Interactive Videoconferencing versus Online Text-Based Module: Which Is Better to Use in a Physics Classroom?

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***Abstract*—This study compares the effectiveness of interactive videoconferencing and online text-based modular learning in improving students' performance in Kinematics and Dynamics lessons in the Philippine education context. Moreover, it explores the students' level of perceptions toward the two modalities. This study used a quantitative experimental crossover method with posttest only. The researchers collected relevant data from 82 Grade-12 students by using a posttest and Likert-scale questionnaire. The results revealed that the students exhibit very satisfactory and satisfactory performances in the interactive videoconferencing and online text-based module, respectively. Furthermore, the students are more likely to use interactive videoconferencing than the online-text-based module as revealed by the test of difference results. As indicated, interactive videoconferencing offers more learning benefits to students. However, this study recommends exploring further benefits, challenges, and other vital factors of these two methods in a virtual classroom. Filipino educators must also consider the blended learning approach.**

***Index Terms*—Online learning, synchronous and asynchronous learning, self-directed learning, mechanics lesson.**

I. Introduction

In the year of unprecedented challenges because of the Covid-19 pandemic, educational systems worldwide are transforming and adapting to new and challenging situations that test conventional learning processes. To contain the spread of the virus, governments have banned most face-to-face teaching and learning activities [1] and opted for schools to use alternative modes [2]. In the Philippines, most schools have shifted to online learning to allow students to learn at their convenience [3]. Various public and private schools are experiencing challenges in adapting to the appropriate mode of delivering the curriculum to their students [4].

In the face of these technological limits and internet access barriers, the modified educational setup has demanded and challenged educators to select the distance learning mode most suited to realize learning competencies. The many types of these learning modes include synchronous (the same-time learning), asynchronous (timed and self-paced), hybrid (combines synchronous and asynchronous), and electronic (computer-based) learning [5], which are receiving positive responses from the students [6]. Identifying which learning mode is more effective in delivering the curriculum has been the effort of many curriculum implementers and developers.

According to the literature, an asynchronous learning environment provides a series of benefits relative to either face-to-face or synchronous computer-mediated communication. These benefits include the self-paced nature of participation, thereby facilitating the availability and review of information and communication openness [7].

The advantages of asynchronous computer-based learning modules include working at one's own pace, monitoring one's understanding of the content, and reviewing as needed [8]. Abutarbush *et al*. revealed that self-directed learners through modules performed significantly better on the test of knowledge than live instructed students and showed perceived benefits to the computer-based module [8]. Self-directed learning is based on the idea that all humans can and should be responsible for their cognitive development [9]. Petro continued that many resources can be made available to the students (online) in this learning mode provided that they know how to use them and know where to locate them. Students are further taking the initiative on learning and receiving minimum guidance from their teachers [10]. It promotes the natural development of self-management, self-efficacy, and self-esteem that can lead to the growth of skills for life-long learning [11]. Bączek *et al*. and Tümen reported that online learning through modules allows students to easily access educational materials and to choose the time and place to study [12], [13].

Meanwhile, [14] discloses that students like live videoconferencing as the curriculum delivery mode because it increases their understanding. Live instructions include delivering the curriculum through interactive video conferencing where both the teacher and students are present and carry out essential tasks together [15]. This form of modality had improved students' learning interests, thereby resulting in increased knowledge and education [16]. The students perceive the opportunities that synchronous distance education can provide [17]. The students predominantly have positive attitudes toward video conferencing [18], and it exhibits higher than the attendance of the traditional lessons [19]. The study further reported that the students were more relaxed and felt like they were in real classrooms. Furthermore, [20] said that teaching through video conferencing had overall positive outcomes with student satisfaction. Students prefer synchronous interactive "online teaching formats" to asynchronous formats and rate them more efficiently [21].

Another research reports that students with synchronous interaction outperformed those with asynchronous interaction [22]. They added that participants' social presence correlated largely with cognitive presence and their

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teaching practice to some extent. Research suggesting that the present generation of Internet-based video conferencing tools can support oral and visual interaction supported this finding [23]. The medium facilitates the development of motivation, enthusiasm for the subject, and the potential for interactivity [24]. However, [13] his study disclosed that the pandemic online education process had weaknesses rather than advantages, such as lack of interaction and communication that made students feel isolated, problems with exams, traditional educational habits, assignment load, and time management.

