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## STUDY FROM HOME! THE ANTECEDENTS AND CONSEQUENCES OF COLLABORATIVE LEARNING ON MALAYSIAN UNIVERSITY STUDENTS

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### ABSTRACT

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Aim/Purpose	Drawing on transactional distance theory (TDT) and collaborative learning, this research proposes a research model to examine the role of collaborative learning during the COVID-19 pandemic. It investigates the potential antecedents that influence students' academic achievements, autonomy, and satisfaction with online learning platforms.
Background	The coronavirus (COVID-19) epidemic devastating the world has shaken the global educational system; such a transformation compelled all educational institutes to utilize online learning platforms. Malaysian higher educational institutions were greatly concerned by this disease and faced considerable transformations that affected higher education learners. Additionally, the campus closure and movement regulations impacted traditional education. Thus, the Malaysian Government ordered students at higher education institutions to return to their hometowns and continue their studies through online learning. Therefore, online learning was the most reasonable alternative to resume the learning process. Furthermore, in the educational world, collaborative learning is pivotal

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to forming students' interpersonal skills. Collaborative learning practice is working in pairs or small groups to attain the learning objectives collaboratively. Collaborative learning refers to the process of acquiring knowledge in a collaborative setting as opposed to alone. Since the instructor and students are in separate locations, it is challenging for the teacher to facilitate collaborative learning.

Methodology	<p>This study utilized a quantitative method; purposive sampling was implemented, and the data were collected from 260 university students, both undergraduate and postgraduate, as long as they were affected by the COVID-19 pandemic in Malaysia.</p> <p>The questionnaire for this research was designed to fit the research hypothesis. The items of the questionnaire have been adapted to certify the content's validity. The collected data were analyzed using Smart PLS software, which has been utilized as an essential data analysis tool.</p>
Contribution	<p>This research contributes to: (1) a better understanding of the importance of communication and connection among students-students and teachers in online learning environments, as the results suggest that the more communication between students, teachers, and the environment itself, the greater the academic achievements, learners' autonomy, and satisfaction; and (2) the role of both collaborative learning and TDT on learners' academic achievements, autonomy, and satisfaction.</p>
Findings	<p>This study advances by incorporating TDT and collaborative learning theories. This research model illustrates six main factors in online learning platforms that enhance students' academic achievements, autonomy, and satisfaction through collaborative learning. The results showed a strong association between TDT and collaborative learning regarding the online learning platforms' utilization for improving academic achievements, learners' autonomy, and satisfaction.</p>
Recommendations for Practitioners	<p>This model provided exceptional support to students during this sudden switch to online alternatives and helped them cope with the considerable challenges they faced under the current circumstances. Moreover, this model provides a guideline for higher education teachers and administrators for coping with online learning platforms.</p>
Recommendations for Researchers	<p>Drawing on the association between TDT and collaborative learning regarding the utilization of online learning platforms for improving academic achievements, learners' autonomy, and learner satisfaction, the research result presents a road map for researchers in the field of online learning. Accordingly, researchers are encouraged to utilize these theories, as they can lead to improvements among online learners in higher education institutions.</p>
Impact on Society	<p>This preliminary model, which was developed throughout this research, will be a great support to both researchers and instructors to be able to utilize and elaborate in accordance with the role of online platforms on students' satisfaction, autonomy, and academic achievements. It is critical for higher education administrators to pay more attention to the nature of communication between students and student instructors, which has been shown to have a positive influence on their academic achievements, to implement online learning. Moreover, instructors and course developers must be trained and skilled to achieve online learning platform goals.</p>

Future Research	Future research could include more information about blended learning environments and their relationship to the technology acceptance model as an online learning model. Researchers may extend the model used in this study.
Keywords	adult learning, collaborative learning, distance education, media in education, transactional distance learning theory, collaborative learning theory

## INTRODUCTION

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The coronavirus (COVID-19) has adversely affected the world's life sectors, including the educational system. The virus spread universally in such a short period that it led to highly critical and surprising economic, spiritual, social, psychological, and biological challenges (Tanhan, 2020). Additionally, the virus has resulted in significant challenges for numerous individuals, thus critically affecting university learners (Tanhan et al., 2020). Students at schools, colleges, and universities were directly affected by the COVID-19 epidemic. As a result of the shutdown of their educational institutions, most were unable to physically attend courses throughout the epidemic. According to scholars from various countries (Tanhan et al., 2020), university learners have been experiencing multiple challenges throughout the COVID-19 outbreak. For instance, a lack of information, skills, and equipment, an unstable internet connection, irrelevance, and challenges with system access were the obstacles faced by instructors and students during the COVID-19 epidemic. Nevertheless, it has offered opportunities and challenges to higher education institutions (Toquero, 2020). This surprising switch to online learning turned into an agility measurement of education institutions (Wu, 2020), with numerous education institutions focused on transferring the traditional education system to online learning. Additionally, this current digital transformation towards online platforms has been accelerated under the compulsory lockdown of many educational establishments due to COVID-19, and numerous educational organizations have begun to use different e-learning systems and tools. This demonstrates that technology use in teaching has gained more importance at all education levels.

Several factors determine the effectiveness of online learning, programs, and classes, for instance, student satisfaction, student autonomy, and students' academic achievements (Abdelkader et al., 2022). Nevertheless, designing and executing effective online environments is a complicated process involving many satisfaction factors, including teacher support, student autonomy, student collaboration, and communication (Zamakhsari & Ridzuan, 2015). Previous research has found a consistent link between student satisfaction and communication in online learning environments (Abdelkader et al., 2022; Zamakhsari & Ridzuan, 2015). Students' most popular online learning activities involve online group discussions, searching, quizzes, and online tests. Consequently, it is critical to improve student communication with their classmates and their instructor in online learning environments (Abuhassna et al., 2021; Abuhassna, Awa, et al., 2022; Zamakhsari & Ridzuan, 2015).

This current study investigates the role of online learning platforms on students' satisfaction, autonomy, and academic achievements during the COVID-19 pandemic in relation to their communications with their instructors and their classmates and their autonomy towards online learning platforms, and their influence on collaborative learning. Additionally, this study investigates the effects of the collaborative learning role on student-student communication, teacher-student communication, students' academic achievement, student satisfaction, and student autonomy. Because most educational institutions now offer online courses as an alternative to traditional classrooms, this study may have an impact not only on online courses but also on other educational institutions. This preliminary model, which was developed throughout this research, will be a great support to both researchers and instructors to be able to utilize and elaborate in accordance with the role of online platforms on students' satisfaction, autonomy, and academic achievements. Online learning advantages and applications have been discussed in earlier correlated literature (Abuhassna et al., 2020; Abuhassna & Yahaya, 2018; Wu, 2015).

