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COVID-19 Pandemic and Blended Learning: A Quantitative Assessment of Revised Community of Inquiry (RCoI) Framework

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Abstract

Covid-19 has compelled educators to change their landscape for teaching and learning in higher education. This new landscape combines physical and virtual environments known as blended or hybrid learning models. The revised Community of Inquiry (RCoI) framework is a useful model for analyzing and improving the blended learning environments. This paper has used the Revised Community of Inquiry (RCoI) framework which involves Learner, Teaching, Social and Cognitive presence. This research tested the impact of RCoI on students learning with the moderating role of Technology. The data was collected from 462 students from 6 different universities in Karachi, Pakistan out of which, 150 were female and 312 were male students. Results indicated that Learner (Std β =0.096; p value<0.1), Teaching (Std β =0.128; p-value <0.05), Social (Std β =0.116; p-value <0.1), and Cognitive presence (Std β =0.378; p-value <0.01) have a positive impact on Students Learning. Technology increases Students Learning with Std β =0.184 and p-value <0.01. Further, technology moderates the relationship between Cognitive Presence and Students Learning with Std β = -0.129, p-value = 0.043. It was found that Technology reduces the cognitive presence of students and their learning. They are lesser involved in critical thinking and problem-solving. Universities must train teachers about the software tools and key pedagogical concepts to increase cognitive thinking for effective learning.

Keywords: blended teaching; COVID; hybrid teaching; learning management system; revised community of inquiry

Introduction

Towards the end of 2019, Wuhan Municipal Health Commission reported massive mysterious cases of pneumonia in Wuhan, China, later named Novel Corona Virus Disease (COVID-19) by the World Health Organization (WHO). Within two years, 150 million people got infected and 3 million died (Worldometer, 2021). WHO announced safety measures to prevent the spreading of the virus such as washing hands frequently, avoiding touching eyes, nose, and mouth, and maintaining the social distance of 1 meter. Social distancing affected the economic system as well as societies. The outbreak closed down many economies, shut down businesses which eventually led to massive layoffs and poverty. The education system was also widely disturbed as schools, colleges, and universities were shut down temporarily due to social distancing. Nearly 200 countries shut down schools (UNESCO, 2021).

Education institutions are a hub of social interaction and learning; therefore, it was an effective measure to control the transmission of COVID-19. The closure of education institutions altered the way of learning for more than half a billion children worldwide (Cohen & Kupferschmidt, 2020). Students, teachers, and staff moved to work from home during the crisis. Students have become virtual learners and parents have taken on the role of pseudo teachers. Distance learning has become the new normal and universities are prepared for both online and face-to-face teaching to meet the requirements. Interactive online classes and various communication applications have been used to ensure communication and learning between teachers and students.

The worldwide rapid shift to distance learning and education in response to COVID-19 calls for examining various classroom methods to gauge effective learning. Online education is the fastest-growing educational trend (Garbe, 2020). Nearly 1 million people got infected with COVID-19 in Pakistan (Government of Pakistan, 2021). Pakistan national education response and resilience plan (K-12) for COVID-19 was created in May 2020 to gauge the disruption in the education system in Pakistan. As per the K-12 directives, the government created a technology spectrum of learning for teachers and students. As per the spectrum learning will be continued with low-tech self-learning (TV, radio) or high-tech self-learning (smartphones, digital books, social media) or low-tech guided learning (teachers follow up calls, SMS based learning) or high-tech guided learning (Online digital

classes like Google meet and Zoom and blended classrooms). The closure of educational institutions required to implementation of a blend of different learning modalities with the focus on creating learning-centric resilience of the education system and expanding the outreach of education (Garbe, 2020). As COVID-19 forced academics to work from home, this sudden change of venue created challenges for universities, therefore, many universities which had the infrastructure or had the capital to buy different digital software implemented the online education system successfully. However, students faced a lot of difficulties due to lack of good Wifi or Internet Connections; power failures, and lack of infrastructure in remote areas of Pakistan. As such universities implemented Blended or Hybrid Learning methods of teaching with a combination of "flipped" classroom models.

In a traditional face-to-face course, learning and teaching are centered on the teacher (teacher-centric learning) and much of the class time is spent on the lecture. While in a hybrid or blended course, learning and teaching are centered on the student (student-centric learning) where both the traditional classroom lecture and online learning activities are used. A 'flipped classroom model, on the other hand, reverses the order of a lecture-based course where the lecture is already recorded and given to students to watch while the class time is used for in-class activities such as case studies, discussions, or presentations (Albert & Beaty, 2016; Buch & Warren, 2017; Green, 2015; Kim et al., 2017; O'Flaherty & Phillips, 2015; Phillips & Trainor, 2014; Prashar, 2016; Song & Kapur, 2017).

