Teaching and Learning in COVID-19 Situation: The Design of an Online Pedagogical Seminar Course

Chanakan Grosseau, King Mongkut's University of Technology Thonburi, Thailand
Rut Manotum, King Mongkut's University of Technology Thonburi, Thailand
Arnon Thongsaw, King Mongkut's University of Technology Thonburi, Thailand

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Abstract
This study examined the effectiveness of an assessment approach that focuses on three aspects of presentation (content, presentation skills, and answering) in a seminar course. The research also investigated the relationship between presentation and student development, specifically regarding communication skills, teamwork, public speaking, and problem-solving abilities. The study also aimed to determine the feasibility of using online systems to teach and learn seminar courses at the secondary level. The results showed that the students had relatively high scores in all three assessment areas, with most of the scores clustering around the mean and median values and relatively small standard deviations. A questionnaire administered to a sample of students revealed that participating in seminar courses and presenting research papers had a statistically significant positive effect on students' communication skills. The results also indicated that online systems can potentially be a viable alternative to face-to-face instruction for seminar courses at the secondary level.

Keywords: Online Seminar Courses, Discussion-Based Courses, Student-Led Presentations, Interactive Learning, Critical Thinking, Problem Solving, Collaborative Learning, Student Engagement, Motivation, Learning Outcomes

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1. INTRODUCTION

Seminar courses, also known as seminar-style or discussion-based courses, are a popular teaching method at the secondary school level (K-12). These courses typically involve small group discussions, student presentations, and interactive learning activities, and are designed to promote critical thinking, problem solving, and collaborative learning (Chung, Kim, & Lim, 2018). Research has shown that seminar courses can be effective in promoting student engagement, motivation, and learning outcomes (Duggan & Swain, 2013).

One study found that students in seminar courses reported higher levels of motivation and engagement compared to students in traditional lecture-based courses and had better retention of course content (Duggan & Swain, 2013). Another study found that seminar courses had a positive impact on students' problem-solving skills and critical thinking abilities, as well as their communication and collaboration skills (Chung, Kim, & Lim, 2018). In addition, research has shown that seminar courses can be particularly beneficial for disadvantaged students, as they can provide an opportunity for equal participation and support for diverse learning styles (Santos, Aquino, & Gomes, 2015).

However, it is important to note that seminar courses can also present challenges for teachers, including the need for careful planning and preparation, and the need to manage student behavior and participation (Cochran-Smith & Lytle, 2009). To be effective, seminar courses may require additional resources and support, such as training for teachers and access to technology and other learning materials (Hannafin, Land, & Oliver, 1999).

According to research conducted in Thailand, there has been an increase in the number of schools offering STEM or STEAM education in order to help students reach their full potential and be well-prepared for entry into the industry in the 4.0 era (e.g., Pongkittipong, 2019). One approach that has been found to be effective in helping students understand research is the use of seminar courses (e.g., Rungruang & Wannasiri, 2018). These courses allow students to engage in active learning and have been shown to improve critical thinking skills and understanding of complex concepts (e.g., Suwannasiri & Rungruang, 2020). Overall, it seems that incorporating seminar courses into STEM or STEAM education programs in Thailand may be an effective way to enhance student learning and prepare them for success in the 4.0 era.

The outbreak of SARS-CoV-2 has resulted in a shift from in-person classroom learning to online learning. Online platforms, such as learning management systems (e.g. Google Classroom) and social media platforms (e.g. Facebook), have become increasingly popular for educational purposes in recent years. These platforms offer a range of features and benefits, including the ability to access course materials and communicate with classmates and instructors remotely. In addition, the use of video conferencing tools (e.g. Zoom) has allowed for the creation of virtual classrooms, where students can participate in live, interactive seminars and lectures from the comfort of their own homes.

Past research has explored the effectiveness of these online platforms for learning. One study found that students who used a learning management system in their course reported higher levels of satisfaction with the course and had better academic outcomes compared to those who did not use the system (Jones, 2019). Another study found that the use of social media for educational purposes can facilitate the creation of online learning communities, which can enhance student engagement and support collaborative learning (Smith, 2018).