Accordingly, this study's main problem lies in the fact that, although COVID-19 is likely to be a temporary crisis, it must nonetheless be a wake-up call for higher education institutions to be more open and flexible regarding online learning implementation and ensure more flexible educational delivery methods that serve various learner populations are provided (Martin & Furiv, 2020). The COVID-19 crisis offers global universities a real chance to get to grips with their addiction to flying staff around the world (Martin & Furiv, 2020). Thus, there is a need to develop a research model to locate significant evidence based on the data of students' interactions within online learning environments that influence their academic achievements, student autonomy, and satisfaction in collaborative learning environments. Consequently, this proposed model should be used as a guideline for both decision-makers and instructors in the industry of online learning regarding the implementation of online platforms to enhance the whole learning experience through these platforms. This study employs an online learning environment and a collaborative learning environment, bringing new and better foundations for the development of the distance learning system; that is, the study-from-home approach. Taking into consideration such conditions, our primary investigation was:

In what way could this proposed model improve students' online learning regarding their academic achievements, autonomy, and satisfaction during the COVID-19 pandemic?

Drawing on the main question, this study aims to answer the following research questions:

1. What are the relationships between student-student communications, teacher-student communications, and collaborative learning?
2. What are the relationships between student-student communications, teacher-student communications through collaboration, and students' academic achievements?
3. What are the relationships between student-student communications, teacher-student communications through collaboration, and students' autonomy?
4. What are the relationships between student-student communications, teacher-student communications through collaboration, and student satisfaction?

## LITERATURE REVIEW

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During the COVID-19 pandemic, switching to distance and online learning resulted in inconsistencies in academic achievement among students (Muflih et al., 2021). Even though online learning addressed many complications caused by the lockdown, practical skills could hardly be delivered or trained via online platforms (Aslan, 2021). Online practical skills could be challenging for online learning (Paudel, 2021). Earlier studies showed conflicting conclusions on learning achievement levels during the COVID-19 epidemic in online learning settings. Academic achievements can significantly impact learning approaches, particularly in a pandemic of contextualized online learning (Coman et al., 2020). Nonetheless, students tended to evaluate online learning productivity negatively, refusing to participate in online learning and focusing on online environment issues (Wang et al., 2021). Several students negatively assessed online learning and have held negative attitudes regarding the efficiency of online learning. They neither thought they could achieve their education goals through online approaches nor considered that their communication skills could be improved through studying online (Coman et al., 2020).

Furthermore, students need to develop autonomy to learn online (Abuhassna et al., 2020; Moore, 2013; Moore & Kearsley, 2012). Student autonomy refers to the learner's ability to track their learning process. Acquiring the learning process with active involvement and self-autonomy is a prerequisite for online learning to be successful (Abuhassna et al., 2020; Abuhassna & Yahaya, 2018; Moore, 2013; Moore & Kearsley, 2012). It is recommended that instructors take responsibility for making students realize that they must become autonomous learners. In other words, the development of autonomy in each learner is intended to be objective in and of itself. This objective improves awareness that student autonomy in online learning should be incorporated into the curriculum (Abuhassna, Busalim, et al., 2022). Accordingly, this current study investigates the role of online learning

platforms on learners' satisfaction, academic achievements, and students' autonomy during the COVID-19 pandemic, their interactions with their instructors and classmates, their autonomy towards online learning platforms, and their influence on collaborative learning. Additionally, this study investigates the effects of the collaborative learning role on student-student communication, teacher-student communication, students' academic achievement, student satisfaction, and student autonomy. This proposed model developed through this study will significantly aid scholars' and instructors' ability to elaborate and apply in accordance with the role of online environments on learners' satisfaction, autonomy, and academic achievements. Previous related research has discussed the benefits and applications of online learning environments (Abuhassna, Van, et al., 2022; Wu, 2015).

Therefore, this study's main problem lies in the fact that, although COVID-19 is likely to be a temporary crisis, it must be a wake-up call for institutions of higher education to be more open and flexible regarding online learning implementation and ensure providing more flexible educational delivery methods that serve various learner populations (Martin & Furiv, 2020). The COVID-19 crisis offers global universities a real chance to get to grips with their addiction to flying staff worldwide. As a result, there is a need to develop a research model to investigate the significant evidence based on student communication data within online learning settings that influence academic achievement and satisfaction in collaborative learning environments. Consequently, this proposed model should be used as a guideline for decision-makers and instructors in the online learning industry regarding online platform implementation to enhance the whole learning experience. Considering such conditions, this model provides a practical implication for future studies on how to improve students' online experiences through these study interventions.

### ***THEORETICAL BACKGROUND***

This study's theoretical framework has been built according to Moore's (2013) transactional distance theory (TDT) in addition to collaborative learning (CL).

Firstly, CL in university courses has its origins in the theories of behavioral learning, cognitive development, and social interdependence (Dahley, 1994). CL is a mature-centered education approach where learners themselves are reliable for education results and group control (Bruffee, 1984). Linda Harasim (2017) developed CL, a theory that focuses on Internet facilities to provide educational settings that promote knowledge-building and collaboration. Harasim explains CL as "a new learning theory that focuses on knowledge building, CL, and Internet use to reshape informal, non-formal, and formal education for the knowledge age" (p. 69).

Secondly, TDT has been chosen in the present study because the "TDT term refers to the physical distance between the instructor and the student" (Moore, 2013, p. 67). That depends on the learner's understanding, which occurs throughout the learner's communications with their classmates and instructor. Although the TDT origins could be traced to Dewey's work, it was Michael Moore who was recognized as the inventor of this theory, which was initially published in 1972. In his development and studies of this theory, he categorized three significant elements of TDT, which serve as the base for this theory. These elements are: (1) course design; (2) dialogue, or what this study refers to as "communications" (both student-to-student communication and teacher-to-student communication); and (3) learning autonomy. Yet this study focused on both TDT and CL theories and related them to CL and student satisfaction as the primary purpose of this study. TDT theory provides courses that differ in the desired autonomy degree based on course format and communication principles. Other theories relating aptitude and inspiration to work independently, such as self-determination theory (Deci & Ryan, 2012; Falloon, 2011) and self-directed learning (Garrison, 1997), are related to the autonomy concept. According to various studies, learning autonomy is critical for online learning (Abuhassna et al., 2020; Hung et al., 2010).

## ***HYPOTHESES DEVELOPMENT***

This study's hypotheses were developed based on a combination of the different aspects of the two theories mentioned above. The first and second hypotheses were developed as a result of students' and teachers' communication and its relationship to collaborative learning.

H1: Students' and students' communications positively influence collaborative learning.

H2: Teachers' and students' communications positively influence collaborative learning.

Then, students' and teachers' communication and its relationship to students' academic achievement led to the formulation of the third and fourth hypotheses.

H3: Students' communications through collaborative learning have a positive influence on students' academic achievements.

H4: Teacher-student communications through collaborative learning positively influence students' academic achievements.