Nonetheless, another study concluded that students might prefer a blended learning approach given the effectiveness and positive perceptions toward live instruction and online learning modules [25]. High school teachers of different learning areas will adopt one or two combinations of these learning modalities. Students can learn their lessons through live interactive videoconferencing (synchronous) and through self-directed, text-based learning modules (asynchronous), which are the two most popular forms of distance learning [5] already in practice.

Despite the several pieces of literature suggesting the learning benefits of these methods, few are conducted in the Philippines due to gaps and challenges posed by the poor living conditions of the learners [26]. On a lighter note, this pandemic has opened opportunities to explore the learning benefits of interactive videoconferencing and online text-based modules in the country. Hence, this study aimed to explore the effectiveness of the two methods in teaching and learning the topics of Kinematics and Dynamics in Grade 12 Physics course in the context of Philippine education. Moreover, this study determined the students' perceptions in using the said methods. The research questions addressed in this study were: 1.) In which method did the students perform better in Kinematics and Dynamics lessons? 2.) Do students have the same level of perceptions toward interactive videoconferencing and online text-based modules?

II. Methodology

This study examined the pedagogical effectiveness of interactive videoconferencing and online text-based modules in Grade 12 physics classrooms regarding students' performance and perceptions. This quantitative research used an experimental crossover design with posttest only. This design enables the researchers to eliminate between-respondents variation that may affect the study outcome. The 82 students were randomly assigned into two groups: Group A and Group B. Both groups were exposed to different learning methods for each topic discussed. For the Kinematics topic, the first group (Group A) was taught through interactive videoconferencing via Google Meet, while Group B was given an online text-based module. For the next topic (Dynamics), Group A was given an online text-based module while Group B was taught through interactive videoconferencing via Google Meet (Figure 1).

The researchers administered a 25-item posttest following each teaching intervention. However, the preexisting differences between students in classes may cause variability in the student's performance and perceptions. To mitigate the threat to validity, the researchers employed a 50-item pretest before the start of experimentation to ensure that the groupings were not statistically different and were comparable. Furthermore, to collect relevant data on student's perceptions, the researchers used a Likert-scale questionnaire where responses vary from "Strongly agree, SA" to "Strongly Disagree, SD" for each question. The questionnaire used was primarily derived and modified from the study of [27].

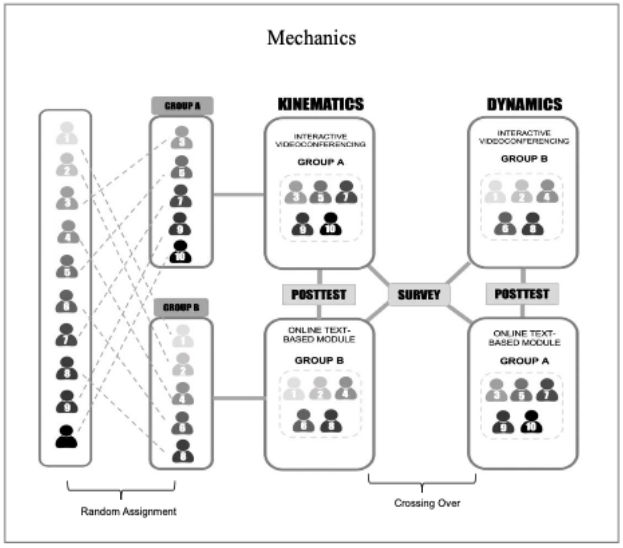

Fig. 1. Visual representation of the method.

All statistical treatments were carried out using the Statistical Package for Social Science. The researchers used the mean percentage score and standard deviation to describe the students' performance on each posttest. The descriptors used for student performance on the posttest were adopted from the Policy and Guidelines on Classroom Assessment for the K to 12 Basic Education Program issued by the Department of Education in the Philippines. The researchers used the mean score and standard deviation to describe the students' perceptions of the method used. An independent sample *t*-test was used to determine the difference between the posttest scores of students who participated in interactive videoconferencing and those who used an online text-based module. A paired sample *t*-test showed a significant difference between the students' perceptions in the interactive videoconferencing and online text-based module. The test for normality using the Kolmogorov- Smirnov test and homogeneity of variance using Levene's test was conducted before conducting the *t*-tests. It is necessary to conduct a test for normality to determine whether the sample data has been drawn from a normally distributed population [28]. The independent sample *t*-test and paired sample *t*-test give information on whether the difference between group means is significant, but they do not give information about the magnitude of the difference. The researchers included the effect size computation in determining the practical significance of the difference between groups. The American Psychological Association suggests on reporting the effect size measures whenever possible [29]. In this study, Cohen's d was used to determine the effect size of the independent variable.

