Student Satisfaction with Online learning during COVID-19

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Abstract

COVID-19 has negatively impacted teaching and learning processes in higher education in Thailand. Online learning has become the primary method of teaching in universities. Therefore, it is interesting to understand how well online classes are practical for students in increasing knowledge and social competence. The main purpose of this paper is to explore student satisfaction with online learning during COVID-19. The data are collected from 146 university students in Thailand. Chi-square test, multiple response analysis, and Wilcoxon signed-rank test are employed as tools for this study. The results show that face-to-face and online classes do not differ in increasing knowledge. However, there is a statistical difference between face-to-face and online learning in increasing social competence. Regrading activity during the classes, students feel less active during online classes but more active during face-to-face classes. Furthermore, the students between 18-25 years old more often choose a lack of interaction with classmates and poor learning conditions at home. Most students prefer recording a meeting, being comfortable with their surroundings, easily accessing online materials, and being happy when they can study independently at home as online learning advantages. However, most students choose a lack of interactions with classmates and with teachers are reduced as the main disadvantage. Finally, most students are satisfied with online learning. To promote learning satisfaction and student social competence, blended learning, which integrates face-to-face and online learning, is one of the good solutions to improve the disadvantages of online learning and still keep the concept of social distancing to prevent COVID-19 infection.

Keywords: student satisfaction; online learning; face-to-face class; knowledge; social competence

1. Introduction

Burgess & Sievertsen (2020) reported that COVID-19 pandemic has affected a health crisis in countries around the world, leading to the interruption of the traditional education system. Online homeschooling has become the main method to transit the knowledge to students. However, this teaching method affects students' social life and learning. Thailand also has faced the same situation as the COVID-19 pandemic has negatively impacted universities in Thailand and needs to be changed from traditional face-to-face classes to online classes in the middle of 2020 (Mala, 2020). Suddenly changing from traditional face-to-face classes to online classes with little experience is challenging for university instructors and students (Kornpitack & Sawmong, 2022). Online teaching with untested and unprecedented has become the main source of student learning, and student assessments are changed toward online learning with many tasks, errors, and uncertainty for everyone (Burgess & Sievertsen, 2020). Therefore, student satisfaction with online classes has been overlooked (Imsa-ard, 2021) because student satisfaction is an important indicator of academic quality that determines the quality of a learning program (Al-Rahmi et al.,2020). Therefore, student satisfaction is essential for online learning (Kornpitack & Sawmong, 2022). Based on the technology use model, students expect that online learning will help them improve their academic performance; furthermore, students' level of satisfaction will increase if what they learn is what they expect (Jongkolthanalarp et al., 2021). The variables that can influence the degree of performance expectation are intrinsic motivation, extrinsic motivation, and perceived ease of use (Jongkolthanalarp et al., 2021). Interactivity between teachers and students, and peers is essential for online learning. Moreover, a lack of interaction with classmates is identified as a barrier to online learning satisfaction (Bisht et al.,2020). Gautam (2021) also indicated that online learning has advantages such as flexibility of time and place, efficiency, reduced expenses, improved student attendance, and students can design their suitable learning styles. On the other hand, disadvantages of online learning are less concentration during the classes, technology issues, less interaction during classes, teacher training, and physical problems after using a computer for a long time. However, instructors need to improve the disadvantages of online learning to increase student satisfaction with online learning.

This study aimed to assess student satisfaction with online learning during the COVID-19 pandemic. Wilcoxon signed-rank test, multiple response analysis, and chi-squared test were applied as a tool for this study. Thai universities were selected because of the health problem and a government policy that affect the education system. The paper is presented as follows: Section 2 describes the theoretical background and hypotheses; Section 3 includes data collection and methodology; Section 4 provides the data analysis and results; Section 5 includes a discussion; Section 6 provides the conclusions and limitations. The findings benefit university instructors to improve teaching quality in higher education based on online teaching methods to enhance student learning quality.