The fifth and sixth hypotheses were developed as a result of student-teacher communication and its relationship to student autonomy.

H5: Communication between students and between students through collaborative learning has a positive impact on students' autonomy.

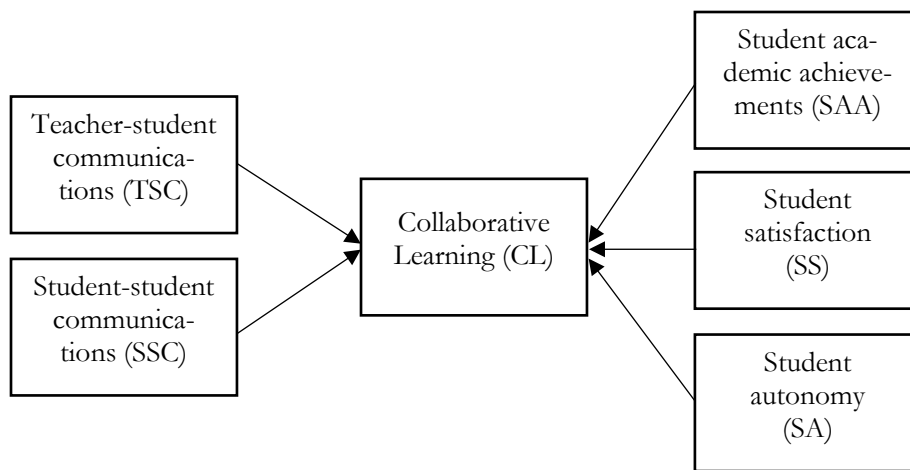
H6: Teacher-student communications through collaborative learning have a positive impact on students' autonomy.

Finally, student-teacher communication and its relationship to students' autonomy led to the formulation of the seventh and eighth hypotheses.

H7: Students' communications through collaborative learning have a positive influence on students' satisfaction.

H8: Teacher-student communications through collaborative learning positively influence students' satisfaction. This demonstrates how these two theories work in parallel to improve this study's variables.

This proposed model explains how the theories of TDT, and the concept of CL can guide these components' roles and their relation to each other, thus making the online learning process more effective. In conclusion, this study employs TDT theory through collaborative learning to hypothesize and develop this study's hypothesis (see Figure 1).



**Figure 1. Conceptual framework**

## ***RESEARCH MODEL AND HYPOTHESIS***

This section discusses the study's hypotheses and proposes the research model (see Figure.1). The research model for this study incorporates antecedents (i.e., student-to-student communications and teacher-to-student communications), collaborative learning factors, and consequences factors, including academic achievement, autonomy, and satisfaction. Thus, this study points to the following hypotheses.

### **Student-student and student-teacher communications and collaborative learning**

Students' communications and collaborative learning in this study are referred to as their connections and feedback among themselves in online settings and how such communications could be enhanced using collaborative learning approaches. Collaborative learning offers social skills like teamwork, professionalism, problem-solving, critical thinking, cultural intelligence, and written and oral communication, which are crucial for future fieldwork in technology and science (Hollis & Eren, 2016). Additionally, collaborative learning is vital when responding and adapting to the new professional demands of drastically changing workplaces. Linton et al. (2014) determined that learners in group environments achieved considerably better conceptual understanding than students in courses with an individual environment. As Vygotsky (1978) suggested, this could be improved if learners were left in groups based on their proficiency and experience level. In this case, less proficient learners benefit from the communication skills of more capable learners. Thus, learners with a higher proficiency level benefit from others teaching their less capable peers. Furthermore, learners with varying levels of proficiency may benefit from the experience as a collaborative one. Communications among learners themselves allow them to improve and use their communication skills (Major, 2015). Prior research on collaborative online learning investigated how traditional collaborative learning features emerged in online learning environments. Collaborative learning characteristics, for example, purposeful design, unique collaboration, and meaningful learning are attempted differently during online meetings than in traditional face-to-face meetings (Barkley et al., 2014). Teacher-student communications and collaborative learning are defined in this study as their relationship and communication with their instructor on online platforms, and how such communications could be improved using collaborative learning approaches. Teacher support for students has been empirically examined, and the results indicate that the students' perceived teacher support influences their communications (Zhao & Qin, 2021). Besides, in online environments, teacher support is a personal feature that affects students' online learning. Several investigations have found that student-teacher support and communications positively correlate with online learning adoption (Lee et al., 2020). As a result, online instructors play an important role as a mediator in creating a constructive-centered learning environment that can encourage collaboration and support the achievement of learning objectives (Rovai, 2004). Group work and activities in online settings need further modifications and factors beyond traditional face-to-face settings. Such a reality involves instructors considering alternate solutions to collaborate, clarify scripted guidelines, and communicate. For instance, Vonderwell and Turner (2005) stated that learners need practical and clear communication of online instruction and messages. Lack of interaction and delay in asynchronous communication are essential factors that need to be considered to avoid any negative impact on online learners (Kang & Im, 2005; Vonderwell & Turner, 2005).

**H1:** Students-students' communications have a positive influence on collaborative learning.

**H2:** Teacher-students' communications have a positive influence on collaborative learning.

### **Students-students' and teacher-students' communications, and students' academic achievements**

Students' communications and students' academic achievements in this study describe their feedback and interactions among themselves on online platforms and how these communications can improve their academic achievements. In the education system, particularly online education, learners work

hard to succeed in their future careers. For instance, in online education, learners require more effort to obtain higher grades, which ascertain their proficiency throughout their course. Students work hard for their academic performance throughout the lessons taught in any semester (McKenzie et al., 2004). In online learning platforms, students and their instructors are physically separated. Thus, their usage of technological resources fills this distance gap, and learners learning online are called distance learners (Casarotti et al., 2002). In this study, teacher-student communications and students' academic achievements describe how students' feedback and interaction among themselves in online settings can improve their academic performance. Furthermore, a study by Henke and Russum (2000) throughout their research suggested that individual separation could create a sense of inaccessibility among many learners. That is why they discovered the use of e-mails, website forums, and internet facilities to alleviate their feelings of isolation. The study suggests that social media and tutorial interaction could decrease student isolation. Additionally, learners and their instructors must be connected throughout the online learning process to overcome their isolation sense (Abuhassna, Awae, et al., 2022; Abuhassna & Yahaya, 2018).

**H3:** Students-students' communications through collaborative learning have a positive influence on students' academic achievements

**H4:** Teacher-students' communications through collaborative learning positively influence students' academic achievements.