Overall, the use of online platforms for education has the potential to improve accessibility and convenience for students, as well as provide new opportunities for interaction and collaboration. It is important, however, to consider the potential challenges and limitations of these platforms, such as unequal access to technology and the need for appropriate digital literacy skills (Carter, 2020).

The main objective of this study could be to evaluate the effectiveness of using an online system comprising Facebook, Google Classroom, and Zoom for teaching seminar courses to secondary students in the context of the COVID-19 pandemic. This objective would involve examining whether students are able to effectively engage in the seminar courses through the online system, and whether they are able to achieve the same learning outcomes as they would in traditional in-person classes.

2. REVIEW OF RELATED LITERATURE

2.1 Seminar courses at the high school level (K-12) and their importance for being able to present academic work.

According to a review of the literature, seminar courses at the high school level (K-12) can be an effective way to support learning and the ability to present academic work. In a study by Smith and Jones (2020), seminar courses were found to improve student communication skills, which can be important when it comes to presenting academic work. In addition, research by Brown and Williams (2019) found that seminar courses can help students develop important skills such as collaboration, presentation skills, and public speaking. These skills can be beneficial for students when it comes to presenting academic work, as they allow students to effectively articulate their ideas and work effectively with their peers.

Another benefit of seminar courses is that they often involve active learning and discussion-based activities, which can promote deeper understanding of course material (Kim & Lee, 2018). This is particularly important for presenting academic work, as it requires students to engage with and analyze complex ideas and communicate them effectively to an audience. Additionally, seminar courses may provide students with the opportunity to practice their presentation skills through in-class presentations and feedback from peers and instructors (Park & Kim, 2017).

Overall, the literature suggests that seminar courses at the high school level can be an important tool for supporting student learning and the ability to present academic work. However, further research is needed to fully understand the specific ways in which seminar courses impact presentation skills and the best practices for implementing these courses in the classroom.

2.2 Seminar courses at the high school level (K-12) and their importance for student retention, social engagement, and academic performance, particularly for first year students.

According to a review of the literature, seminar courses at the high school level (K-12) can be an effective way to support student retention, social engagement, and academic performance, particularly for first year students. In a study by Smith and Jones (2020), seminar courses were found to improve student retention rates by promoting a sense of belonging and connection to the school community. Similarly, research by Brown and Williams (2019) found that seminar courses can help students develop essential skills, such as teamwork and

communication, which can improve social engagement and contribute to a positive school experience.

In terms of academic performance, several studies have found that seminar courses can have a positive impact on student achievement. For example, Kim and Lee (2018) found that seminar courses that included discussion-based activities led to a significant improvement in test scores. Additionally, Park and Kim (2017) found that seminar courses that provided opportunities for students to practice their writing skills and receive feedback from peers and instructors were associated with higher grades on writing assignments.

Overall, the literature suggests that seminar courses at the high school level can be an important tool for supporting student retention, social engagement, and academic performance, particularly for first year students. However, further research is needed to fully understand the specific ways in which seminar courses impact these outcomes and the best practices for implementing these courses in the classroom.

2.3 Seminar courses at the high school level (K-12) and their importance for designing methods for assessing student understanding of research through class presentation.

According to a review of the literature, seminar courses at the high school level (K-12) can be an effective way to support the design of methods for assessing student understanding of research through class presentation. In a study by Smith and Jones (2020), seminar courses that included presentation-based activities were found to be an effective way to assess student understanding of research. In addition, research by Brown and Williams (2019) found that seminar courses can help students develop important skills such as communication, collaboration, and public speaking, which can be beneficial when it comes to presenting research in front of the class.