2. Literature review

2.1 Online learning satisfaction

She et al. (2021) indicated that satisfaction with online learning presents feelings and attitudes of learners towards the process of learning and the success of learning based on learners' desires caused by their learning experience. Therefore, learning satisfaction is the most important influence on students' continuing online learning. Further, learner satisfaction is essential for successful learning and achieving the implementation of online learning. However, eight barriers hinder students from satisfactory online learning: Management and technical problems, a lack of technical and academic skills, interactions, motivations, time and support for the study, and accessibility (Muilenburg & Berge, 2005). On the one hand, Baber (2020) indicated that student engagement and interactions in the classrooms, teachers' awareness and support, and course structure positively induce student satisfaction with online learning. Moreover, Jiang et al. (2021) indicated that perceived ease of use and usefulness of online platforms, the quality of online support service, self-efficacy of IT and academic skills, and online learning experiences affect student satisfaction with online learning. Simonds & Brock (2014) reported that students' age and online learning preference have a significant relationship. Students are likely to record the lectures for viewing later. Additionally, students in the older age group are likely to enjoy watching pre-recorded video lectures, and they think it is very helpful for their studies. Chyung (2007) reported that older age students (ages 40-57) tend to enjoy online classes more than younger age students (ages 22-39). Regarding the academic performance of students who performs online classes (ages18-26), when the age of students increases, the final test scores also increase (Koh & Lim, 2012). On the other hand, the level of social interaction during the online classes, as the age of students decreases, the students prefer tools that allow them to have more online communication increase. Young age students score better on the assignment when they can chat online, post pictures, and share opinions. Furthermore, young students require social interactions during their classes (Simonds & Brock, 2014). However, online learning is difficult to supervise students to improve their professional and social skills (Mukhtar et al.,2020). Gautam (2021) indicated that the advantages of online learning include: First, online learning provides many effective tools to support instructors in delivering the lessons to students (efficiency); Second, online learning allows students to attend classes anywhere, and in addition, students can record lectures and lessons during their classes, and they can access learning material anytime when they feel comfortable (accessibility of time and place); Third, online learning can reduce financial costs such as transportation, food, accommodation, and paperless learning with benefit for an environment(affordability); Fourth, students who take online classes will study at home or location of choice that lower chance for students to miss out their lessons (improved student attendance); Fifth, Students can study based on their suitable styles since the system of online learning provides options and resources that students can choose such as learning through visual or audio learning to establish a perfect environment for each student (suits variety styles). On the other hand, Gautam (2021)

demonstrated that the disadvantages of online learning comprise: First, students cannot concentrate on their lessons for a long period when instructors are lecturing during online classes because they may be distracted by social media or else(Inability to focus on screens); Second, technological problems can disconnect students from lessons and lectures during the classes (technology issues); Third, the physical interaction between teachers and students and classmates can be interrupted or decreased that may lead to students' sense of isolation (sense of isolation); Fourth, teachers need to be trained online programs before beginning of their classes(teaching training); Fifth, students spend more hours to use computer leading to health problems (manage screen time). However, instructors or teachers require the solution to solve online learning disadvantages to promote student satisfaction with online learning satisfaction as the main disadvantages are human interaction and relationships. Also, online learning cannot deal with the problem of students' less discipline and practice. Concerning improving online learning satisfaction, hypotheses 1 and 2 are formed.

Hypothesis 1: There is a significant association between age and a lack of interactions with classmates (online learning disadvantage).

Hypothesis 2: There is a significant association between age and poor learning conditions at home (online learning disadvantage).

2.2 Online classes and traditional face-to-face classes

Macon (2010) reported a systematic difference between online and traditional face-to-face classes that affect student satisfaction. Traditional face-to-face learning is known to be passive learning in which teachers have a role to be centered on delivering knowledge, while online learning is active learning that requires students to be centered. Paul & Jefferson (2019) noted that nowadays, students feel comfortable with online classes because they think traditional face-to-face classes are restrictive, inflexible, and impractical. Online learning offers time and places flexibility that enables students to study without interruption in unexpected situations. The quality of interactions between teachers and students and between peers is crucial for student satisfaction. These interactions are more required in online classes; therefore, being comfortable with online tools for both teachers and students affects success and failure in online classes (Song et al.2004). Moreover, student preference between online classes and face-to-face classes depends on the subject matter or type of university (Macon,2010). In the era of technological advancement, universities can offer effective online classes through Web-based education or Web-based learning. However, teachers must design online classes well before starting to ensure that learners feel comfortable with online learning environments (Paul & Jefferson, 2019). Moreover, communication during online classes is another important factor influencing student satisfaction because it can improve the atmosphere in the classes and reduce any possible tensions. In addition, online classes benefit students who cannot attend the classes because of their work or unexpected situations such as COVID-19. While the benefits of traditional face-to-face classes are that teachers can directly respond and have a more flexible content delivery, online classes must limit questions and give teachers and peers more time to

respond to their questions. Therefore, some students prefer traditional classroom learning because of well-established classroom learning and view online learning as negatively. These students may have technical problems when studying online classes and feel more comfortable studying in traditional face-to-face classes. Further, students may value traditional classroom learning interactions and pre-post-class discussions. Concerning the above mentioned, hypotheses 3, 4, and 5 are formed to compare face-to-face and online classes.