III. Results

Group A participated in interactive videoconferencing for the Kinematics lesson, while Group B used the online text-based module. The participants took the posttest and completed survey questionnaires after the intervention. As seen in Table I, Group A students had a "very satisfactory" performance (M = 77.46%, SD = 14.75) compared to Group B students who had a "satisfactory" performance only (M = 72%, SD = 11.49). The mean percentage scores in the posttest were normally distributed, as assessed by Shapiro-Wilk's test (p >.05), and variances were homogeneous, as assessed by Levene's test for equality of variances (p = 0.121). When the significance was tested using an independent sample *t*-test at alpha level 0.05, the results revealed a statistically significant difference of 5.17% (SE = 2.85), t(80) = 2.817, p = 0.007. To measure the degree of the difference, the researchers calculated the effect size using Cohen's d (Cohen, 1988). The results show that the difference of 5.17% was of medium practical importance, d = 0.501. This implies that an increase of 5.17% in the students' test scores is a moderate improvement. Moreover, this also suggests that this measure of effect size is not trivial, large enough to observe from the two means, and is significant (Cohen, 1988). There are enough findings that the group taught via interactive videoconferencing (Group A) was more successful than the group that used online text-based modules (Group B).

TABLE I: Independent Sample T-Test in Kinematics

Group	M	SD	*t*-value	df	*p*-value	Cohen's d
Group A (I.V.)	77.46%	14.75	2.82	80	0.007	0.501
Group B (O.T.M.)	72.00%	11.49				

Scaling of Mean Percentage Score: 0.0–59.9 = Did not meet expectations. 60.0–67.9 = Fairly Satisfactory. 68.0–75.9 = Satisfactory. 76.0–83.9 = Very satisfactory. 84.0 –100 = Outstanding.
Scaling of Cohen's d: 0.2 = indicates small effect.; 0.5 = indicates a medium effect. 0.80 = indicates a large effect.

The researchers conducted another experiment with the same groups of students. However, a different topic was discussed, and the teaching methods used for each group were interchanged. Interchanging the intervention enabled the researchers to investigate the significance of interactive videoconference further and determine if the study would yield consistent results.

Group B students had interactive videoconferencing in the Dynamics lesson, while Group A used the online text-based module. Table II shows the descriptive measure of students' performance after the experiment. The results show that students (Group B) who participated in the interactive videoconferencing gained a "very satisfactory performance" (M = 82.54%, SD = 10.15). On the other hand, Group A students engaged in online text-based modules had a "satisfactory" performance only (M = 75.02%, SD = 13.14). The mean percentage scores in the posttest for both sets of data were normally distributed as assessed by Shapiro-Wilk's test (p >.05), and the variance was homogenous, as assessed by Levene's test for equality of variances (p = 0.158). Using independent sample *t*-test at alpha level 0.05, the results showed a statistically significant difference of 7.51% (SE = 2.85), t(80) = 2.897, p = 0.005. Using Cohen's d, the result shows that the difference of 7.51% between the mean percentage scores in both groups was of medium practical importance, d = 0.501. This implies that 7.51% of the increase in using the interactive videoconferencing has a moderate improvement but significant on the test score of the students in Dynamics when compared to online text-based module.

TABLE II: Independent Sample T-Test in Dynamics

Group	M	SD	*t*-value	df	*p*-value	Cohen's d
Group A (I.V.)	82.54%	10.15	2.89	80	0.005	0.609
Group B (O.T.M.)	72.02%	13.14				

Scaling of Mean Percentage Score: 0.0–59.9 = Did not meet expectations. 60.0–67.9 = Fairly Satisfactory. 68.0–75.9 = Satisfactory. 76.0–83.9 = Very satisfactory. 84.0 –100 = Outstanding.
Scaling of Cohen's d: 0.2 = indicates small effect.; 0.5 = indicates a medium effect. 0.80 = indicates a large effect.