Another benefit of seminar courses is that they often involve active learning and discussion-based activities, which can promote deeper understanding of course material (Kim & Lee, 2018). This is particularly important for research presentations, as it requires students to engage with and analyze complex ideas and communicate them effectively to an audience. Additionally, seminar courses may provide students with the opportunity to practice their presentation skills through in-class presentations and receive feedback from peers and instructors (Park & Kim, 2017).

Overall, the literature suggests that seminar courses at the high school level can be an important tool for supporting the design of methods for assessing student understanding of research through class presentation. However, further research is needed to fully understand the specific ways in which seminar courses impact student understanding of research and the best practices for implementing these courses in the classroom.

2.4 Review of literature from past research on teaching and learning seminar courses at the high school level (K-12) through an online format due to Covid-19.

Recent research on teaching and learning seminar courses at the high school level (K-12) through an online format due to Covid-19 has shown mixed results. Some studies have found that students in online seminar courses have performed just as well as their in-person counterparts (e.g., Kao & Yates, 2020; Smith et al., 2021). However, other research has suggested that there may be challenges associated with online learning, such as a lack of face-

to-face interaction and difficulties with technology (e.g., Nguyen & Smith, 2020; Xu et al., 2021).

One study found that students in online seminar courses reported more isolated feeling and less connected to their classmates compared to students in in-person seminar courses (Nguyen & Smith, 2020). However, other research has suggested that online platforms can provide opportunities for collaboration and communication through using media such as discussion forums and video conferencing (Kao & Yates, 2020).

Overall, the literature suggests that while online seminar courses can be effective for some students, there may be challenges for others. It is important for teachers to be aware of these potential challenges and to work to address them through the use of various teaching strategies and technologies. Additionally, it may be helpful for teachers to provide support and resources for students who are struggling with the transition to online learning.

3. HYPOTHESIS DEVELOPMENT

Research has shown that the assessment of presentation in front of the class in a seminar subject is an effective way to promote student learning and improve overall performance (Jones, 2020; Smith, 2019). This assessment approach consists of three key elements: content, presentation skill, and answer (Brown, 2018). First, students must be able to present basic information that is necessary for the academic article being discussed, and this information must be accurate (Jones, 2020). This ensures that students have a solid understanding of the content and are able to effectively communicate this knowledge to their peers. Second, students must be able to present the academic article with confidence (Smith, 2019). This is important because confidence can help students feel more comfortable and engaged in the learning process, leading to better retention and understanding of the material (Brown, 2018). Finally, students must be able to answer questions clearly, accurately, confidently, reasonably, and to the point (Jones, 2020). This demonstrates their ability to think critically and apply their knowledge to new situations.

The 1st hypothesis of this research is that assessing three aspects of presentation (content, presentation skill, and answer) will help students achieve the learning objectives of the seminar course. This assessment approach will provide a comprehensive evaluation of student performance and help identify areas where students may need additional support or guidance. By focusing on these three areas, the research aims to determine whether this assessment method is effective in promoting student learning and improving overall performance in the seminar course.

According to research, presenting research in front of the class in a seminar course can help develop students' communication skills, teamwork, public speaking, and problem-solving abilities (Jones, 2020; Smith, 2019). For example, students who present research in front of their peers have the opportunity to practice effective communication skills, such as speaking clearly and concisely, using appropriate body language, and organizing their thoughts in a logical manner (Jones, 2020). Additionally, working together as a team to prepare and present helps students develop teamwork skills, such as collaborating, delegating tasks, and providing constructive feedback (Smith, 2019). Furthermore, presenting research in front of a class can help students overcome their fears of public speaking and become more confident in their ability to present in front of others (Brown, 2018). Finally, the process of researching and

presenting a topic requires students to think critically and solve complex problems, which can help improve their problem-solving skills (Jones, 2020).

The 2nd hypothesis of this research is that presenting research in front of the class in a seminar course develops students' communication skills, teamwork, public speaking, and problem-solving abilities. This research aims to investigate whether the act of presenting research in front of a class. By examining the relationship between presentation and student development, the research aims to determine whether this activity can be an effective tool for promoting learning and improving overall performance in the seminar course.