Hypothesis 3: There is a significant difference between face-to-face and online classes in increasing social competence.

Hypothesis 4: There is a significant difference between face-to-face and online classes in increasing knowledge.

Hypothesis 5: There is a significant difference between activity during traditional face-to-face classes and online classes.

3. Methodology

This research employed multiple response analysis, chi-square test, and Wilcoxon signed-rank test to explore the advantages and disadvantages of online learning and level of satisfaction. The following steps were taken: Multiple response analysis was used to analyze the advantages and disadvantages of online learning. Second, the chi-square test was used to compare the associations between students' age and disadvantages of online learning and the associations between gender and advantages of online learning. Third, the Wilcoxon signed-rank test was adopted to compare traditional face-to-face and online class opinions. Fourth, the frequency was used to compare students' satisfaction and dissatisfaction with online learning. Furthermore, the questionnaire was developed by Bączek et al. (2021) with slight modifications to fit the current research context.

3.1 Data Collection

The respondents of this study were students who were studying online classes in Thai universities. We collected data in Thailand over two months, from March 1 to April 30, 2022. The data were collected from 180 Thai students through a convenience sampling approach. A total of 180 questionnaires were distributed to respondents through online tools. Further, 160 questionnaires (91.25%) were returned. According to incomplete questionnaires, we were able to use 146 questionnaires (81%). The respondent demographics are summarized in Table1. Among the 146 students, 55 (37.7%) were males, and 91 (62.3%) were females. The age of students was separated into three groups that were 18-25 years (100, 68.5%), 26-35 years (25,17.1%), and 36-55 years (21,14.4%). 63 (43.2%) students participated in online learning before COVID-19, whereas 83 (56.8%) students did not have any experience with online

learning. A total of 23 (15.8%) respondents described their technological skills (IT) as good, 114 (78.1%) respondents were described as moderate, and 9 (6.2%) as poor.

Table1: Respondent demographics

Demographics	Frequency	Percentage
Gender		
Male	55	37.7
Female	91	62.3
Age (year)		
18-25	100	68.5
26-35	25	17.1
36-55	21	14.4
It skills		
Low	9	6.2
Moderate	114	78.1
High	23	15.8
Experience online classes before COVID-19		
Yes	63	43.2
No	83	56.8
total	146	100

4. Results

4.1. Multiple response analysis

Table 2 presents the advantages and disadvantages of online classes. The results showed that the most frequently selected for online learning advantages were: First, they could record a meeting (59.6%). Second, they were comfortable with their surroundings (59.6%). Third, they could easily access online materials (57.5%). Fourth, they were happy when they could study at home (52.7%). Finally, they could study on their own (52.1%). Most students selected a lack of interaction with classmates (68.5%), and the interactions with teachers were reduced (65.8%) as the main disadvantage. According to the above results, it can be implied that online classes benefit students in terms of learning on their own with no limited time and places. An

online program provides efficient equipment for students to help them access and use the program easier. However, a lack of interactions with teachers and classmates may negatively affect online classes when students need help and require social interactions among members in classes.

Table2: descriptive statistic

variables	Frequency	Percentage	Percentages of cases
Advantages			
You can easily access online learning.	84	18.8	57.5
You can learn your lesson by yourselves.	76	17	52.1
You are happy when you can study at home.	77	17.3	52.7
There is class interactivity.	35	7.8	24
You can record a meeting.	87	19.5	59.6
You are comfortable with your surroundings.	87	19.5	59.6
Total	446	100	305.5
Disadvantages			
The interactions with teachers are reduced.	96	24.3	65.8
You have experienced technical problems.	66	16.7	45.2
You have problems with a lack of interactions with classmates.	100	25.3	68.5
There are poor learning conditions at home.	45	11.4	30.8
You have problems with a lack of self-discipline.	47	11.9	32.2
You feel social isolation.	41	10.4	28.1
Total	395	100	270.5

4.2 Chi-square test

Chi-square statistics were employed to examine the association between age and a lack of interactions with classmates and between age and poor learning conditions at home. As shown in Table 3, the students between 18 - 25 years old more often chose a lack of interactions with

classmates and poor learning conditions at home. Further, there was a significant association between age and a lack of interactions with classmates ($\chi 2 = 11.255$, $p < 0.05$) and between age and poor learning conditions at home($\chi 2 = 9.984$, $p < 0.05$). Moreover, age had a moderate effect on a lack of interactions with classmates (value = 0.278, $p < 0.05$) and poor learning conditions at home ($r = 0.261$, $p < 0.05$). Hence, hypotheses 1 and 2 were fully supported.