TABLE III: Students' Perceptions toward Interactive Videoconferencing

Statements	M	SD
1. The teacher encourages me to be actively involved during discussion activities.	4.20	0.58
2. Synchronous videoconferencing is effective for student learning.	3.85	0.77
3. Technical problems with videoconferencing seldom interfere with my learning.	3.79	1.00
4. I would recommend learning through videoconferencing to my friends.	3.76	0.90
5. Synchronous videoconferencing meets my expectation.	3.70	0.87
6. I believe I received a quality education through live conferencing.	3.86	0.86
7. I rate interactive videoconferencing as effective in learning Kinematics/Dynamics.	3.63	0.88
8. The class allows me to proceed at an individualized pace or my own pace	3.63	0.79
9. Live contact with my classmates helps me get more out of discussion activities.	3.60	0.74
10. I can communicate with my classmates and teacher during discussion activities.	3.46	0.83
11. I feel comfortable engaging with my classmates and teacher in videoconference discussions.	3.43	0.96
12. I would like to attend future online classes taught in videoconferencing or live online instructions.	3.40	0.87
13. I sometimes feel isolated during the video conferencing discussion. (Reversed)	3.18	0.97
14. I do not feel pressured to complete tasks/exercises during live online discussions.	3.06	1.01
15. I feel comfortable engaging with my classmates and teacher in videoconferencing discussions than in traditional classes.	3.04	1.00

Scaling: 1.0–1.7 = Highly Negative. 1.8–2.5 = Negative. 2.6–3.3 = Neutral. 3.4–4.1 = Positive. 4.2–5.0 = Highly Positive.

A 15-item survey questionnaire was administered to measure students' level of perception on the interactive videoconferencing in Kinematics and Dynamics lessons. The scale had a high level of internal consistency, as determined by a Cronbach's alpha of 0.817. The value of Cronbach's alpha for this questionnaire indicated that the instrument used has high reliability since 0.70 is the minimum required level of acceptance for a questionnaire to be considered reliable. No question was invalidated due to the high reliability of the instrument. All of the students who participated in the study completed the survey questionnaire after each intervention.

Overall, the students perceived interactive videoconferencing as "positive" (M = 3.54, SD = 0.46). This implies that interactive videoconferencing has a high degree of learning benefits for lessons in Kinetics and Dynamics.

As seen in Table III, the students believed that encouragement from their teacher to be actively involved during the discussion activities as "highly positive" (M = 4.20, SD = 0.58). However, the students indicated "neutral" perception in statements "I feel comfortable in engaging with my classmates and teacher in video conferencing discussions than in traditional classes." (M = 3.04, SD = 1.00), "I sometimes feel isolated during the videoconferencing discussion. (Reversed)" (M = 3.18, SD = 0.97) and "I don't feel pressured in completing tasks/exercises during live online discussions." (M = 3.06, SD = 1.01). The students rated the other 11 statements "positive."

Another 15-item survey questionnaire was administered to students to measure the level of perception on using an online text-based module in the lessons in Kinematics and Dynamics. As determined by a Cronbach's alpha of 0.841, the scale had a high level of internal consistency. No question was invalidated due to the high reliability of the questionnaire, and it exceeded the standard minimum value of 0.70.

TABLE IV: STUDENTS' PERCEPTIONS TOWARD ONLINE TEXT-BASED MODULE

Statements	M	SD
1. When I encounter a difficult task, I look for answers using different resources.	4.09	0.75
2. The class allows me to proceed at an individualized pace or my own pace.	3.73	0.86
3. I feel that I am more responsible for my own learning.	3.71	0.88
4. I feel comfortable communicating with my teacher, learning partner, or classmate when I find the lesson difficult or do not understand a particular part of the lesson.	3.22	1.10
5. I feel that I am now an independent learner.	3.22	1.10
6. I feel comfortable learning at my own pace, and I take responsibility for my learning.	3.21	1.03
7. Self-directed module is effective for student learning.	2.95	0.93
8. Learning on my own helps me to be more focused and get more out of learning activities.	2.85	1.20
9. Learning through a self-directed module meets my expectation.	2.87	1.13
10. I would like to attend future classes delivered through a self-directed learning module.	2.87	1.14
11. Online text-based module is effective for student learning.	2.87	1.14
12. I do not feel pressured to complete tasks/exercises in the learning module.	2.82	1.20
13. I believe I received a quality education through the self-directed learning module.	2.80	1.07
14. I rate my overall learning experience in the self-directed module as effective in learning Kinematics/Dynamics.	2.73	1.01
15. I sometimes feel isolated during learning in the self-directed module.	2.83	0.95

Scaling: 1.0–1.7 = Highly Negative. 1.8–2.5 = Negative. 2.6–3.3 = Neutral. 3.4–4.1 = Positive. 4.2–5.0 = Highly Positive.