### **Students-student communications and students' autonomy**

Students' communications and autonomy in this study refer to their feedback and communication among themselves in online settings and how these communications could enhance their autonomy in online learning settings. Recently, researchers found that students' autonomy was predicted by online learning communication (Al-Tarawneh et al., 2021). Moreover, a study by Martin et al. (2021) has shown that students' autonomy is considerably correlated to achievement and dramatically facilitates the link between achievement and adaptability. Furthermore, studies have examined students' autonomy and teacher support with students' deep learning (Zhao & Qin, 2021) in online materials and contexts. The students need to gain the strategies and habits of studying, which will help them determine the learning steps and master their learning process. Online learning eliminates the temporal aspect of learning and teaching by providing continuous guidance and materials. However, the smooth access does not indicate the increasing amount of time students spend on their studies, as the lack of autonomy is noticeable. Non-temporality introduces the possibility of increased transactional distance, which becomes an impediment to the learning process (Martin et al., 2021).

**H5:** Students-students' communications through collaborative learning have a positive influence on students' autonomy

**H6:** Teacher-students' communications through collaborative learning have a positive influence on students' autonomy

### **Students-students' and teacher-students' communications and students' autonomy**

In this study, students' communications and academic achievements imply their feedback and communication among themselves in online settings, as well as how these communications could improve their satisfaction in online learning settings. Satisfaction may be defined as a point factor of performance and expectation. Cultural differences impact the learner's satisfaction level with their perception of the services (Tian & Wang, 2010). An encouraging learning context could improve students' satisfaction and achievement through online learning. The learner's satisfaction level is the boundary between the anticipation level and the present findings. Learner satisfaction is the outcome of achievement, enjoyment, and thus, "a successful and pleasant experience" (Tian & Wang, 2010). Understanding learning satisfaction is important because it can provide the necessary point to improve learners' education (Khiat, 2013). Studies on learners' satisfaction with online learning



platforms have gained a lot of interest and attention due to their impact on the educational effectiveness of instructional materials. As online learning courses are broadening, it is significant to study learners' satisfaction with such curriculums and how these affect their academic achievement and satisfaction. Teacher-student communications and students' autonomy in this study refer to their feedback and communication among themselves in online settings and how these communications could enhance their autonomy in online learning settings. Any student, whether they are enrolled in conventional or online learning, is required to possess the essential skill and capacity of autonomy. Both methods provide the issue of monitoring novel learning models, although the former is more prevalent. Learners have been encouraged to work toward becoming independent learners as an important component of online education for a long time (Alley, 2019; Cheon et al., 2012). Therefore, determining online learning autonomy has tremendous importance and presents challenges for establishments, educators, and students. Thus, teaching how to learn is not just in a classroom but also changing what is done. Communication between learners and instructors is essential in online learning environments (Jacobs et al., 2016). In this context, it is evident that creating students capable of reinforcing their learning is essential. However, what is the way to make this happen? The need to answer such a question is simply met by providing instant feedback from their instructor during online learning courses (Abuhassna et al., 2020). Teacher-student communications and students' academic achievements in this study refer to their feedback and communication among themselves in online settings and how these communications could enhance their satisfaction in these settings. Many identifications of the learner's satisfaction can determine the satisfaction level, for example, the learning environment, the course elements, interaction and communication elements, individual learner elements, the institution, and the faculty. At the same time, they discuss the details related to the instructor's role, the learner's attitude, the effectiveness of online environments, and social presence. To design and create the proper online learning courses or programs to meet the requirements and satisfaction of online learners, it is essential to examine the communications between the students and their instructors (Abuhassna, Van, et al., 2022; Jackson, 2014; Kardo, 2015). The kind of learners in the course may also be necessary, as some of them may not have the experience to compensate for the lack of face-to-face interaction with the tutor, mainly when they are registering for their first time in online programs. Many have concentrated on the associations between learner satisfaction with online programs and student experience or demographics with ICT and online education (Abou Naaj et al., 2012; Ryan, 2013).

**H7:** Students-students' communications through collaborative learning have a positive influence on students' satisfaction

**H8:** Teacher-students' communications through collaborative learning positively influence students' satisfaction.

## RESEARCH METHOD

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### *SURVEY INSTRUMENT*

The questionnaire for this research was designed to fit the research hypotheses. Accordingly, the questionnaire was designed to measure Teacher-Student Communications (TSC), Students-Students Communications (SSC), Collaborative Learning (CL), Students Academic Achievements (SAA), Students Satisfaction (SS), and Students Autonomy (SA) through social media platforms. The items of the questionnaire have been adapted to certify the content's validity. Thus, this study's questionnaire was comprised of two major sections.

The first section included the respondents' demographic details, such as age, gender, and educational level. The second section (See Appendix) consisted of 35 items that were adapted from earlier studies as follows. Teacher-Students Communications and Students-Students Communications were taken from Abuhassna et al. (2021) and Bolliger and Inan (2012). Collaborative learning was measured using six adapted items (So & Brush, 2008). Eight items were adapted from Students' Academic

Achievements (Abuhassna et al., 2020). Six Student's Satisfaction items were adapted from Dziuban et al. (2007). Five Students' Autonomy items were adapted from Barnard et al. (2009) and Pintrich et al. (1991).

### ***SAMPLING AND SAMPLE SIZE***

While this study was being conducted, Malaysia's COVID-19 pandemic remained active. Due to the pandemic, the Malaysian Government, and the Ministry of Higher Education (MOH) ordered that those educational institutions, schools, and universities close their doors. Thus, all samples in this study were students affected by COVID-19 who were studying from home. The most important criterion for individual inclusion in the research is that "they are students that have actively been involved in online teaching during the COVID-19 pandemic." Both undergraduate and postgraduate students were involved in this study as one category since they both have been affected by the pandemic. Purposive sampling was implemented. Using purposive sampling, the authors of this study determine the significant characteristics of the people who would form the samples and reach the people who match these characteristics. Due to this criterion, the sample may also be considered within the scope of criterion sampling (Maxwell, 2012). The respondents' demographic collected data show that of the 260 respondents, 76 (29.2%) were males, 184 (70.7%) were females, 201 (77.3%) were in the age range of 24 years and above, 41 (15.7%) were in the age range of 21 to 23 years old, and 18 (6.9%) were in the age range of 18 to 20 years old. Regarding the level of study, 78 (30%) were in their first year of study, 100 (38.4%) were in their second year of study, 22 (8.4%) were in their third year of study, and 3 (1.1%) were in their fourth year of study, 12 (7.5%) were in their fifth year of study, and 45 (17.3%) did not select their level of study. The collected data were analyzed using Smart PLS software, which has been utilized as an essential data analysis tool. The Smart PLS utilization process includes two stages: first, evaluating construct validity and convergent validity, together with the discriminant validity of the measurements; and second, analyzing the structural model. The phases mentioned above are suggested by Hair et al. (2012).