Table3: disadvantages

		A lack of interactions with classmates						
		no	yes	Total	χ2	sig	Effect size (r) (Phi and Cramer's V)	
							value	Approximately sig
Age	**18-25**	40	60	100	11.255	0.004	0.278	0.004
	26-35	2	23	25			0.278	0.004
	36-55	4	17	21				
total		46	100	146				
		Poor learning conditions at home						
		no	yes	Total	χ2	sig	Effect size(r) (Phi and Cramer's V)	
							value	Approximately sig
Age	**18-25**	61	39	100	9.984	0.007	0.261	0.007
	26-35	22	3	25			0.261	0.007
	36-55	18	3	21				
total		101	45	146				

Note: $p < 0.05$ was statistically significant.

4.3 Wilcoxon signed-rank test

Wilcoxon signed-rank was employed to test if there was a difference between traditional face-to-face classes and online classes in terms of social competence, knowledge, and activity during classes. As shown in Table 4, there was a significant difference between face-to-face and online learning in terms of increasing social competence ($p < 0.05$). Therefore, hypothesis 3 was fully accepted. On the other hand, there was no significant difference between face-to-face and online learning regarding increasing knowledge ($p > 0.05$). Therefore, hypothesis 4 was rejected. Similarly, there was a significant difference between activity during face-to-face classes and online classes ($p < 0.05$). Hence, hypothesis 5 was fully accepted.

Table4: Comparing traditional face-to face classes and online classes

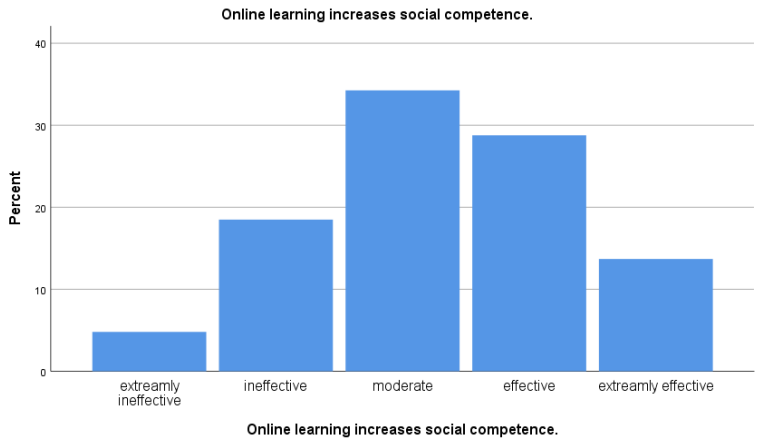
		N	Mean Rank	Sum of Rank	z	sig
Increasing social competences	**Negative Ranks**	28[a]	26.75	749	-3.433	0.001
	Positive Ranks	45[b]	43.38	1952		
	Tie	73[c]				
Increasing knowledge	**Negative Ranks**	23[a]	28.52	656	-1.817	.069
	Positive Ranks	36[b]	30.94	1114		
	Tie	87[c]				
your activity during classes	**Negative Ranks**	22[a]	28.39	624.50	-2.709	0.007
	Positive Ranks	41[b]	33.94	1391.50		
	Tie	83[c]				

Note: $p < 0.05$ was statistically significant.