Overall, the students perceived the use of online text-based module as "neutral" (M = 3.08, SD = 0.59). This implies that the students perceived the online text-based module as neither beneficial nor non-beneficial to learning. However, the mean score perception of the students on an online text-based module is lower than the interactive videoconferencing. Moreover, out of 15 statements, 12 were rated neutral, while three were rated positively. Though most of the statements were rated neutral, students appreciate the online text-based module because it allows the students to proceed at an individualized pace (M = 3.73, SD = 0.86), students feel that they are more responsible for their learning (M = 3.71, SD = 0.88). When the students encounter a difficult task, they look for answers using different sources (M = 4.09, SD = 0.75) (Table IV).

Using alpha level 0.05, a paired sample *t*-test was used to determine whether there was a statistically significant mean difference between the students' perceptions in the interactive videoconferencing compared to an online text-based module. The assumptions of normality on both sets of data were not violated, as assessed by Shapiro-Wilk's test (p = 8.39 and p = 0.548). Participants perceived the interactive videoconferencing more positively (M = 3.54, SD = 0.46) as opposed to the online text-based module (M = 3.08, SD = 0.59), a statistically significant mean increase of 0.461, *SE* = 0.085, $t(81) = 6.352$, $p < 0.05$. This implies that both groups perceive interactive videoconferencing to be more helpful in learning the lessons in Kinematics and Dynamics as compared to the online text-based module. Cohen's d value of 0.6011 suggests that students perceived the engagement in the interactive videoconferencing has moderate practical effect when compared to the use of online text-based module. There are enough findings that the group who was taught in interactive videoconferencing perceived the method more positively as opposed to the group who used online text-based modules (Table V).

TABLE V: PAIRED SAMPLE T-TEST FOR STUDENTS' PERCEPTIONS

Group	M	SD	*t*-value	df	p-value	Cohen's d
Interactive Videoconferencing	3.54	0.46	5.44	81	0.000	0.601
Online Text-Based Module	3.08	0.59				

Scaling of Cohen's d: 0.2 = indicates small effect.; 0.5 = indicates a medium effect. 0.80 = indicates a large effect.

IV. DISCUSSION

On both topics, interactive video conferencing showed statistically significant higher results than online text-based modules. The result of the study is consistent with the studies conducted by [30] and [31]. The authors claimed that interactive video conferencing could be an alternative to face-to-face teaching since it simulates most of its learning environment. Most of the participants in this study are more familiar with the traditional way of learning than the self-paced learning offered in the online text-based modules. The results of this study could also be explained by the effective interaction in videoconferencing between students and teachers. Stewart *et al*. explained that distant learners who participated in the interactive videoconferencing were able to receive real-time attention and feedback from their teachers and peers [32]. Compared to the online text-based modular learning, students were not able to receive academic

support and immediate response from their teachers and peers to help them understand the concepts better. When concepts and processes are not clear, students who used text-based modules in Kinetics and Dynamics often rely on other resources for help.

The interactive features of the platform used for videoconferencing can be an advantage over the online text-based module. With the more advanced features of Google Meet in video conferencing, teachers could support constructivist learning, which has great potential for improving the learning process and learning outcomes [33]. Interactive video conferencing features with pedagogical relevance include whiteboard, screen sharing, file transfer, picture-in-picture, user-friendliness, integration of interactive activities, and ease of use [23]. These features have a significant impact on the academic performance of the students. Some features of Google Meet allow collaborative learning among students. Collaborative learning in interactive videoconferencing is beneficial for learners since it allows conceptual and socio-cognitive support measures that promote learning [31]. The study [34] stated that collaborative discussions among students during video conferencing promoted learners' knowledge construction. Students did not interact with their peers and teachers compared to online text-based modular learning. These interactions allowed students to access interactive videoconferencing to a dynamic, collaborative effort in the online classroom activities [32].