### ***DATA COLLECTION AND ANALYSIS***

The data collected in this research was mainly accumulated from undergraduate and postgraduate students at one Malaysian university. A combined total of 268 questionnaires were received. However, eight questionnaires have been excluded due to incomplete items. Consequently, the total number of valid questionnaires was 260 after this exclusion. Thus, the research was carried out with 260 students taught at different levels of education in other cities all over Malaysia. Such an exclusion step was supported by Hair et al. (2012). Furthermore, Venkatesh et al. (2012) noted that this method is vital to be carried out as the presence of outliers can cause biased results.

## **RESULTS**

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### ***COMMON METHOD BIAS***

Before examining the measurement model, we test the standard method for the collected sample. Using the Human Single Factor Test (Podsakoff et al., 2003), all constructs were loaded into a single factor. The result showed that the percentage of the explained variance by the single factor accounted for 34.19%, below the threshold value of 50% (Podsakoff et al., 2003). Thus, the data used in the study has no severe issues in terms of common method bias.

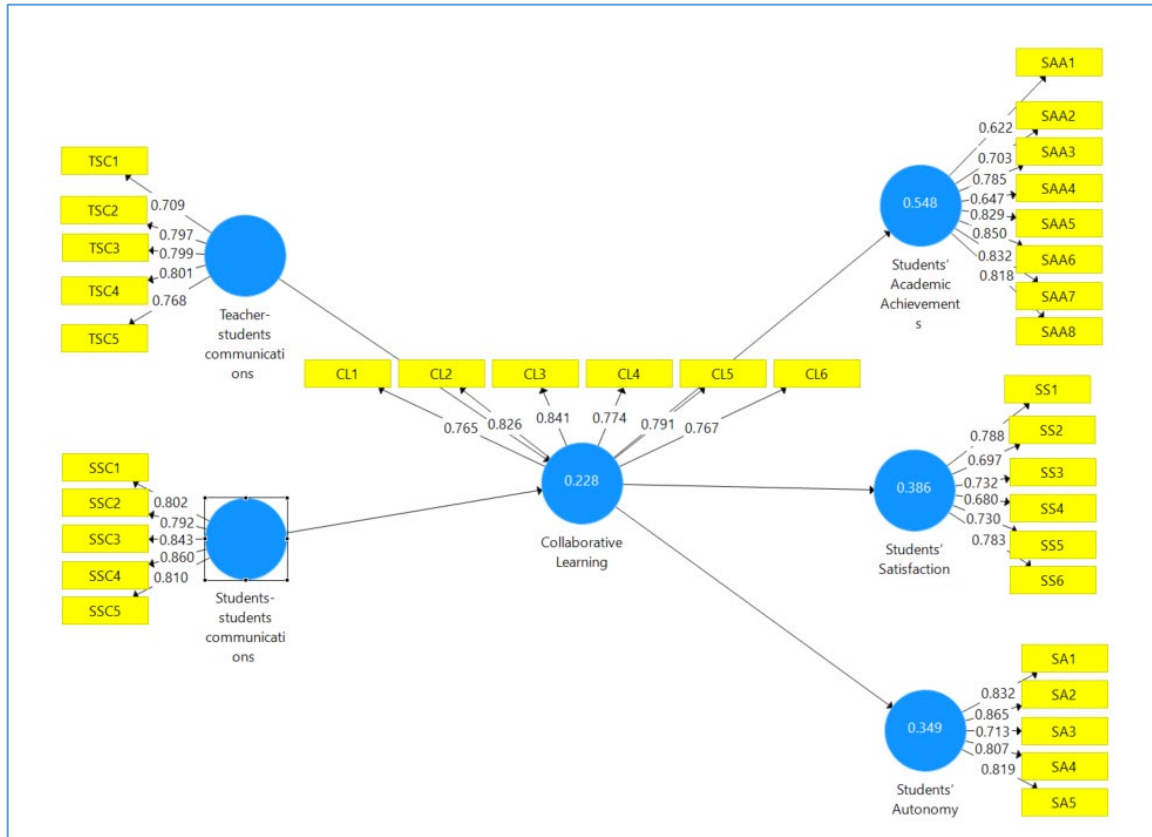
### ***MEASUREMENT MODEL ASSESSMENT***

The first step in the data analysis procedure is to examine the measurement model. Measurement model assessment tests the reliability and validity of the measurement items and their respective constructs. Internal consistency, convergent validity, and discriminant validity were examined (Hair et al., 2017). Two metrics were used to investigate the internal consistency: Cronbach's alpha and

Composite Reliability (CR). The value of Cronbach's alpha should exceed 0.7, and a CR value of 0.70 and above can be considered satisfactory (Hair et al., 2021). Concerning convergent validity, two metrics were applied: items' outer loading was 0.5 and above, and the average variance extracted (AVE) should exceed 0.5 (Hair et al., 2017). As shown in Table 1, the results on internal consistency show that Cronbach's alpha of all constructs exceeds 0.7 and the CR value of each construct exceeds the required value of 0.70. Furthermore, the convergent validity metrics show that the outer loading of all measurement items was above the threshold value (Table 1). Similar to the AVE value, all constructs have shown an AVE value more significant than the required value of 0.5. These results demonstrate that the model's constructs have high internal consistency and convergent validity (See Figure 2).

**Table 1. Internal consistency and convergent validity results**

Construct Name	Items	Outer loadings	Cronbach's Alpha	CR	AVE
Teacher- Students' Communica-tions	TSC1	0.709	0.837	0.883	0.602
	TSC2	0.797			
	TSC3	0.799			
	TSC4	0.801			
	TSC5	0.768			
Students-Students Communica-tions	SSC1	0.802	0.88	0.912	0.675
	SSC2	0.792			
	SSC3	0.843			
	SSC4	0.860			
	SSC5	0.810			
Collaborative Learning	CL1	0.765	0.883	0.911	0.631
	CL2	0.826			
	CL3	0.841			
	CL4	0.774			
	CL5	0.791			
	CL6	0.767			
Students' Academic Achievements	SAA1	0.622	0.897	0.918	0.586
	SAA2	0.703			
	SAA3	0.785			
	SAA4	0.647			
	SAA5	0.829			
	SAA6	0.850			
	SAA7	0.832			
	SAA8	0.818			
Students' Satisfaction.	SS1	0.788	0.837	0.876	0.542
	SS2	0.697			
	SS3	0.732			
	SS4	0.680			
	SS5	0.730			
	SS6	0.783			
Students' Autonomy	SA1	0.832	0.872	0.904	0.654
	SA2	0.865			
	SA3	0.713			
	SA4	0.807			
	SA5	0.819			



**Figure 2. Items outer loadings**

The discriminant validity was examined using the Fornell-Larcker criterion and the Heterotrait-Monotrait ratio (HTMT) (Hair et al., 2017). The first metric Fornell-Larcker criterion compares the value of the square root of AVE with all the constructs. The square root value of AVE for each construct should be greater than its correlation with the other constructs in the model (Hair et al., 2017). In this study, the result of the Fornell-Larcker criterion, as shown in Table 2, indicates that the AVE square root for each construct is greater than the highest correlation with any other construct. The second metric we used to examine discriminant validity is HTMT. According to Henseler et al. (2015), the HTMT value of each variable should not exceed 0.090. As shown in Table 3, all HTMT values are less than 0.90, thus indicating adequate discriminant validity.