a. Traditional face-to-face classes < Online classes

b. Traditional face-to-face classes > Online classes

c. Traditional face-to-face classes = Online classes



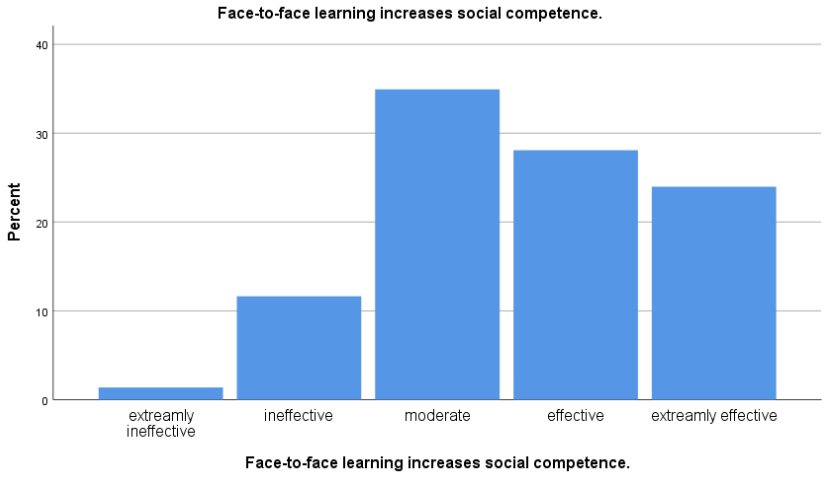
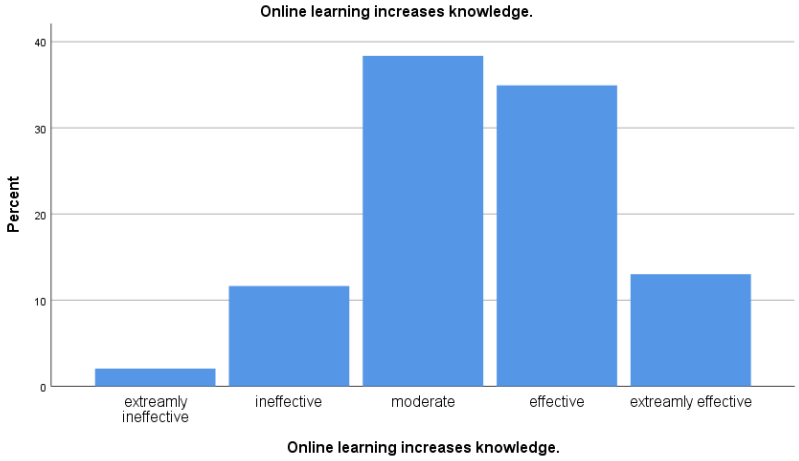


Figure 1. Comparing traditional face-to-face classes and online classes in terms of improving social competences

As shown in Figure1, most students rated face-to-face classes that they were more active than online classes in improving their social competence.



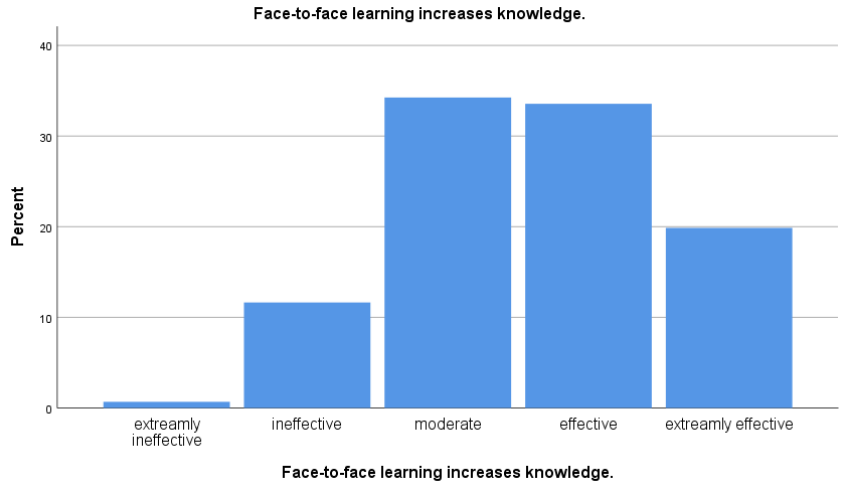
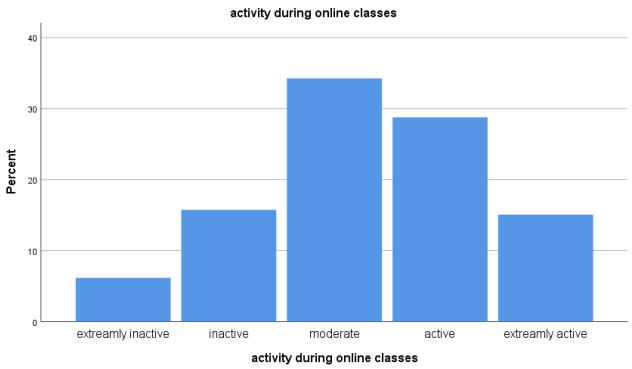


Figure 2. Comparing traditional face-to-face classes and online classes in terms of increasing knowledge

As shown in Figure2, students rated face-to-face classes and online classes that they did not have a difference with regard to increasing knowledge. Both were good.



