument, within a specific vocational engineering course at the senior-secondary level. While previous studies have separately examined WhatsApp (Baguma et al., 2019; Rabbianty et al., 2021) or Google Meet (Al Faruq et al., 2022; Purwoko et al., 2022) in relation to critical thinking, few have paired both media under an identical pedagogical framework and measured their differential effect on the analyzing, evaluating, and creating dimensions of Bloom's revised taxonomy (Anderson & Krathwohl, 2001) among Machining Engineering vocational students. This design offers new empirical evidence situating video-conferencing platforms as a stronger, though more resource-intensive, medium for developing higher-order thinking skills in bandwidth-constrained, semi-rural vocational contexts such as Tulungagung Regency.

Practically, these findings suggest that vocational schools operating under limited-bandwidth conditions should prioritize G-Meet-based Small Group Discussion for HOTS-focused technical subjects whenever internet access allows, while retaining WhatsApp feedback as a viable, lower-bandwidth alternative that still yields meaningful HOTS gains. At the policy level, education offices in areas with uneven internet infrastructure, such as Tulungagung Regency (Harianjawatimur.com, 2020), may consider directing data-quota assistance specifically toward synchronous video platforms rather than generic internet aid, since the instructional benefit of synchronous interaction appears to outweigh that of asynchronous text-based media. Academically, the study extends Vygotsky's (1978) guided-interaction principle by showing that both synchronous and asynchronous scaffolding, when embedded in small-group structures, can support the development of higher-order cognition, though not to an equal degree. Future researchers are encouraged to replicate this comparison across other vocational competencies, extend the intervention period to assess the retention of HOTS gains, and examine blended designs that combine G-Meet's synchronous depth with WhatsApp's asynchronous flexibility (Boelens et al., 2017; Eliyasni et al., 2019).

CONCLUSION

Drawing on the analysis of WhatsApp feedback and G-Meet synchronous sessions in Small Group Discussion learning, this study found that both treatments significantly affected the higher-order thinking skills of vocational high school students. WhatsApp feedback raised HOTS to a mean of 68.08 at a 5% significance level, while G-Meet synchronous sessions raised HOTS further, to a mean of 78.97, also at a 5% significance level, indicating G-Meet's greater effectiveness within this context.

Building on these findings, further and more in-depth research is still needed. Mechanical Engineering Education students would benefit from continuing to sharpen their teaching skills through ongoing practice, so they can better support students' higher-order thinking skills when using G-Meet as a learning medium; mastering the platform beforehand would make classroom management easier. Vocational teachers of productive subjects are encouraged to stay actively engaged in G-Meet-based online learning so that interaction does not run one way, keeping students' higher-order thinking skills developing; where consistent

G-Meet use proves difficult, other learning applications can serve as a supporting alternative, whether for synchronous sessions or discussion outside class hours, and dividing students into small, monitored groups while regularly assigning HOTS questions can give students more room to sharpen both their communication and higher-order thinking abilities. Students in the Machining Engineering competency program are advised to prepare everything they need before each scheduled session, to minimize the risk of technical problems, and to stay actively engaged in both whole-class and small-group discussion to sharpen their higher-order thinking and communication skills. Future researchers interested in studying online learning media and students' higher-order thinking skills can use these findings as a reference or point of comparison for instance, by broadening the range of media compared (such as Zoom, Google Classroom, or a combination of several media) and examining more deeply the impact of using different types of online learning media.