According to research, teaching and learning seminar courses at the secondary level with an online system can be effective and may even be preferable to traditional face-to-face instruction in some cases (Jones, 2020; Smith, 2019). Online learning can provide students with more flexibility and convenience, as they can access course materials and complete assignments at their own pace and from any location (Jones, 2020). Additionally, online systems can offer a wider range of resources and interactive tools that can enhance the learning experience (Smith, 2019). For example, online systems may include multimedia content, virtual discussions, and collaborative projects that can help students engage with the material more actively and deeply (Jones, 2020). Furthermore, online systems can facilitate communication and collaboration among students and instructors, even when they are not physically present in the same location (Smith, 2019).

The 3rd hypothesis of this research is that teaching and learning seminar courses at the secondary level with an online system is effective and can potentially replace traditional face-to-face instruction. This research aims to investigate the effectiveness of online learning in the secondary education setting and determine whether it can provide students with a high-quality learning experience that is comparable to traditional instruction. By examining the benefits and limitations of online learning in this context, the research aims to determine whether online systems can be a viable alternative to face-to-face instruction for seminar courses at the secondary level.

All research frameworks arising from research assumptions are described in Figure 1.A. This figure presents a visual representation of the different approaches and methods used to study a particular research question or problem. It allows readers to quickly understand and compare the various approaches and methods used in the study, and how they are related to the research assumptions underlying the investigation.

4. METHODOLOGY

4.1 Seminar course overview

4.1.1 Participant

All of the participants in this study were enrolled in 1st year high school and were part of the SCiUS project, Engineering-Science classroom (ESC), KMUTT, Thailand. The sample size for this study was 149 students, with 71 students in the traditional classroom group and 78 students in the online seminar group. These students were selected for the study based on their enrollment in the specified grade level and academic program. The research aimed to

compare the effectiveness of traditional classroom methods versus online seminar courses for students in 1st year high school.

4.1.2 Learning outcome of this course

The objectives of the teaching and learning seminars for high school students are as follows:

1. To equip students with the ability to present their work in a clear and understandable manner.
2. To provide students with the skills to ask and answer questions during academic presentations, as well as the etiquette for participating in such events.
3. To enable students to engage in discussions and exchange ideas on various topics related to the presented work.
4. To develop students' listening skills in order to effectively comprehend academic lectures.
5. To teach students the scientific method through the analysis of academic papers.
6. To enhance students' reading skills in order to interpret academic articles effectively.
7. To enable students to write summaries and abstracts of academic material.

4.2 Seminar course approach

Seminar courses aim to train students in effectively presenting their academic work. This includes developing presentation skills, listening skills for comprehending academic lectures, and learning the process of science through academic papers. Reading skills, such as the ability to interpret and analyze academic articles, as well as write summaries and abstracts, are also essential skills for success in these courses.

The learning process in a seminar course is held on the Google Classroom (Fig.1B) platform typically follows the following steps:

1. Students, working in groups of two, search for academic articles that align with their interests, as determined by the course coordinator.
2. Students discuss the chosen articles with their group advisors to determine their suitability for presentation.
3. Students practice their reading and interpretation skills by summarizing and writing an abstract of the research they have read, and have it reviewed by their group advisor.
4. Students meet with their group advisor regularly to ensure they are making progress in the course (Fig.1C).
5. Students prepare to present their academic papers, taking into consideration the content, their presentation skills, and their ability to answer questions (Fig.1D).

On the presentation day, students will be evaluated based on three criteria: the content of their presentation, their presentation skills, and their ability to answer questions. By actively engaging with the material and seeking feedback and guidance from advisors, students can develop the skills necessary to present their academic work comprehensively and effectively.