**Table 2. Fornell-Larcker criterion**

Construct	CL	SSC	SAA	SA	SS	TSC
Collaborative Learning	<b>0.795</b>					
Students-Students Communications	0.394	<b>0.822</b>				
Students' Academic Achievements	0.74	0.329	<b>0.770</b>			
Students' Autonomy	0.591	0.275	0.633	<b>0.809</b>		
Students' Satisfaction	0.621	0.313	0.651	0.643	<b>0.736</b>	
Teacher-students communications	0.386	0.336	0.526	0.35	0.452	<b>0.776</b>

**Table 3. Heterotrait-Monotrait ratio (HTMT)**

Construct	CL	SSC	SAA	SA	SS	TSC
Collaborative Learning						
Students-Students Communications	0.441					
Students' Academic Achievements	0.825	0.389				
Students' Autonomy	0.625	0.32	0.649			
Students' Satisfaction	0.677	0.363	0.683	0.701		
Teacher-Students communications	0.428	0.399	0.602	0.378	0.524	

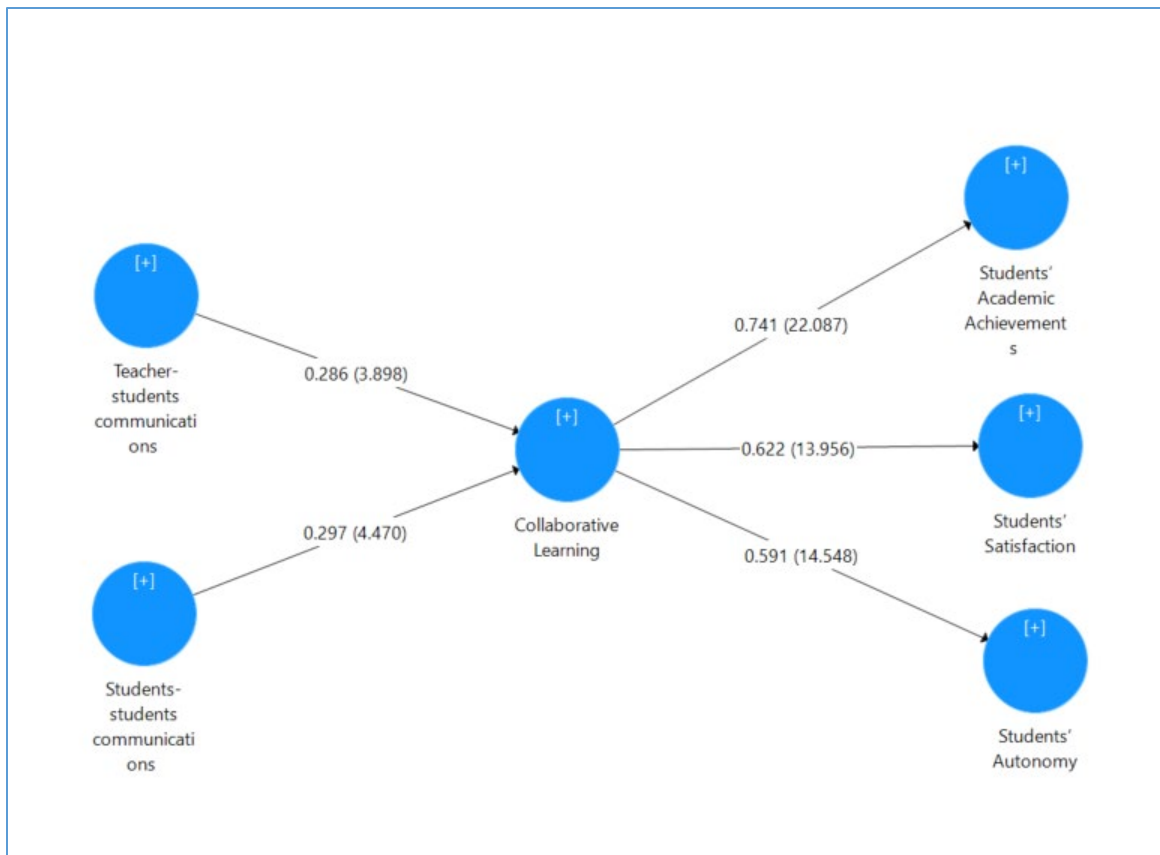
### ***STRUCTURAL MODEL ASSESSMENT***

Following the measurement model assessment, we performed the structural model assessment to test the variance explained ( $R^2$ ) by the dependent variables and the path coefficient based on the proposed hypotheses. Based on Hair et al. (2017), we used the bootstrapping technique with 5,000 subsamples, two-tailed tests, and a 0.5 significant level to generate the standard error and t-statistics. The  $R^2$  values in Figure 2 reveal that the explained variance of collaborative learning, students' academic achievement, students' satisfaction, and students' autonomy is 22%, 54%, 38%, and 34% respectively, thus demonstrating satisfactory predictive power (Hair et al., 2017). Moreover, the path coefficient results in Table 4 show that the eight main paths are significant and have a positive effect. Students-students' communications have a significant impact on collaborative learning ( $\beta = 0.29$ ,  $t = 4.464$ ), supporting H1. Furthermore, the findings revealed a significant positive effect of Teacher-Students communications on collaborative learning ( $\beta = 0.286$ ,  $t = 3.936$ ), supporting H2. Further, both student and teacher-student communications have indirect positive effects on students' academic achievements; through collaborative learning, the bootstrapping test showed a highly significant level of both indirect paths with  $\beta = 0.22$ ,  $t = 4.436$ , and  $\beta = 0.212$ ,  $t = 3.592$ , supporting H3 and H4 respectively. Student-student communication has an indirect positive effect on students' autonomy via collaborative learning ( $\beta = 0.176$ ,  $t = 4.207$ ), which supports H5. Similarly, teacher-student communication has an indirect positive effect on students' autonomy via collaborative learning ( $\beta = 0.169$ ,  $t = 3.592$ ), supporting H6. Furthermore, the findings revealed that both student-student and teacher-student communications have a positive indirect effect on students' satisfaction via collaborative learning ( $\beta = 0.185$ ,  $t = 4.272$ ,  $\beta = 0.178$ ,  $t = 3.444$ ), supporting H7 and H8.