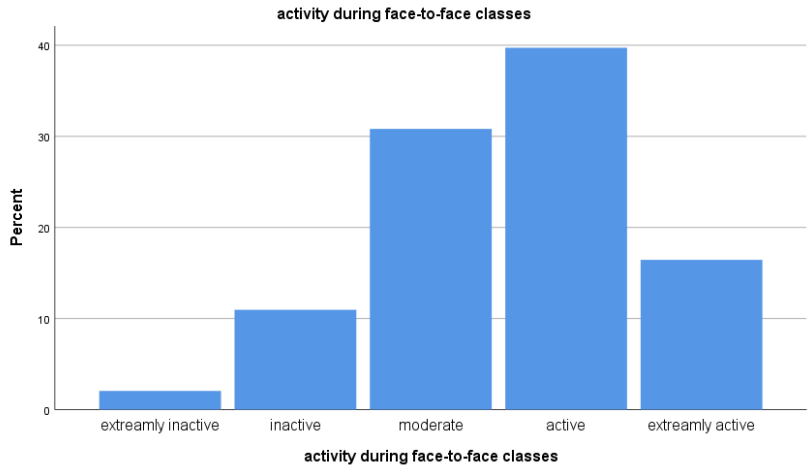


Figure 3. Comparing activities during face-to-face classes and online classes

As shown in Figure3, most students rated activity during face-to-face classes as more active than in online classes.

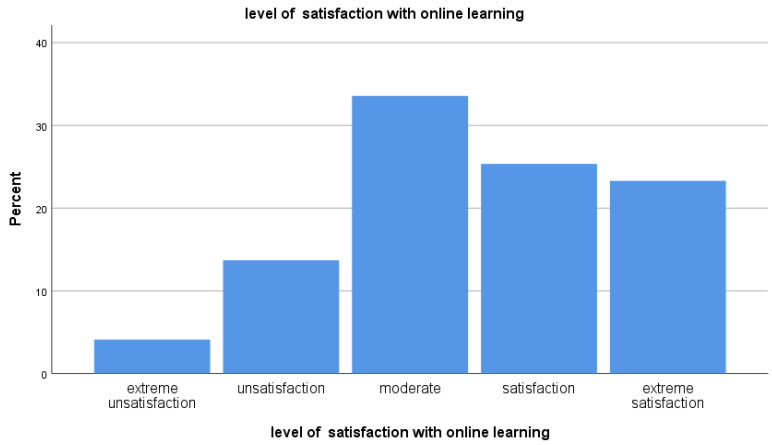


Figure 4. level of students' satisfaction with online learning

As shown in Figure4, a total of 61 (48.4%) students rated online learning as satisfaction. Of these, 34 (23.3%) found extreme satisfaction, and 37 (25.3%) found it somewhat satisfying. A total of 26 (17.8%) did not satisfy online learning. Of these, 6(4.1%) students were extremely unsatisfied, and 20(13.7%) were unsatisfied.

5. Discussion and Conclusion

The study outcomes show no difference between traditional face-to-face and online classes in increasing knowledge. However, there is a difference between traditional face-to-face and online classes according to social competence and activity during classes. Paul & Jefferson (2019) indicated that both traditional face-to-face and online classes increase students' knowledge and academic performance indifferently, while students' social competence and eagerness to do a class activity are increased differently between traditional face-to-face and online classes. Similarly, Herman & Banister (2007) noted that online learning is proven that can promote students' successful academic learning outcomes comparable to students who study by using traditional face-to-face learning. However, students will prefer online classes depending on the subjects and class offerings. Callister & Love (2016) reported that subjects in applied qualitative courses, such as marketing or management, may have more successful outcomes than in quantitative courses, such as finance, when teachers need to deliver their knowledge in online classes. Moreover, skill-based learning such as communication, negotiation, influencing people, problem-solving, and managing stress and conflict is more effective when learned through face-to-face classes than online classes. Technology-mediated negotiation may reduce the relationship-building in online classes when communicating or negotiating through technology is not as effective as actual negotiation. Additionally, a lack of interactions between teachers and students and between peers is likely to reduce the relationships and trust, leading to less cooperation or noncooperation during class activities (Thompson,2012). Therefore, it can be concluded that students' social skills or social competence can be well developed in face-to-face classes than in online classes. Multiple