During the Coronavirus pandemic, universities experimented and implemented such hybrid models for the continuation of learning and safety of students, teachers, and staff. These blended or hybrid learning methods integrated learning and web-based technologies and there needs to be an investigation on the impact of such practices on student learning. As one of the major stakeholders in the education process, the experiences of students with remote learning are worth examining to inform future policy decision-making.

Several studies have been conducted on blended learning (Chaeruman, et. al, 2018; Johnson, & Misterek, 2017; Ocuaman, 2010; Zainuddin, & Keumala, 2018) while few studies have been conducted on RCoI framework (Shea, et al, 2012; Kim et al, 2014; Pool, et al, 2017). Most studies have used three dimensions of RCoI framework (Teaching Presence, Social Presence, Cognitive Presence) (Amemado,

& Manca, 2017; Stover, & Ziswiler, 2017; Popescu, & Badea, 2020). This study has used four dimensions (Teaching Presence, Social Presence, Cognitive Presence, Learner Presence) of RCoI and investigated the impact of RCoI on Student Learning with the moderating role of Technology Use (LMS). This was a quantitative study conducted on the University students of Karachi, Pakistan. No such studies have been conducted using these variables in the past.

Literature Review

The developing nature of technology has offered opportunities in the education sector especially in times of COVID-19 when they can be blended with traditional teaching. Technology provides infrastructure, tools, and resources during blended course preparation and delivery. Blended learning has helped to continue teaching and learning in times of pandemic when teachers work from home and students study from home. Pandemic has changed the way government and businesses operate, similarly, universities have also recognized that technology needs to be adapted to educate and learn as one cannot stop the growth and development of upcoming generations. Technology has contributed to the blended learning environments where information and knowledge are easily accessible through interactive technologies. Universities have explored effective learning environments using different technologies, such as electronic books, simulations, podcasts, blogs, vlogs. Covid-19 has pressured universities to move from the face-to-face mode of teaching towards online and blended learning models as technology supports the online delivery and preparation of courses (Ocuaman, 2010).

Blended/ Hybrid Learning

The culture of teaching and learning has transformed rapidly with the advent of media technologies. Blended learning incorporates the terms such as virtual learning, online learning, mobile learning. Blended learning is defined as a combination of both face-to-face and online learning. It integrates advanced online technologies with face-to-face teaching. It combines both synchronous (face-to-face interaction) and asynchronous (online learning activities on learning management systems). Synchronous learning occurs in real-time between learner and teacher. While asynchronous occurs anytime anywhere between learner and teacher (such as videos, presentations, articles, websites, assignments, activities in an online mode). The blended/hybrid model represents flexibility where teachers take on the

role of mentors, facilitators, consultants more than passive lecturers. The culture has been changed from teacher-centric to student-centric. Poon (2014) states that the digital age has brought opportunities inside and outside the class for learning and interaction. It allows learners to learn independently outside the classroom with accessibility to more material online. Blended learning was introduced in 2000 when e-learning was not successful (Zainuddin, 2017).

Under the blended mode of learning, discussions are taken both online and in class. Technology assists students to interact which makes the learning process more effective. The learning material can be delivered via Facebook, Blogs, Wiki, or Learning Management Systems (LMS). Teachers can provide feedback and solve queries through online platforms (Zainuddin, & Keumala, 2018).

Indeed, it requires careful planning by the teacher and appropriate tools and technology by the university to implement blended/ hybrid learning in courses. Teachers must have skills in using advanced technology and developing methods and materials to teach outside the classroom on the online LMS Platform. Teachers need to prepare the learning materials including videos (animated or simulated), online quizzes, assignments, and activities. Further, universities also need to have appropriate technical staff and infrastructure to accommodate blended learning. Senior teachers such as baby boomers have had issues in adopting advanced technology. If teachers are unable to make attractive and interesting videos then students will not watch them on LMS outside the classroom (Zainuddin, & Keumala, 2018).