The result of the study is also consistent with the theory of Community of Inquiry. Wang and Wang stated that students with synchronous interaction outperformed students with asynchronous and no interactions [22]. Anderson highlights the importance of teaching presence [35]. In the case of the participants, the teachers were able to model effective problem-solving in Kinematics and Dynamics, provide immediate feedback, offer probing questions interjections through direct instructions, and facilitate classroom activities for knowledge construction. The students were able to develop higher cognitive presence from the effective social presence and direct instruction of the teachers in the interactive video conferencing as compared to the online text-based modular learning. Although online text-based modular learning offers learners autonomy and self-responsibility, the study agrees with [36], underscoring the importance of teaching presence in providing support for more effective instruction.

On the other hand, the result of the study disagrees with the study of [25], [37], and [38]. The authors claimed that students who participated in the video conferencing performed significantly lower than those who did not. The variation of the results of this study and the literature could be explained by a prevalent mode of videoconferencing that did not offer interactive features. The studies conducted were dominated by lecture-type videoconferencing with no interactive features present in today's existing online applications.

Moreover, the study's result is consistent with the study conducted by [20] claimed that students highly appreciate the teaching quality and session quality in videoconferencing sessions. The author also stated that students value the intellectually challenging sessions, dynamic facilitation of the teachers, and motivation for students to participate. Akarasriworn stated that students positively perceive the collaborative learning environment of synchronous video conferencing [34]. Britt *et al*. stated that students appreciate the sessions because they increased their understanding and effectiveness as learning tools [14]. Moreover, in this study, students perceived the comfort of engaging with classmates and teachers in video conferencing compared to traditional classes as "neutral." Some students are anxious in a learning environment that they have never experienced before [39]. On the other hand, Candalari *et al*. stated that students have positive perceptions because they feel relaxed since it simulates the real classroom experience [18]. Karal *et al*. reported that students' perception became positive after experiencing the videoconferencing sessions [17]. They further explained that teachers, environment, distance, course type, and duration are the factor that change the students' perceptions.

The result in Table IV agrees with the study of [12]. Their study claimed that the students often saw choosing the time and place to learn the lesson as the strongest advantage of online learning. However, self-paced learning could be a disadvantage during the pandemic. In the research conducted by [13], students during the COVID-19 pandemic mostly complained about not having enough opportunities to ask questions to their teachers. During the online text-based modular learning, students could not ask questions immediately and had to wait for a reply from their teachers through email. In addition, [40] suggested that the lack of collaborative activities provided during distance education leads students to feel isolated. The feeling of isolation during the pandemic could bring more anxiety to the students. This could explain why online text-based modular learning did not receive a higher rating from the students.

The result in Table V is expected since most of the participants are used to the traditional classroom environment. The students' significantly higher rating of interactive video conferencing may be attributable to its effectiveness in simulating a face-to-face classroom learning environment. The results are consistent with the studies of [21] and [41]. Their studies have reported that students prefer interactive synchronous formats to asynchronous formats and have rated them as more efficient. Morse reported that participants in asynchronous learning complained about their inability to meet with their peers and teachers [7]. Without interaction and collaborative activities, text-based modular learning is perceived to be less effective than interactive videoconferencing.

V. Conclusion and Recommendation

Students learned the lessons in Kinematics and Dynamics by participating in the interactive videoconference and using an online text-based learning module. Both learning modalities have been useful to students in some aspects. However, students perform significantly better by participating in the interactive videoconference than using the online text-based module. Moreover, the students recognized a higher degree of learning benefits from

interactive video conferencing than online text-based modules.

Filipino educators should note the learning benefits and challenges of interactive videoconferencing and online text-based modules in planning to integrate them into their classrooms. As reflected in the results, interactive videoconferencing is good, but it must not be the stand-alone learning modality used in online distance education. Blended learning, which utilizes both videoconferencing and learning modules to complement one another, is far better. Interactive videoconferencing positively affects learning and may be valued as the only means of interaction among teachers and students. However, the students also accept online learning modules as playing a useful role in supplementing virtual education. Thus, with the goals, expectations, and learning possibilities within the virtual environment, there is a need for educators and learners to take advantage of the learning opportunities offered by the blended learning model. Finally, as teachers use these teaching methods, research must continue to explore the overall effectiveness of these online learning modalities in education and investigate other vital factors that affect student learning in a virtual learning environment.

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

All authors have a fair share of contributions to this work.

References

[1] R. H. Huang, D. J. Liu, A. Tlili, J. F. Yang, and H. H. Wang, "Handbook on facilitating flexible learning during educational disruption: The Chinese experience in maintaining undisrupted learning in COVID-19 outbreak," Beijing: Smart Learning Institute of Beijing Normal University, Mar. 2020.