response analysis results show that students are satisfied with functions in web-based instruction or online platforms; for example, students can record the lecture from their classes and quickly and easily access web-based instruction. Moreover, they feel comfortable with their surroundings and are free to study anywhere since they can study at their own pace. On the other hand, students do not satisfy with a lack of interactions with classmates and teachers. In addition, there is an association between age and a lack of interactions with classmates and between age and poor learning conditions at home. Similar to the study of Simonds & Brock (2014), there is an association between age and student preference for online activity types. While older age students prefer to have more videos of the professors' lecturing, younger age students prefer to have more interactive learning strategies. Figure 4 shows that most students rate online learning as satisfaction. Likewise, Fatani (2020) reported that most medical students are delighted with online classes (using web-video conferencing (WVC) case-based discussion (CBD) session teaching). However, online class teaching quality needs to rely on instructors' teaching, cognitive, and social skills rather than technology to satisfy students. Technology becomes a supportive role as an important platform for helping teachers' educational activities. Dziuban et al. (2018) suggested that blended learning, which integrates traditional face-to-face and online learning, can solve the problem of less interaction with classmates and teachers and improve the learning environment. However, successful blended learning requires well-designed courses and planning by institutions. Therefore, it is challenging for institutions to create blended learning. In establishing a blended learning course, course instructors need to consider these activities. First, analyze and define the goals of courses, such as what skills students need to learn, what information should be included, and what tools should be used to deliver knowledge and format (e.g., video, text, quiz). Second, design and create a blended learning course outline. Third, determine the level of interactivity of the courses, such as how much students can learn and progress through learning activities (e.g., online learning, social learning, and virtual class or face-to-face group meeting). Fourth, in integrating group collaboration activities, instructors must set up group collaboration so that students can have the opportunity to interact with classmates and teachers. Fifth, since online learning is an important part of blended learning, instructors should ensure that students can communicate with instructors or facilitators via electronic mail within 24 or 48 hours because students may face different problems with online learning, such as tools or applications that can affect group activity. For example, students cannot log in to group activities such as chart room. Sixth, gathering the list of resources to support learning, blended learning provides many resources and tools for students to promote their learning styles, such as links to videos and articles that support their deep learning. Seventh, create an assessment plan to check students' progress in learning.

6. Conclusion

Regarding social distance during COVID-19, universities inevitably adopt online learning to continue educating students after the suspension of the traditional face-to-face classroom.

Most students are satisfied with online learning regarding flexibility in time and places as well as increasing knowledge. On the other hand, the disadvantages of online learning are a lack of interactions with classmates and teachers. Similarly, Atwa et al. (2022) reported that students tend to be dissatisfied with online classes due to a lack of interactions with classmates and teachers. Students must attend online classes despite dissatisfaction with the lack of interactions with teachers and classmates during the classes. Moreover, Muthuprasad et al. (2021) indicated that practical or social skills orientation subjects are not appropriate with only online learning. Therefore, universities should design classes that blend online learning together with traditional face-to-face learning to solve the disadvantages of online classes.

Limitation

This study has some limitations. First, the sample size is small because of the time limit to collect data. Second, the result may be restricted to students in Thai universities. Another limitation, this study collected data from a wide variety of fields. For further study should select respondents in a specific field to provide a more specific conclusion.

References

Al-Rahmi, A. M., Shamsuddin, A., & Alismaiel, O. A. (2020). Unified theory of acceptance and use of technology (UTAUT) Theory: The Factors Affecting Students' Academic Performance in Higher Education. Psychology and Education Journal, 57(9), 2839-2848.

Atwa, H., Shehata, M. H., Al-Ansari, A., Kumar, A., Jaradat, A., Ahmed, J., & Deifalla, A. (2022). Online, face-to-face, or blended learning? Faculty and Medical Students' perceptions during the COVID-19 pandemic: A mixed-method study. *Frontiers in Medicine, 9*. https://doi.org/10.3389/fmed.2022.791352

Baber, H. (2020). Determinants of students' perceived learning outcome and satisfaction in online learning during the pandemic of covid19. *Journal of Education and e-Learning Research, 7*(3), 285–292. https://doi.org/10.20448/journal.509.2020.73.285.292

Bączek, M., Zagańczyk-Bączek, M., Szpringer, M., Jaroszyński, A., & Wożakowska-Kapłon, B. (2021). Students' perception of online learning during the COVID-19 pandemic. *Medicine, 100*(7). https://doi.org/10.1097/md.0000000000024821

Bisht, R. K., Jasola, S., & Bisht, I. P. (2020). Acceptability and challenges of online higher education in the era of COVID-19: A study of students' perspective. *Asian Education and Development Studies, 11*(2), 401–414. https://doi.org/10.1108/aeds-05-2020-0119

Burgess, S., & Sievertsen, H. H. (2020). *Schools, skills, and learning: The impact of COVID-19 on education*.VOX CEPR Policy Portal. Retrieved from https://voxeu.org/article/impact-covid-19-education. (Accessed on May 30,2022)

Callister, R. R., & Love, M. S. (2016). A comparison of learning outcomes in skills-based courses: Online versus face-to-face formats. *Decision Sciences Journal of Innovative Education*, *14*(2), 243–256. https://doi.org/10.1111/dsji.12093

Chyung, S. Y. (2007). Age and gender differences in online behavior, self-efficacy, and academic performance. *The Quarterly Review of Distance Education*, *8*(3), 213-222.