Technology (Learning Management System) in Blended/ Hybrid Learning

Technology has been used in various forms for a long in education. Going back to the printing presses which printed books replaced slates and chalk. Eventually, television was used as a means for teaching through educational programs broadcasted. Today, computer and telecommunication technologies have greatly affected businesses and education. Campus technologies have given a competitive advantage to universities by integrating technology, teaching, and learning. Technology promotes knowledge sharing, facilitating distance learning and global collaboration. Most institutions recognize the role of technology in the classroom and administration. Technology has facilitated instant access, interactive experiences, and robust access to the teaching and learning environment (Ocuaman, 2010).

Educational institutions continuously find ways to leverage technology to facilitate learning environments that involve electronic books, simulations, podcasts, wikis, blogs, and learning management systems. These provide monitoring of online activities, administrative support, a repository of content materials, various assessment options, and collaborative tools (Ocuaman, 2010).

Blended learning is more effective than purely online learning. In blended courses, students have the 'best of both worlds. Learners can learn from anywhere in blended /hybrid learning mode with the use of the internet and online LMS platform. LMS is an electronic learning platform, also called a course management system. It is usually a web-based software, where all the online classroom materials are posted or uploaded. LMS contains a variety of content such as forums, videos, assessments, collaborations, lessons, etc. these include Blackboard, Moodle, Desire2Learn and Vclassrooming, Schoology, Blendspaces TES, and Google Classroom. Moodle is flexible, dynamic, and interactive. Web-based LMS provides content that supports effective blended learning (Krasnova, & Demeshko, 2015). LMS is flexible learning software that allows both individual and collaborative learning. Teachers can upload zoom lecture recordings, YouTube videos, PowerPoint presentations, word documents, multiple choice quizzes, pdf documents, to support their face-to-face lectures.

Students review the learning material uploaded on LMS and come to class with questions and concepts to debate. Activities in the class are focused on discussions and critical thinking questions to expand knowledge. Students with the help of presentations and simulation activities implement theories studied online. Teachers provide a synopsis of the concepts in class, facilitate students on dialogues, act as moderators in group discussions, help in solving problems, and guide in analyzing case studies. Teachers must integrate technology into teaching and learning and the internet supports this integration (Zainuddin, & Keumala, 2018). They must equip themselves with the tools to prepare course materials and manage a classroom. The teachers have become the 'creators' and 'designers' in delivering course materials. They must learn about these tools to support their pedagogical needs in the classroom (Ocuaman, (2010).

The Revised Community of Practice (RCoI) Analytic Framework

This study has deployed the Revised Community of Inquiry (Shea et al., 2012; Swan et al., 2012) to investigate the impact of blended/hybrid classroom models on the students learning moderated by technology use. The premise of this study is that student learning results from collaborative interaction between students and teachers actively participating in online LMS and RCOI framework conceptualizes four factors that contribute to the successful learning of students. They include; cognitive presence, social presence, teaching presence, and learner presence. Cognitive presence involves tasks related to knowledge building and creative thinking. Social presence involves tasks linked to interactive learning and collaborative activities. Teaching presence involves tasks related to designing, facilitating, and delivering the course activities. Learner presence involves tasks related to self-learning and self-regulations (Kim et al, 2014).

The RCoI framework is an important framework for describing and improving the blended/ hybrid education model. COI emphasizes different roles of strategic learners and teachers, while previous researches used social, teaching, and cognitive presence, then learner's presence was incorporated and converted into RCOI (Pool, 2017). Social presence involves connecting with members of a community. Cognitive presence involves the process of knowledge construction and Teaching presence involves the process of designing teaching instructions and different teaching structures to facilitate education. Learners' presence is important in an online setting where learners need to be self-directed and self-motivated to be engaged and learn. With the expansion of blended learning, research on learner's presence will provide insights into how self-regulated students effectively learn through online modes (Shea, et al., 2012)

Student Learning

There are two theories of student learning, behaviorism, and constructivist. The teacher-centric behavioral theory of student learning was advocated by B. F. Skinner and Albert Bandura. The behavioral theory states that students learn through behavior modeling. It involves lecture-based teaching with limited or no use of technology. However, the constructivist theory given by Jerome Bruner, Jean Piaget, and Lev Semyonovich Vygotsky states that classroom teaching should be student-centered and emphasize knowledge sharing and collaboration. Teachers act

as co-learners and guide students to acquire knowledge reciprocally. The premise of this theory is that learners are self-motivated and mature enough to actively be involved in knowledge acquisition and sharing.