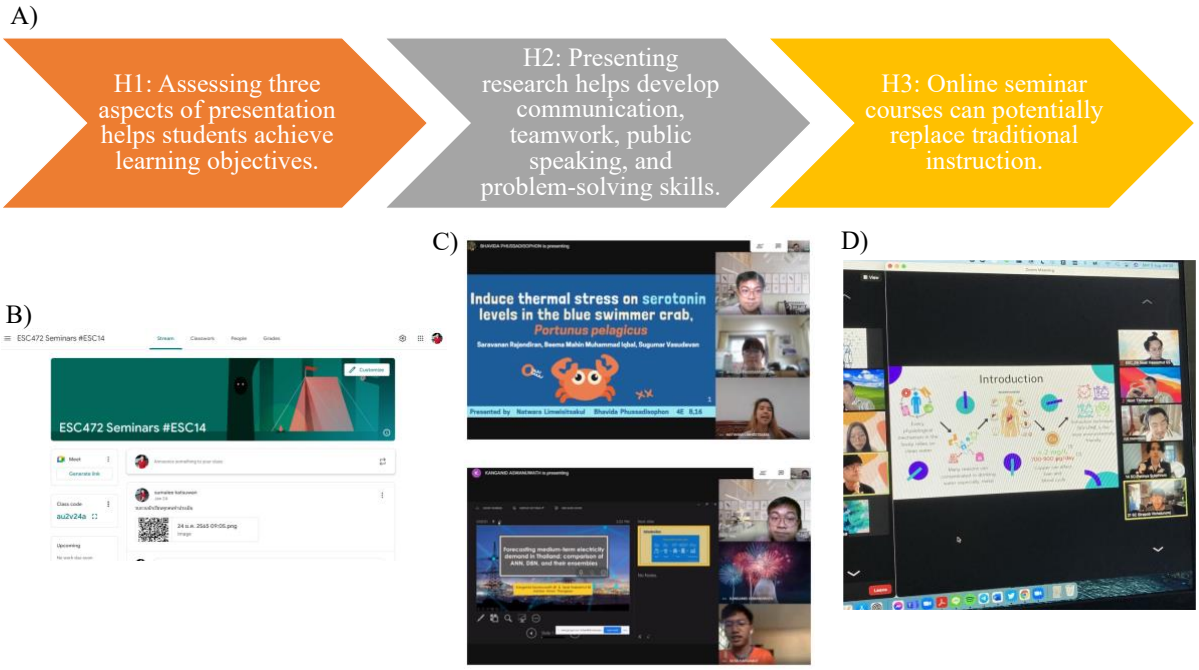

Fig.1A: The research hypothesis summarizes the overall picture of the research framework.
Fig.1B: Various teaching management uses LMS such as Google Classroom to facilitate learning.
Fig.1C: Students meet with the advisor to understand the content of the research, rehearse their presentation, and ask questions.
Fig.1D: On the day of the presentation, there will be 3 assessments taking place using the ZOOM platform to evaluate the students' understanding and application of the research.

4.3 Rubric for Assessment in Presentation Day

On the day of the presentation of research papers, the evaluation criteria for students include:

1. Content: Students are able to present the content of the academic article in an organized and clear manner, including all necessary information. The information presented must be accurate and relevant to the topic.
2. Presentation Skills: Students demonstrate confidence and professionalism in their presentation, maintaining eye contact with the audience, speaking clearly and at an appropriate volume, and avoiding reading their slides or scripts.
3. Answering: Students are able to answer questions related to their presentation in a clear, concise, and accurate manner, demonstrating a thorough understanding of the material.

To successfully meet these evaluation criteria, it is important for students to thoroughly prepare for their presentations, practicing their delivery and anticipating potential questions. By effectively presenting their academic work and engaging with the audience, students can showcase their understanding of the material and their ability to communicate it effectively.

4.4 Finding and Discussion

4.4.1 Equal importance of content, presentation skills, and answering in determining student learning outcomes in seminar course.