Dziuban, C., Graham, C. R., Moskal, P. D., Norberg, A., & Sicilia, N. (2018). Blended learning: The new normal and emerging technologies. *International Journal of Educational Technology in Higher Education*, *15*(1). https://doi.org/10.1186/s41239-017-0087-5

Fatani, T. (2020). Student satisfaction with videoconferencing teaching quality during the COVID-19 pandemic. https://doi.org/10.21203/rs.3.rs-61592/v1

Gautam, P. (2021). *Advantages and disadvantages of online learning*. eLearning Industry. Retrieved from https://elearningindustry.com/advantages-and-disadvantages-online-learning (accessed on May 30, 2022).

Herman, T., & Banister, S. (2007). Face-to-face versus online coursework: a comparison of cost and learning outcomes. *Contemporary Issues in Technology and Teacher Education*, *7*(4), 318-326.

Imsa-ard, P. (2021). THAI UNIVERSITY STUDENTS' PERCEPTIONS TOWARDS THE ABRUPT TRANSITION TO 'FORCED' ONLINE LEARNING IN THE COVID-19 SITUATION. *Journal of Education Khon Kaen University*, *43*(3), 30-44.

Jiang, H., Islam, A. Y., Gu, X., & Spector, J. M. (2021). Online learning satisfaction in higher education during the COVID-19 pandemic: A regional comparison between Eastern and western Chinese universities. *Education and Information Technologies*, *26*(6), 6747–6769. https://doi.org/10.1007/s10639-021-10519-x

Jongkolthanalarp, p, Chaiyasoonthorn, W., & Chaveesuk, S. (2021). Factors Affecting Satisfaction in Use Online Tutorial Business of Secondary School Students in The Central Region . *Journal of KMITL Business School*, *11*(1), 12–25.

Koh, E., & Lim, J. (2012). Using online collaboration applications for group assignments: The interplay between design and human characteristics. *Computers & Education*, *59*(2), 481–496. https://doi.org/10.1016/j.compedu.2012.02.002.

Kornpitack, P., & Sawmong, S. (2022). Empirical analysis of factors influencing student satisfaction with online learning systems during the COVID-19 pandemic in Thailand. *Heliyon*, *8*(3). https://doi.org/10.1016/j.heliyon.2022.e09183

Macon, D. K. (2010). *Student satisfaction with online courses versus traditional courses: A meta-analysis.* ProQuest LLC. Retrieved from https://eric.ed.gov/?id=ED526373 (Accessed on May 21, 2022)

Mala, D. (2020). *Covid-19 fear pushes classes online*. Bangkokpost. Retrieved from https://www.bangkokpost.com/thailand/general/1876594/covid-19-fear-pushes-classes-online (Accessed on May 27, 2022)

Muilenburg, L. Y., & Berge, Z. L. (2005). Student barriers to online learning: A factor analytic study. *Distance Education*, *26*(1), 29–48. https://doi.org/10.1080/01587910500081269.

Mukhtar, K., Javed, K., Arooj, M., & Sethi, A. (2020). Advantages, limitations and recommendations for online learning during COVID-19 pandemic era. *Pakistan Journal of Medical Sciences*, *36*(COVID19-S4). https://doi.org/10.12669/pjms.36.covid19-s4.2785.

Muthuprasad, T., Aiswarya, S., Aditya, K. S., & Jha, G. K. (2021). Students' perception and preference for online education in India during covid -19 pandemic. *Social Sciences & Humanities Open*, *3*(1), 100101. https://doi.org/10.1016/j.ssaho.2020.100101

Paul, J., & Jefferson, F. (2019). A comparative analysis of student performance in an online vs. face-to-face environmental science course from 2009 to 2016. *Frontiers in Computer Science*, *1*. https://doi.org/10.3389/fcomp.2019.00007.

She, L., Ma, L., Jan, A., Sharif Nia, H., & Rahmatpour, P. (2021). Online learning satisfaction during COVID-19 pandemic among Chinese University Students: The Serial Mediation Model. *Frontiers in Psychology*, *12*. https://doi.org/10.3389/fpsyg.2021.743936

Simonds, T., & Brock, B. (2014). Relationship between age, experience, and student preference for types of learning activities in online courses. *The Journal of Educators Online*, *11*(1). https://doi.org/10.9743/jeo.2014.1.3

Song, L., Singleton, E. S., Hill, J. R., & Koh, M. H. (2004). Improving online learning: Student perceptions of useful and challenging characteristics. *The Internet and Higher Education*, *7*(1), 59–70. https://doi.org/10.1016/j.iheduc.2003.11.003.

Thompson, L. L. (2012). *The mind and heart of the negotiator*. Pearson Education Inc.