Ocuaman, (2010) argues that technology plays an important role in students' active, constructive, intentional, authentic, and cooperative learning. This is influenced by the constructivist theory of learning. blended courses are characterized by constructivist theories which can integrate technology i.e. online delivery and face-to-face classroom delivery (Hybrid classroom). Blended courses have reduced traditional face-to-face instruction and increased web-based instruction methods which can enhance communication, and facilitate collaborative learning. Learners acquire sophisticated skills and knowledge with the appropriate use of technology. The use of technology facilitates the conceptualization of important topics before class by the students. They are involved in critical thinking, problem-solving, and decision making, through the use of technology and constructivism.

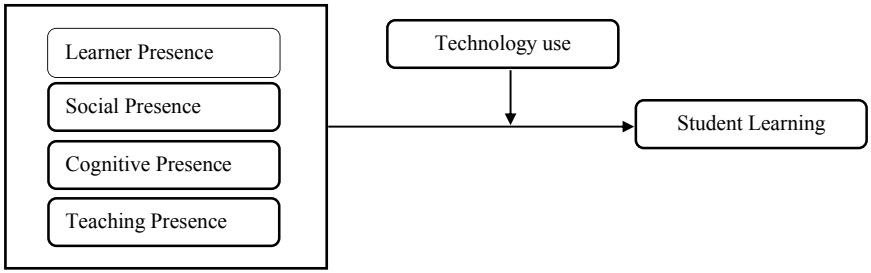
Active learning involves interaction and students are in control of how they learn and achieve their goals. Technology supports the learning process where students reflect, interpret, articulate, and collaborate using technology. Ocuaman, (2010) found that students in a blended course were more satisfied as compared to the students in a traditional course. Blended learning using technology helped them improve their skills. They had more positive experiences and they would prefer a blended course as a substitute to face-to-face teaching. This study advocates constructivism theory of learning as compared to behaviorism theories of learning given by B.F. Skinner and Albert Bandura.

Therefore, to address the existing gap in the literature of blended learning methods which involves the combination of face-to-face learning and online learning modes, this research has assessed the role of LMS between RCoI framework and student learning.

Figure 1

Conceptual Framework

The Revised Community of Practice (RCOI) Analytic Framework



Research Questions

1. Does the RCoI framework (learner, teaching, social, cognitive presence) affect students learning?
2. Does the technology use affect students learning?
3. Does Technology Use moderate the relationship between RCoI framework (learner, teaching, social and cognitive presence) and students' learning?

The first research question relates to the H_{a1}-H_{a4} hypotheses of the study. The second research question relates to the H_{a5} hypothesis of the study. The third research question relates to the H_{a6}-H_{a9} hypotheses of the study. To answer the above research questions, first, the analytic framework of RCoI was used as a theoretical basis for the research. Thereafter followed by the empirical results, discussion of the findings given the research conducted for instructors in higher education, and limitations of the study.

Hypotheses

RQ1.

H_{a1}. There is a relationship between Teaching Presence and Student Learning

H_{a2}. There is a relationship between Cognitive Presence and Student Learning

H_{a3}. There is a relationship between Social Presence and Student Learning

H_{a4}. There is a relationship between Learner Presence and Student Learning

RQ2.

H_{a5}. There is a relationship between Technology Use and Student Learning

RQ3.

H_{a6}. Technology Use moderates the relationship between Teaching Presence and Student Learning

H_{a7}. Technology Use moderates the relationship between Cognitive Presence and Student Learning

H_{a8}. Technology Use moderates the relationship between Social Presence and Student Learning

H_{a9}. Technology Use moderates the relationship between Learner Presence and Student Learning

Methodology

Research Design

This study used a quantitative research design to assess the causal relationship between independent, dependent, and moderating variables. This study has used Saunders, (2016) six layers of the onion model for developing research methodology. The six layers include; research philosophy, research approaches, research strategies, choices, time horizon, and techniques and procedures. The research philosophy in this study was positivism achieved through hypotheses development, data gathering, and evaluation. A deductive research approach was applied in this study through hypotheses development based on an existing theory and then testing the hypotheses using statistical measures (Silverman, 2013). Quantitative research was applied in this study as the scale was numeric and the mono method was used as the data was gathered from a single source. Cross-sectional data were gathered instead of longitudinal. Further, primary data was collected via a structured questionnaire from the students to test the hypotheses (Saunders, 2016).