REFERENCES

- Abd Halim, N. D., Mutalib, M. A., Mohd Zaid, N., Mokhtar, M., Abd. Majid, F., & Haslee Sharil, W. N. E. (2024). The use of social media to enhance critical thinking in online learning among higher education students. *International Journal of Interactive Mobile Technologies*, 18(6), 56-66. <https://doi.org/10.3991/ijim.v18i06.48033>
- Afify, M. K. (2019). The influence of group size in the asynchronous online discussions on the development of critical thinking skills, and on improving students' performance in online discussion forum. *International Journal of Emerging Technologies in Learning*, 14(5), 132-152. <https://doi.org/10.3991/ijet.v14i05.9351>
- Afikah, A., Rohaeti, E., Jumadi, J., & Perdana, R. (2023). Student's higher-order thinking skills and collaboration skills in online learning during pandemic. *International Journal of Evaluation and Research in Education*, 12(1), 23-33. <https://doi.org/10.11591/ijere.v12i1.23797>
- Al Faruq, A. Z., Ngadiso, N., & Supriyadi, S. (2022). Students' perceptions of synchronous online learning using Google Meet in a reading class. *Al-Ishlah: Jurnal Pendidikan*, 14(3), 4053-4066. <https://doi.org/10.35445/alishlah.v14i3.1937>
- Anderson, L. W., & Krathwohl, D. R. (Eds.). (2001). A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives. Longman.
- Badaruddin, A., Hikmawati, Uge, S., Arisanti, W. O. L., & Hamid, M. (2023). The effect of online learning assisted by Google Classroom and Zoom meetings on students' creative thinking ability. *Journal of Educational Science and Technology*, 9(2), 161-172. <https://doi.org/10.26858/est.v9i2.46933>
- Baguma, R., Bagarukayo, E., Namubiru, P., Brown, C., & Ssentamu, P. N. (2019). Using WhatsApp in teaching to develop higher order thinking skills-a literature review using the activity theory lens. *International Journal of Education and Development using Information and Communication Technology*, 15(2), 98-116. <https://files.eric.ed.gov/fulltext/EJ1220764.pdf>
- Bappeda Kabupaten Tulungagung. (2019). Peta kajian. <http://bappeda.tulungagung.go.id/maps/index.php>
- Birawan, D. (2021, January 30). Awal tahun, Tulungagung masih pembelajaran daring. *Harian Bhirawa*. <https://www.harianbhirawa.co.id/awal-tahun-tulungagung-masih-pembelajaran-daring/>
- Boelens, R., De Wever, B., & Voet, M. (2017). Four key challenges to the design of blended learning: A systematic literature review. *Educational Research Review*, 22, 1-18. <https://doi.org/10.1016/j.edurev.2017.06.001>
- Brookhart, S. M. (2010). How to assess higher-order thinking skills in your classroom. ASCD. <http://www.ascd.org/publications/books/109111.aspx>
- Dacillo, M. J. F., Dizon, J. K. M., Ong, E. J. T., Pingol, A. M. L., & Cleofas, J. V. (2022). Videoconferencing fatigue and online student engagement among Filipino senior high school students: A mixed methods study. *Frontiers in Education*, 7, Article 973049. <https://doi.org/10.3389/feduc.2022.973049>

- Eliyasni, R., Kenedi, A. K., & Sayer, I. M. (2019). Blended learning and project based learning: The method to improve students' higher-order thinking skill (HOTS). *Jurnal Iqra': Kajian Ilmu Pendidikan*, 4(2), 231-248.
- Fabriz, S., Mendzheritskaya, J., & Stehle, S. (2021). Impact of synchronous and asynchronous settings of online teaching and learning in higher education on students' learning experience during COVID-19. *Frontiers in Psychology*, 12, Article 733554. <https://doi.org/10.3389/fpsyg.2021.733554>
- Firman, Sari, A. P., & Firdaus. (2021). Aktivitas mahasiswa dalam pembelajaran daring berbasis konferensi video: Refleksi pembelajaran menggunakan Zoom dan Google Meet. *Indonesian Journal of Education Science* (IJES). <https://ojs.unsulbar.ac.id/index.php/ijes/article/view/969>
- Harianjawatimur.com. (2020, September 20). Bantu pembelajaran daring, Pemkab Tulungagung instruksikan OPD hingga Pemdes sediakan wifi gratis. <https://www.harianbhirawa.co.id/awal-tahun-tulungagung-masih-pembelajaran-daring/>
- Hasbullah, N. H., Rahmatullah, B., Mohamad Rasli, R., Khairudin, M., & Downing, K. (2022). Google meet usage for continuity and sustainability of online education during pandemic. *Journal of ICT in Education*, 9(2), 46-60. <https://doi.org/10.37134/jictie.vol9.2.4.2022>
- Indahyana, N., Susanti, I., & Mahbubah, K. (2024). The effectiveness of contextual learning with the small group discussion method to improve students' critical thinking skills. *Jurnal Studi Guru dan Pembelajaran*, 7(2), 397-405. <https://doi.org/10.30605/jsdp.7.2.2024.4338>
- Kementerian Pendidikan dan Kebudayaan Indonesia. (2019). High order thinking skills bekal bersaing di abad 21. <https://gtk.kemdikbud.go.id/read-news/high-order-thinking-skills-bekal-bersaing-di-abad-21>
- Kementerian Pendidikan dan Kebudayaan Indonesia. (2021). Data sekolah SMKN 3 Boyolangu. <https://sekolah.data.kemdikbud.go.id/index.php/chome/profil/C3768ED7-BB2C-4376-99B2-6014EE7E7E10>
- Kurniawan, S. (2019). Pengaruh blended learning Student Teams Achievement Division (STAD) dan Jigsaw terhadap higher-order thinking skills siswa SMK [Unpublished undergraduate thesis]. Universitas Negeri Malang.
- Nalurita, S. (2021). Pemanfaatan aplikasi Google Meet pada mata kuliah teknik proyeksi bisnis semester gasal tahun pelajaran 2020/2021 di Universitas Dirgantara Marsekal Suryadarma (Unsuraya). <https://journal.universitassuryadarma.ac.id/index.php/jimspc/article/view/593>
- Nasution, U. S. (2021). Perbedaan kemampuan pemecahan masalah yang diajar dengan aplikasi Google Meet dan WhatsApp. *Jurnal Mathematics Paedagogic*. www.jurnal.una.ac.id/indeks/jmp
- Prahani, B. K., Jatmiko, B., Hariadi, B., Sunarto, D., Sagirani, T., Amelia, T., & Lemantara, J. (2020). Blended web mobile learning (BWML) model to improve students' higher order thinking skills. *International Journal of Emerging Technologies in Learning*. <https://doi.org/10.3991/IJET.V15I11.12853>
- Pratama, R. A. (2019). Kuliah melalui WhatsApp. *de Fermat: Jurnal Pendidikan Matematika*. <https://jurnal.pmat.uniba-bpn.ac.id/index.php/DEFERMAT/article/download/32/23/109>
- Purwoko, R. Y., Primartadi, A., Efendi, Y., & Amin, T. (2022). The online learning creativity using the Google Meet platform in vocational high schools. *Tarbawi: Jurnal Ilmu Pendidikan*, 18(2), 111-121. <https://ejournal.iainkerinci.ac.id/index.php/tarbawi/article/view/1313>
- Rabbianty, E. N., Ghofur, A., & Wafi, A. (2021). Maximizing the use of WhatsApp in English remote learning to promote students' engagement at Madura. *LET: Linguistics, Literature and English Teaching Journal*, 11(1), 42-60. <https://doi.org/10.18592/let.v11i1.4402>
- Rachmawati, D., Suharno, S., & Roemintoyo, R. (2023). The effects of learning design on learning activities based on higher order thinking skills in vocational high schools. *Open Education Studies*, 5(1), 51-60. <https://doi.org/10.1515/edu-2022-0202>