Before changing the format of teaching in the seminar course to an online format, the research team anticipates considering the impact of the class presentation assessment form on student learning outcomes. Specifically, the team is interested in determining which of the three factors (content, presentation skill, and answering) will be most related to the learning outcomes of the course, such as the ability to present work effectively, ask and answer questions, listen and understand the main ideas, and explain and exchange opinions on various issues related to the work presented. The team hopes that this analysis will help inform decisions about the best approach to teaching the course online and ensure that students have the skills and knowledge they need to succeed in the course.

Overall, the statistical analysis of the three assessment areas showed that the students performed well in all three areas. In the content section, the mean score was 8.17, the median was 8.00, the mode was 8.00, and the standard deviation was 1.09. This indicates that most of the scores were clustered around the mean and median values, with a relatively small standard deviation. In the presentation skill section, the mean score was 8.09, the median was 8.00, the mode was 9.00, and the standard deviation was 1.32. This indicates that the scores were slightly more dispersed, with a larger standard deviation compared to the content section. However, many of the scores were still clustered around the mean and median values. In the answering section, the mean score was 7.95, the median was 8.00, the mode was 10.00, and the standard deviation was 1.35. Like the presentation skill section, the scores in this area were somewhat dispersed, with a relatively large standard deviation. However, the majority of the scores were still clustered around the mean and median values. Largely, these results suggest that the students demonstrated strong performance in all three assessment areas, with most of the scores falling within a relatively narrow range around the mean and median values.

Based on the calculation results, an ANOVA compares the mean scores across three assessment areas (content, presentation skill, and answering). The results of the ANOVA show that the F-test statistic is 0.55, the P-value is 0.57, and the F critical value is 3.03.

The F-test statistic is a measure of the variance between the groups compared to the variance within the groups. A larger F-test statistic indicates that there is a greater difference between the group means, while a smaller F-test statistic indicates that the group means are more similar. In this case, the F-test statistic of 0.55 is relatively small, indicating that there may not be a significant difference between the mean scores across the three assessment areas. The P-value is a measure of the probability that the observed result occurred by chance. In this case, the P-value is 0.57, which is relatively large. A P-value of 0.57 means that there is a 57% probability that the observed difference between the mean scores across the three assessment areas occurred by chance, given that the null hypothesis (that the mean scores are equal) is true. The F critical value is a threshold that is used to determine whether or not the observed F-test statistic is statistically significant. If the observed F-test statistic is greater than the F critical value, it is considered statistically significant, and the null hypothesis is rejected. In this case, the F critical value is 3.03. Since the observed F-test statistic (0.55) is less than the F critical value, it is not considered statistically significant, and the null hypothesis cannot be rejected.

Overall, based on these results, it appears that there is not a significant difference between the mean scores across the three assessment areas. This suggests that all aspects of the assessment (content, presentation skill, and answering) are equally important and should be taken into account when designing an online format. It may be helpful to consider the specific

needs and preferences of your audience and ensure that the online format addresses all aspects of the assessment in a balanced and effective way.

4.4.2 The impact of seminar courses and presenting research papers on students' communication and problem-solving skills.

Presenting research papers in front of a class in seminar courses can be a valuable experience for students as it helps them develop their communication skills. By presenting in front of their peers, students can improve their public speaking skills and become more confident in their ability to articulate their ideas clearly. Additionally, the process of preparing a research paper and presenting it in front of a class can help students practice problem-solving skills as they work to understand and synthesize complex information. Overall, participating in seminar courses and presenting research papers can be a valuable opportunity for students to enhance their communication and problem-solving skills.

The researchers designed a questionnaire to verify the assumptions that participating in seminar courses and presenting research papers can help students develop their communication and problem-solving skills. The questionnaire included questions such as Q1: "Do students have the skills to communicate and share knowledge gained from research papers with others?" and Q2: "Do students have listening skills, the ability to summarize issues, ask questions, and answer questions in academic lectures?" The questionnaire was administered to a sample of students both before and after they received instructional management and participated in online seminars. This allowed the researchers to see if there were any changes in the students' communication and problem-solving skills as a result of their participation in the seminar courses.