Teacher presence, learner presence, social presence, and cognitive presence were independent variables taken from The RCoI analytic framework. technology/ LMS use was the moderating variable while student learning was the dependent variable. A survey method was used to collect the primary data from the university students of Karachi, Pakistan. A structured questionnaire was developed using already established scales from previous studies. These scales were adapted for cultural and technological differences in the Pakistani educational environment.

Sampling Technique

The target population in this study was university students. The data was collected from 6 universities in Karachi. The population was difficult to calculate thus; the sample size was unidentified. Convenience based unrestricted sampling technique was used. The questionnaire was created online and distributed to various faculties in these universities. These faculties collected the data from 474 students. Out of 474, 12 responses were incomplete and therefore dropped from the data. Finally, the data of 462 students were taken further for the results and data analysis. The confidentiality of information was kept.

Statistical Technique

Structural Equation Modelling was applied using the partial least squares method in SMART-PLS 3 software. All the direct and indirect hypotheses were tested in SMART-PLS 3. SPSS 21 version was used to assess the demographics of the sample collected.

Measures

The Revised Community of Practice (RCOI) Analytic Framework

The RCoI consists of four sub-variables; teaching presence; social presence; cognitive presence and learner presence. These sub-variables evaluated the specific features of the teaching orientation in the blended/hybrid classroom. The items of all four sub-variables were taken from Kim, et. al (2014) and adapted. There were 8 items for teaching presence; 8 items for a social presence; 8 items for cognitive presence and 9 items for learner presence. all these items used a four-level Likert scale; strongly disagree, disagree, agree, and strongly agree to range from 1 to 4.

Technology Use (LMS)

The technology use measure was used to indicate the extent to which students felt easy and comfortable when using the learning management system of the university in the hybrid course they studied during COVID. 4 items were taken from Kim, et. al (2014) and adapted. All these items used a four-level Likert scale; strongly disagree, disagree, agree, and strongly agree to range from 1 to 4.

Student Learning

Student Learning was measured using the perception of learning experiences scale developed by Ocuaman, (2010). 11 items measured content delivery, use of communication and collaboration tools, assessment tools, and learning experiences. All these items used a four-level Likert scale; strongly disagree, disagree, agree, and strongly agree to range from 1 to 4.

Data Analysis

Data was collected from 462 students from 6 different universities in Karachi, Pakistan. Table 1 shows the demographics of the sample collected in this study. 20 students were from university 1*; 79 students belonged from university 2*; 41 students were from university 3*; 130 students belonged to university 4*; 161 from university 5* and 31 from university 6*. The data was gathered from all the business programs of these universities. Out of 462, 150 were female students and 312 were male students. 124 were between 18-21 age group; 297 belonged to the age group of 21-30; while 41 were from the age bracket of 31-40.

Table 1

Demographics

Demographics		Frequency	Percent
University	University 1	20	4.3
	University 2	79	17.1
	University 3	41	8.9
	University 4	130	28.1
	University 5	161	34.8
	University 6	31	6.7
Gender	Female	150	32.5
	MALE	312	67.5
Age	18-21	124	26.8
	21-30	297	64.3
	31-40	41	8.9

N=462

Second generation SMART-PLS version 3.3.3 (Ringle et al., 2015) was used to test the measurement and structural model in this study. The measurement model tested for the mean, standard deviation, kurtosis, skewness, reliability, and validity

for the variables. After that, the structural model was tested using the bootstrap method.

Measurement Model

Convergent validity was tested using Average Variance Extracted (AVE) which must be >0.5 (Hair et al. 2020). Table 2 shows that AVE is greater than 0.5 thus there was convergent validity in this study. To test the reliability; composite reliability, rho_A, and Cronbach's alpha were used. Table 2 shows that all values are greater than 0.7 which shows good reliability. To test the discriminant validity, Heterotrait- Monotrait (HTMT) ratio (Henseler et al. 2015) was used. The HTMT ratios confirm that the constructs are distinct.