In addition, the effect sizes ( $f^2$ ) and predictive relevance ( $Q^2$ ) of the independent variables were estimated. The  $f^2$  results, according to Hair et al. (2017) guideline, show that students-students communication has a medium effect on collaborative learning ( $f^2 = 0.102$ ), and teacher-student communication has a small effect on collaborative learning ( $f^2 = 0.094$ ). Moreover, collaborative learning has a large effect on students' academic achievements ( $f^2 = 1.02$ ), students' autonomy ( $f^2 = 0.53$ ), and students' satisfaction ( $f^2 = 0.62$ ). The results also revealed that the  $Q^2$  results of all dependent variables, collaborative learning ( $Q^2 = 0.194$ ), students' academic achievements ( $Q^2 = 0.228$ ), students' autonomy ( $Q^2 = 0.122$ ), and students' satisfaction ( $Q^2 = 0.175$ ), are above zero, which indicate the predictive relevance of the independent variables.

**Table 4. Hypotheses results**

Path (direct effect)	Original Sample (O)	T-value	P-values	Sig. Level	Decision
Students-Students Communications -> Collaborative Learning	0.297	4.470	0.00	***	Supported
Teacher-Students Communications -> Collaborative Learning	0.286	3.898	0.00	***	Supported
Path (indirect effect)					
Students-Students Communications -> Collaborative Learning -> Students' Academic Achievements	0.22	4.436	0.00	***	Supported
Teacher-Students Communications -> Collaborative Learning -> Students' Academic Achievements	0.212	3.592	0.00	***	Supported
Students-Students Communications -> Collaborative Learning -> Students' Autonomy	0.176	4.207	0.00	***	Supported
Teacher-Students Communications -> Collaborative Learning -> Students' Autonomy	0.169	3.592	0.00	***	Supported
Students-Students Communications -> Collaborative Learning -> Students' Satisfaction	0.185	4.272	0.00	***	Supported
Teacher-Students Communications -> Collaborative Learning -> Students' Satisfaction	0.178	3.444	0.001	***	Supported



**Figure 3. Path results**

## DISCUSSION

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This study concentrated on answering the main question: “In what way could this proposed model improve students’ online learning regarding their academic achievements, autonomy, and satisfaction during the COVID-19 pandemic?” Thus, to answer this question, this study investigated Hypotheses H1, H2, H3, H4, H5, H6, H7, and H8 illustrated in the proposed model (illustrated in Figure 1). Developing a new model through the combination of collaborative learning (CL) and transactional distance theory (TDT) was the main goal of answering this question by examining the critical factors towards employing online learning environments to enhance learners’ academic achievements, student autonomy, and satisfaction in institutions of higher education during the COVID-19 pandemic. This study is taking a step forward by employing TDT and the CL theories. This research model illustrates eight main factors in online learning platforms that enhance students’ academic achievements, autonomy, and satisfaction through collaborative learning. The results of this study showed a positive association between student communications and collaborative learning (H1), which indicates that putting the students through such an experience would enhance their collaboration among themselves and give them the capability to conquer any challenges that might arise when using online platforms. This agrees with some prior studies (Abuhassna, Busalim, et al., 2022; Barkley et al., 2014; Major, 2015; Moore & Kearsley, 2012). Furthermore, for H2, teacher-student communications and collaborative learning showed a significant and positive association (Hämäläinen & Vähäsantanen, 2011; Oncu & Cakir, 2011; Rovai, 2004), indicating the importance of communication between learners and their tutors during online learning sessions. Such findings are consistent with Hämäläinen and Vähäsantanen (2011).

Collaborative capability and perceived enjoyment are likely to be the most powerful causal factors influencing university students’ adoption of social-media platforms for collaborative learning. Cooperative learning influences the academic achievements of students in universities, and active collaborative learning and engagement through social media enrich the learning activities of students and facilitate group discussions. Thus, their use should be encouraged in learning and teaching processes in higher education institutions. Moreover, in line with Vonderwell and Turner (2005), who examined preservice teachers’ experiences and the meaning they gave to their experiences in a Technology Applications in Education online course, Kang and Im (2005) showed that factors related to instructional interaction predicted perceived learning achievement and satisfaction better than factors related to social interaction. However, social interaction, such as social intimacy, was found to have a negative impact on perceived learning achievement and satisfaction. In addition, Kai-Wai Chu and Kennedy (2011) reported and described the use of MediaWiki and Google Docs at the undergraduate level as online collaboration tools for co-constructing knowledge in group project work. Additionally, Xiong et al. (2015) concluded that the lack of interaction and delay factors in asynchronous online courses can influence learner learning negatively. Furthermore, students’ communications and academic achievements demonstrated a significant and positive association (H3), revealing the learners’ level of acceptance of online learning environments. This is consistent with Hussain (2013), Furnborough (2012), and Moore and Kearsley (2011), who stated that cooperation is a feeling that students share with their classmates and affects their response regarding their collaboration with their classmates. Additionally, teacher-student communications and students’ academic achievements demonstrated a significant and positive association (H4), which specifies the primary role of the web-based platform in learners’ academic achievements. This is consistent with Henke and Russum (2000), Kamal and Sultana (2000), Pillai (2011), Rwejuna (2008), and Shen (2004), who argued that the lack of online group work impedes the effectiveness of communication in online learning settings.

Additionally, the absence of subject knowledge and the language barriers prevent communication effectiveness in online learning environments. Furthermore, students’ communications and students’ autonomy showed a significant and positive association (H5), which shows that students need a sense of dependence on online environments, which is in line with Furnborough (2012) and Santos and Camara (2012). In contrast, Aldhafeeri and Male (2016) argue that students require aptitudes to

investigate and combine information, recognize knowledge, and build meanings. Besides, teacher-student communications and students' autonomy demonstrated a significant and positive association (H6), which agrees with Jackson (2014), Jacobs et al. (2016), and Moore (2013), who indicated that the temporal and physical distance between educator and learner establishes an environment that must be taken into consideration psychologically and pedagogically as interactive relations are created within. Furthermore, determining online learning autonomy has great importance and challenges that revolve around institutions, educators, and students; thus, teaching how to learn is not only in a classroom but also changing what is done there. Therefore, communication between learners and instructors is essential in online learning environments. Additionally, student-student communications and satisfaction demonstrated a positive and significant association (H7), which indicates a level of acceptance by the students for adapting to online learning platforms. This agrees with Abou Naaj et al. (2012), Kardo (2015), Khiat (2013), Sinclaire (2011), and Tian and Wang (2010), who stated that learners' satisfaction in online settings is a statement of confidence in the system; furthermore, regardless of the environment used, the quality of the courses along with the connection with the learners themselves throughout the online learning sessions are very significant. Learner satisfaction is a primary need in the education process. Finally, teacher-student communications and student satisfaction demonstrated a positive and significant association (H8); these results are in line with Areti and Despina (2006); Biggs and Tang (2015); Thiagarajan and Jacobs (2001); and Trinidad and Pearson (2004). Furthermore, the findings of Abou Naaj et al. (2012), Jackson, 2014, Kardo, 2015, and Ryan (2013), claimed that online programs are often criticized for their low standard of dependability and less communication between instructors and students.