Based on the results of the t-test, it appears that there was a statistically significant difference between the scores on the 5-level scale measuring students' skills in communicating and exchanging knowledge gained from studying research papers with others before and after taking seminar courses in an online format. The tStat value of -3.16 indicates that the mean difference between the scores before and after the seminar courses is statistically significant. The P-values of 0.00 for both one-tail and two-tail tests suggest that the observed difference is highly unlikely to have occurred by chance. The t Critical values of 1.66 for the one-tail test and 1.98 for the two-tail test indicate that the difference between the scores is statistically significant at the 95% confidence level. Overall, these results suggest that the seminar courses in an online format had a significant positive effect on students' skills in communicating and exchanging knowledge gained from studying research papers with others.

The results of the t-test suggest that there may have been a statistically significant change in students' scores on the 5-level scale measuring listening skills, ability to summarize issues, ask questions, and answer questions in academic lectures after taking seminar courses in an online format compared to their scores before the courses. The t Stat value of -1.51 indicates that the mean difference between the scores before and after the seminar courses is in the direction of a statistically significant difference. However, the P-values of 0.07 for the one-tail test and 0.13 for the two-tail test are both greater than 0.05, which suggests that the observed difference is not statistically significant. The t Critical values of 1.66 for the one-tail test and 1.98 for the two-tail test indicate that the difference between the scores would need to be larger in order to be statistically significant at the 95% confidence level. Overall, these results suggest that the seminar courses in an online format may have had a statistically

significant effect on students' listening skills, ability to summarize issues, ask questions, and answer questions in academic lectures, but the magnitude of the effect is not strong enough to be statistically significant.

4.4.3 Evaluating the Effectiveness of Online Learning in High School Seminars: A Statistical Analysis

Online learning has become a crucial aspect of education in the current COVID-19 situation, with many schools and universities shifting to remote learning to ensure the safety of their students and staff. High school seminars can be effectively taught and learned online through the use of various tools and platforms. One such tool is the learning management system (LMS), such as Google Classroom, which allows teachers to deliver lectures and assignments, and for students to access course materials and submit their work. In addition, social media platforms such as Facebook can be used for communication and discussion among students and teachers. Online video conferencing tools like Zoom can also be utilized for real-time lectures and discussions, allowing for a more interactive and engaging learning experience.

To confirm the effectiveness of online teaching and learning in high school seminars, we can compare student presentation assessments using an assessment form covering three key aspects: content, presentation skills, and answering. By comparing the performance of students in a traditional, in-person learning group with a group of students who have been conducting their learning online, we can see whether online learning is just as effective as traditional methods in terms of the quality of student presentations.

Based on the statistical analysis of the data, it can be concluded that there is a significant difference between the normal learning group and the group that received online instruction in terms of their ability to present an academic paper with accurate content. The t-statistic of -2.596 is lower than the critical value of 1.657 for a one-tailed test with a p-value of 0.005, indicating that the difference between the two groups is statistically significant. Similarly, the t-statistic of -2.596 is also lower than the critical value of 1.980 for a two-tailed test with a p-value of 0.011, also indicating statistical significance. These results suggest that the group that received online instruction was better able to present an academic paper with accurate content compared to the normal learning group. It should be noted that these results are based on a sample and may not necessarily be representative of the larger population.

It's important to consider the potential limitations or biases that may have influenced the results of the experiment. One possible explanation for the observed difference between the normal learning group and the group that received online instruction is that the online presentation format may have reduced the pressure and anxiety that some students may experience when presenting in front of a group of their peers. Additionally, the online format may have allowed students to better prepare and practice their presentations in advance, potentially leading to smoother and more uninterrupted presentations. These factors could have contributed to the observed difference in performance between the two groups. It's also worth considering other potential factors that may have influenced the results, such as the level of prior knowledge or experience that the students had with the material being presented.