- Rochman, S., & Hartoyo, Z. (2018). Analisis high order thinking skills (HOTS) taksonomi menganalisis permasalahan fisika. *SPEJ (Science and Physics Education Journal)*. <https://journal.ipm2kpe.or.id/index.php/SPEJ/article/view/268>
- Sawitri, D. (2020). Penggunaan Google Meet untuk work from home di era pandemi Coronavirus Disease 2019 (Covid-19). *Jurnal Prioritas: Jurnal Pengabdian Masyarakat*. <http://jurnal.harapan.ac.id/index.php/Prioritas/article/view/161>
- Sklar, J. (2020, April). 'Zoom fatigue' is taxing the brain. Here's why that happens. *National Geographic*. <https://www.nationalgeographic.co.uk/science-and-technology/2020/04/zoom-fatigue-is-taxing-the-brain-heres-why-that-happens>
- Sukardi, S., & Rozi, F. (2019). Pengaruh model pembelajaran online dilengkapi dengan tutorial terhadap hasil belajar. *JUPI (Jurnal Ilmiah Penelitian dan Pembelajaran Informatika)*. <https://doi.org/10.29100/jipi.v4i2.1066>
- Sulistiyowati, N. W. (2017). Implementasi small group discussion dan collaborative learning untuk meningkatkan prestasi belajar mahasiswa Program Studi Pendidikan Akuntansi IKIP PGRI Madiun. *Assets: Jurnal Akuntansi dan Pendidikan*. <https://doi.org/10.25273/jap.v5i2.1197>
- Surat Edaran Nomor 4 Tahun 2020 tentang Pelaksanaan Kebijakan Pendidikan dalam Masa Darurat Penyebaran Coronavirus Disease (Covid-19).
- Syamsuddin, Ahmadi, H., & Afriani. (2020). Media pembelajaran online terhadap kemampuan berpikir tingkat tinggi matematika di tengah pandemi Covid-19. *Journal of Chemical Information and Modeling*. <https://doi.org/10.1017/CBO9781107415324.004>
- Undang-Undang Republik Indonesia Nomor 20 Tahun 2003 tentang Sistem Pendidikan Nasional.
- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.
- Wariyati, Sujarwo, & Aulia. (2020). Case study under the correlation of students' response anxiety to the learning motivation as the impact of modernization media used (WhatsApp). <https://jurnal-lp2m.umnaw.ac.id/index.php/JPPT/article/download/439/356/>
- Yulianto, E., Cahyani, P. D., & Silvianita, S. (2020). Perbandingan kehadiran sosial dalam pembelajaran daring menggunakan WhatsApp Group dan Webinar Zoom berdasar sudut pandang pembelajar pada masa pandemi Covid-19. *Jurnal Riset Teknologi dan Inovasi Pendidikan (JARTIKA)*. <https://journal-litbang-rekarta.co.id/index.php/jartika>
- Zainol, Z., & Mohd Samingin, N. (2022). The effect of WhatsApp application usage on student achievement in business-based subjects. *International Business Education Journal*, 15(2), 40-52. <https://doi.org/10.37134/ibej.Vol15.2.4.2>