## **LIMITATIONS, RECOMMENDATIONS, AND FUTURE WORK**

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The limitations of this research must be put into consideration. The first possible limitation was the self-reported tools, which have some inherent limitations; more studies are required to investigate online learning platforms and their effectiveness toward students' academic achievement, satisfaction, and autonomy in online learning platforms. Secondly, the type of institution in the data collection process; the researcher conducted the study at one government university in Malaysia, so accordingly, the results from any other institution might vary. The voluntary nature of the participants is the second limitation of this study. Before participating in this research, students were told that participating in this experience was voluntary; any students who were unwilling to participate, unmotivated to participate, or unable to participate were summarily excluded from the results. Moreover, it must be acknowledged that because the course was taught online and developed independently by the instructors, there were differences in the structure, format, and requirements.

### ***RECOMMENDATIONS FOR RESEARCHERS***

For researchers, our findings contribute to the expanding body of knowledge on the integration of CL and TDT theories. During the COVID-19 epidemic, this research provides major empirical findings by studying the essential criteria for using online learning environments to improve students' academic achievements, autonomy, and satisfaction in higher education institutions. Moreover, this research emerges as the most influential factor in the adoption of online learning environments in teaching and learning. This finding demonstrates that online learning environments are a viable alternative to traditional classrooms. Nonetheless, this study offers significant insights into the design and implementation of successful online learning environments including several satisfaction criteria, such as instructor support, student autonomy, student participation, and communication (Abdelkader et al., 2022; Zamakhsari & Ridzuan, 2015). More theories are applicable in such a research field, for instance, the technology acceptance model (TAM). Future studies might integrate more information about blended learning settings and their relation to this model as an online learning model. Researchers may extend the model used in this study.



### ***RECOMMENDATIONS FOR PRACTITIONERS***

For practitioners, it is critical for higher education institution administrators to pay more attention to the nature of communication between students and student instructors, which has proven to have a positive influence on their academic achievements (Moore, 2013). Moreover, this proposed model provides a guideline for higher education teachers and administrators for coping with online learning platforms by underlining the integration of CL and TDT and the actions that need to be taken by all Malaysian universities to make their courses innovative and interesting for their students while studying online. Malaysian universities should also be considering the implementation of online teaching as a new method for teaching and learning in the future, not necessarily during pandemics but as an alternative approach; consequently, instructors and students must be ready and willing to utilize online learning during normal occasions. Moreover, instructors and course developers must be trained and skilled to achieve the goals of an online learning platform. Workshops and training sessions must be given to instructors and students to make them more familiar with and take advantage of such platforms.

### **CONCLUSION**

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In summary, this study connected TDT and CL theories that attach collaborative learning with students' satisfaction, academic achievement, and student autonomy. Based on the authors' knowledge, no other studies have collaborated on these two theories. The TDT and CL theories have been authenticated in the educational framework, presenting further understanding concerning learners' readiness and perspective on utilizing online learning platforms to enhance their satisfaction, academic achievement, and autonomy. The contribution of this study shows that further understanding of students' academic achievements, student satisfaction, and student autonomy needs to be introduced. This study highlights that the integration of CL and TDT has influenced this study's findings positively. In the case of traditional settings, students' communication through collaborative learning positively impacts their achievement, which is expected because students are used to such conventional classrooms. However, this study proved that even in the distance learning context, students' communication through collaborative learning positively influences their achievement, which is the primary purpose of the study by getting students to adopt such innovative settings as online learning.

This study has concluded that numerous educational institution administrators, for instance, online course designers, academic instructors, and users of online learning platforms, rationally consider learners' needs and demands. Implementation among users of online learning platforms could be generally simplified by this study's eight factors based on this model. As a result, this study suggests further research into the relationships between the complexity of online learning settings and the TAM as a theoretical approach to reasoned action with a role in online collaborative learning. This model postulates that users will accept a certain technology only when the factors that affect their decision to accept such a technology are already in place and influencing information technology behavior.

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## LIST OF ABBREVIATIONS

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TDT: Transactional Distance Theory  
CL: Collaborative Learning  
ICT: Information and Communications Technology  
TSC: Teacher-Students Communications  
SSC: Students-Students Communications  
SAA: Students' Academic Achievements  
SS: Student Satisfaction  
SA: Students Autonomy  
CR: Composite Reliability  
AVE: Average Variance Extracted  
HTMT: Heterotrait-Monotrait Ratio

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**APPENDIX**

***STUDY QUESTIONNAIRE SECOND SECTION***

<b>Teacher-Students Communications (TSC)</b>					
	<b>Strongly disagree</b>	<b>Dis-agree</b>	<b>Neu-tral</b>	<b>Agree</b>	<b>Strongly agree</b>
If I have an inquiry, my instructor will find time to answer.					
Instructor helps to identify problem areas in my study.					
Instructor gives me valuable feedback on my assignments.					
Instructor encourages me to participate in online sessions.					
It is easy for me to Communicate with my instructor online.					
<b>Students-Students Communications (SSC)</b>					
I work with my other colleagues' students					
I relate my work to my colleagues' work					
I share information with other students.					
I collaborate with other students online.					
We do group work as a part of our activities.					
<b>Collaborative learning (CL)</b>					
Collaborative learning experience in the computer-mediated communication environment is better than in a face-to-face learning environment.					
I felt part of a learning community in online learning sessions.					
I actively exchange my ideas with group members in online learning sessions.					
I am able to develop new skills and knowledge from other members in online sessions.					
I am able to develop problem solving skills through peer collaboration.					
Collaborative learning is effective in online learning classes.					
<b>Students' Academic Achievements (SAA)</b>					
Whenever I study online, all the necessary information will be provided for me (i.e., how to log in, how to end session).					
Whenever I study online, all instructions for using the materials will be provided (i.e., how to download materials, how to access links and videos).					
Whenever I study online, all discussion groups will be well organized (i.e., how to participate in a discussion, how to collaborate).					
Whenever I study online, grades will be returned in timely matters (i.e., I get grades immediately after I finish my quiz).					
I would take more online courses.					
I would recommend studying online to my colleagues.					



I consider studying online as an effective tool rather than face to face classes.					
I would enjoy my education more if all my classes were online.					
<b>Students' Satisfaction (SS)</b>					
I relate what I learn to my outside life of university.					
I always pursue topics that interest me.					
I connect my studies to my activities outside of class.					
I apply my everyday experiences in class.					
I am satisfied with online learning more than face to face classes.					
I can solve my own problems I face by reviewing the material provided online.					
<b>Students' Autonomy (SA)</b>					
I explore my own strategies for learning.					
I make my own decisions about my learning.					
I work during times I find convenient.					
I am in control of my learning.					
Online education is worth my time.					

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