[2] G. P. Cuaton, "Philippines higher education institutions in the time of COVID-19 pandemic," *Revista Românească pentru Educație Multidimensională,* vol. 12, no. 1, Dec. 2020.

[3] C. M. Toquero, "Challenges and opportunities for higher education amid the COVID-19 pandemic: The Philippine context," *Pedagogical Research*, vol. 5, no. 4, Apr. 2020.

[4] J. Saavedra, "Educational challenges and opportunities of the coronavirus (COVID-19) pandemic," *World Bank Blogs*, 2020.

[5] X. Du, M. Zhang, B. E. Shelton, and J. L. Hung, "Learning anytime, anywhere: A spatio-temporal analysis for online learning," *Interactive Learning*, 2019.

[6] O. Ullah, W. Khan, and A. Khan, "Students' attitude towards online learning at tertiary level," *PUTAJ–Humanities and Social Sciences*, vol. *25*, no. 1-2, pp. 63-82, 2017.

[7] K. Morse, "Does one size fit all? Exploring asynchronous learning in a multicultural environment," *Journal of Asynchronous Learning Networks*, vol. 7, no. 1, pp. 37-55, 2003.

[8] S. M. Abutarbush, J. M. Naylor, G. Parchoma, M. D'Eon, L. Petrie, and T. Carruthers, "Evaluation of traditional instruction versus a self-learning computer module in teaching veterinary students how to pass a nasogastric tube in the hose," *Journal of Veterinary Medical Education*, vol. 33, no. 3, pp. 447-454, 2006.

[9] L. Petro, "How to put self-directed learning to work in your classroom," Access Mode: clck. ru/Dojdt, Jan 5, 2018.

[10] C. Halupa, "Reaching "creating" in bloom's taxonomy," 2017.

[11] G. S. Shokar, N. K. Shokar, C. M. Romero, and R. J. Bulik, "Self-directed learning: Looking at outcomes with medical students," *Family Medicine-Kansas City*, vol. 34, no. 3, pp. 197-200, Mar. 2002.

[12] M. Bączek, M. Zagańczyk-Bączek, M. Szpringer, A. Jaroszyński, and B. Wożakowska-Kapłon, "Students' perception of online learning during the COVID-19 pandemic: A survey study of Polish medical students," *Medicine*, vol. 100, no. 7, Feb. 2021.

[13] S. Tümen Akyildiz, "College students' views on the pandemic distance education: A focus group discussion," *International Journal of Technology in Education and Science*, vol. 4, no. 4, pp. 322-334, Aug. 2020.

[14] K. L. Britt, S. Hewish, J. Rodda, and B. Eldridge, "The use of videoconferencing to enhance interprofessional clinical education for allied health students," *Journal of Interprofessional Care*, vol. 26, no. 4, pp. 333-335, Jul. 2012.

[15] H. Al-Samarraie, "A scoping review of videoconferencing systems in higher education: Learning paradigms, opportunities, and challenges," *International Review of Research in Open and Distributed Learning*, vol. 20, no. 3, Aug. 2019.

[16] B. M. T. Pereira, T. R. A. Calderan, M. T. N. D. Silva, A. C. D.. Silva, A. C. Marttos Jr, and G. P. Fraga, "Experience at a university teaching hospital from using telemedicine to promote education through video conferencing," *Sao*, 2012.

[17] H. Karal, A. Cebi, and Y. E. Turgut, "Perceptions of students who take synchronous courses through video conferencing about distance education," *Turkish Online Journal of Educational Technology-TOJET*, vol. 10, no. 4, pp. 276-293, Oct. 2011.

[18] D. Candarli and H. G. Yuksel, "Students' perceptions of video-conferencing in the classrooms in higher education," *Procedia-Social and Behavioral Sciences*, vol. 47, pp. 357-361, Jan. 2012.

[19] G. Nurieva and L. Garaeva, "Zoom-based distance learning of English as a foreign language," *Research in Applied Linguistics*, vol. 11, pp. 439-528, Dec. 2020.

[20] T. H. Fatani, "Student satisfaction with videoconferencing teaching quality during the COVID-19 pandemic," *BMC Medical Education*, vol. 20, no. 1, pp. 1-8, Dec. 2020.