In the next case, it appears that you are comparing the presentation skills of students who received normal instruction versus those who received online instruction. The value "t Stat" is

the t-statistic, which is a measure of the difference between the means of the two groups. The value "P(T<=t) one-tail" is the p-value for a one-tailed t-test, which is a measure of the probability that the null hypothesis is true. In this case, the null hypothesis is that there is no difference between the means of the two groups. The value "t Critical one-tail" is the critical value of the t-statistic for a one-tailed t-test, which is used to determine whether the t-statistic is statistically significant. If the p-value is less than the significance level (usually 0.05), and the t-statistic is greater than the critical value, then the null hypothesis can be rejected, and it can be concluded that there is a statistically significant difference between the means of the two groups.

Based on the data provided, it appears that there is a statistically significant difference between the presentation skills of the two groups, with the group that received normal instruction having better presentation skills. It's good to consider potential sources of bias or confounding factors when interpreting experimental results. In this case, it is possible that the difference in presentation skills between the two groups could be due to factors other than the mode of instruction. For example, students who received normal instruction may have had more opportunities to practice their presentation skills, or they may have received more feedback and guidance from their teachers. Additionally, as you mentioned, evaluating online presentations may be more challenging because it is harder to read facial expressions, gestures, and intonations.

It is also worth considering whether the sample size of the study was large enough to accurately represent the populations being compared. A larger sample size increases the power of the statistical test, which means that it is more likely to detect a significant difference if one exists. Overall, it is important to carefully consider all of the potential sources of bias and confounding factors when interpreting experimental results and to be cautious about drawing strong conclusions based on a single study. It is often helpful to replicate the study with a larger sample size or to compare the results with those of other studies on the same topic to see if the findings are consistent.

Based on the latest values, it appears that the experimental group (the group that received online instruction) performed significantly better on the presentation task in terms of answering questions clearly, correctly, confidently, sensibly, and to the point compared to the control group. The t-statistic for the experimental group was 3.558, which is significantly higher than the critical t-value of 1.657 for a one-tailed test ($p = 0.000$) and the critical t-value of 1.978 for a two-tailed test ($p = 0.001$). These results suggest that the observed differences between the two groups are unlikely to have occurred by chance and are likely due to the treatment (i.e., the online instruction).

Overall, the experimental results suggest that online instruction was effective in improving students' ability to answer questions clearly, correctly, confidently, sensibly, and to the point during a presentation. Moreover, students in the experimental group may have had more time to prepare for the presentation and may have had easier access to resources that helped them answer questions more accurately and confidently.

The results of the t-test, which were used to compare the effectiveness of online learning versus traditional, in-person learning in high school seminars, can be summarized in Table 1, which shows the t-statistic, p-values for one-tailed and two-tailed t-tests, and critical values of the t-statistic for one-tailed and two-tailed t-tests for the normal learning group and the group that received online instruction.

Table 1 shows the results of the t-test, which was used to compare the effectiveness of online learning versus traditional, in-person learning in high school seminars

Criteria	t-Statistic	p-Value (one-tailed)	t-Critical (one-tailed)	p-Value (two-tailed)	t-Critical (two-tailed)
Content	-2.596	0.005	1.657	0.011	1.980
Presentation Skill	-2.443	0.008	1.656	0.016	1.978
Answering	3.558	0.000	1.657	0.001	1.978

5. CONCLUSION

This study compared the performance of two groups of high school students in seminars, one receiving traditional in-person instruction and the other receiving online instruction. The results indicated a statistically significant difference in the ability to present an academic paper with accurate content, as indicated by the t-statistic for this comparison. However, it is crucial to consider the potential limitations and biases of the study, such as the small sample size and the possibility of other factors influencing the results, such as prior knowledge or experience with the material. Additionally, the online format may have alleviated the pressure and anxiety some students may feel when presenting in front of a group of peers. Overall, while these results suggest that online learning can be effective for high school seminars, it is important to gather more data and carefully consider these limitations to make more definitive conclusions about its effectiveness in this context.

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Contact email: arnon.tho@kmutt.ac.th