[21] L. Eigbrecht and U. D., "Students' perspectives and strategies on studying at home in times of Covid-19 learnings from podcast conversations and an online survey," in *Proc. EDEN Conference Proceedings*, no. 1, pp. 21-30, Oct. 2020.

[22] J. Wang and Y. Wang, "Compare synchronous and asynchronous online instruction for science teacher preparation," *Journal of Science Teacher Education*, pp. 1-21, Apr. 2020.

[23] Y. Wang, "Supporting synchronous distance language learning with desktop videoconferencing," *Language Learning & Technology*, vol. 8, no. 3, pp. 90-121, Sep. 2004.

[24] C. Harman and M. Dorman, "Enriching distance teaching and learning of undergraduate mathematics using videoconferencing and audiographics," *Distance Education*, vol. 19, no. 2, pp. 299-318, Jan. 1998.

[25] J. A. PharmD Phillips, "Replacing traditional live lectures with online learning modules: Effects on learning and student perceptions," *Currents in Pharmacy Teaching and Learning*, vol. 7, no. 6, pp. 738-744, Nov. 2015.

[26] H. B. Ancheta and H. Ancheta, "The new normal in education: A challenge to the private basic education institutions in the Philippines?" *Development*, vol. 1, no. 1, Oct. 2020.

[27] A. G. Black, "At a distance: A comparative study of distance delivery modalities for PhD nursing students," Capella University, 2010.

[28] H. W. Lilliefors, "On the Kolmogorov-Smirnov test for normality with mean and variance unknown," *Journal of the American statistical Association*, vol. 62, no. 318, pp. 399-402, Jun. 1967.

[29] J. Cohen, "The effect size," *Statistical Power Analysis for the Behavioral Sciences*, pp. 77-83, 1988.

[30] G. Nurieva and L. M Garaeva, "Zoom-based distance learning of English as a foreign language," *Research in Applied Linguistics*, vol. 11, pp. 439-448, Dec. 2020.

[31] B. Ertl, F. Fischer, and H. Mandl, "Conceptual and socio-cognitive support for collaborative learning in videoconferencing environments," *Computers & Education*, vol. 47, no. 3, pp. 298-315, Nov. 2006.

[32] A. R. Stewart, D. B. Harlow, and K. DeBacco, "Students' experience of synchronous learning in distributed environments," *Distance Education*, vol. 32, no. 3, pp. 357-381, Nov. 2011.

[33] A. P. Correia, C. Liu, and F. Xu, "Evaluating videoconferencing systems for the quality of the educational experience," *Distance Education*, vol. 41, no. 4, pp. 429-452, Oct. 2020.

[34] C. Akarasriworn and H. Y. Ku, "Graduate students' knowledge construction and attitudes toward online synchronous videoconferencing collaborative learning environments," *Quarterly Review of Distance Education*, vol. 14, no. 1, Mar. 2013.

[35] T. Anderson, "How communities of inquiry drive teaching and learning in the digital age," *North Contact*, pp. 1-16, Feb. 2017.

[36] M. Simonson, L. Visser, Y. L. Visser, and R. Amirault, "Trends and issues in distance education 2nd edition: international perspectives," IAP, Jul. 2012.
[37] R. S. Kidd and M. K. Stamatakis, "Comparison of students' performance in and satisfaction with a clinical pharmacokinetics course delivered live and by interactive videoconferencing," *American Journal of Pharmaceutical Education*, vol. 70, no. 1, Feb. 2006.
[38] M. D. Roblyer, J. Freeman, M. B. Donaldson, and M. Maddox, "A comparison of outcomes of virtual school courses offered in synchronous and asynchronous formats," *The Internet and Higher Education*, vol. 10, no. 4, pp. 261-268, Jan. 2007.
[39] P. Fitzgibbon, "Challenges of video-conferencing teaching and effective teaching methods," *Turkish Online Journal of Educational Technology-TOJET*, vol. 2, no. 3, pp. 30-34, Jul. 2003.
[40] M. S. Cohen, R. D. Manning, and R. L. DeMichiell, "Distance learning: Step by step," *Journal of Information Technology Education: Research*, vol. 2, no. 1, pp. 115-130, 2003.
[41] A. A. Skylar, "A comparison of asynchronous online text-based lectures and synchronous interactive web conferencing lectures," *Issues in Teacher Education*, vol. 18, no. 2, pp. 69-84, 2009.

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