Table 2

Measurement Model

Variables	Mean	Std. Dev.	Kurtosis	Skewness	Alpha	rho_A	CR	AVE
TP	0.128	0.048	1.899	-0.792	0.916	0.918	0.931	0.630
CP	0.378	0.067	3.105	-0.719	0.903	0.903	0.922	0.597
SP	0.116	0.067	1.376	-0.602	0.884	0.888	0.909	0.590
LP	0.096	0.056	2.216	-0.562	0.813	0.816	0.870	0.572
TU	0.184	0.056	1.429	-0.504	0.783	0.788	0.860	0.607
SL	0.018	0.569	3.108	-0.979	0.849	0.852	0.893	0.625

Note: TP=Teaching Presence; CP= Cognitive Presence; SP=Social Presence; LP=Learner Presence; TU= Technology Use; SL= Student Learning; N=462

Table 3

Discriminant Validity (HTMT)

Variables	CP	LP	SL	SP	TP	TU
CP	-	-	-	-	-	-
LP	0.874	-	-	-	-	-
SL	0.882	0.814	-	-	-	-
SP	0.835	0.778	0.794	-	-	-
TP	0.782	0.719	0.747	0.789	-	-
TU	0.788	0.857	0.807	0.767	0.656	-

Note: TP=Teaching Presence; CP= Cognitive Presence; SP=Social Presence; LP=Learner Presence; TU= Technology Use; SL= Student Learning; N=462

Structural Model

To test the structural model, the Bootstrapping method was used with 5000 resamples suggested by Hair et al., (2020). Table 4 shows the hypotheses testing of both direct and indirect effects. Hypotheses 1 till 5 were direct and hypotheses 6-9 were indirect. Hypothesis 1 tested the relationship between teaching presence and student learning which was positive and accepted (Std. B= 0.128 and P value= 0.012). Hypothesis 2 tested the relationship between cognitive presence and student learning which was positive and accepted (Std. B=0.378 and P-value = 0.000). Hypothesis 3 tested the relationship between social presence and student learning which was positive and accepted (Std. B= 0.116 and P value= 0.071). Hypothesis 4 tested the relationship between learner presence and student learning which was positive and accepted (Std. B= 0.096 and P value= 0.088). Hypothesis 5 tested the relationship between technology use and student learning which was positive and accepted (Std. B= 0.184 and P value= 0.001). Hypothesis 6 tested the moderation of technology use between teaching presence and student learning which was rejected (Std. B= -0.011 and P value= 0.872). Hypothesis 7 tested the moderation of technology use between cognitive presence and student learning which was accepted (Std. B=-0.129 and P value=0.043). Hypothesis 8 tested the moderation of Technology Use between Social Presence and student learning which was rejected (Std. B= 0.074 and P value=0.302). Hypothesis 9 tested the moderation of technology use between learner presence and student learning which was rejected (Std. B=0.038 and P value=0.408). The results conclude that teaching, social, cognitive, and learner presence directly affect student learning thus h_{a1}-h_{a4} were accepted and RQ1 is satisfied. It was also found that technology use (LMS) directly affects student learning, hence H_{a5} is also accepted and research question RQ2 is satisfied. While, technology use (LMS) only moderates the relationship between cognitive presence and student learning, thus, research question 3 is partially accepted as the technology use does not moderate social, learner and teaching presence and student learning. Only H_{a7} was accepted.

Figure 2 shows the structural equation model in SMART-PLS software. Only one moderation effect was significant which was the role of technology between cognitive presence and student learning. Figure 3 shows the interaction plot of technology use (TU) between cognitive presence (CP) and student learning (SL). The interaction plot was used to visualize the interaction effect. The interaction plot presented in Figure 3 shows that the relationship between cognitive presence

and student learning is stronger if the technology use (LMS) is low. It means that technology or interaction on LMS reduces the cognitive processing of students. They tend to be less involved in critical thinking. This is a downside of technology which may mean that we are creating robots.

Table 4

Hypothesis Testing

Hypotheses	Relationship	Std. β	Std. Dev.	t-value	p-value	BCI LL	BCI UL	f2	Decision
1	TP -> SL	0.128	0.048	2.536	0.012	0.012	0.205	0.018	Accept**
2	CP -> SL	0.378	0.067	5.653	0.000	0.253	0.507	0.126	Accept***
3	SP -> SL	0.116	0.067	1.807	0.071	-0.006	0.258	0.016	Accept*
4	LP -> SL	0.096	0.056	1.709	0.088	0.003	0.206	0.010	Accept*
5	TU -> SL	0.184	0.056	3.258	0.001	0.066	0.287	0.045	Accept***
6	Moderating Effect (TP*TU) -> SL	-0.011	0.066	0.161	0.872	-0.127	0.126	0.000	Reject
7	Moderating Effect (CP*TU) -> SL	-0.129	0.068	2.031	0.043	-0.271	-0.011	0.018	Accept**
8	Moderating Effect (SP*TU) -> SL	0.074	0.075	1.034	0.302	-0.054	0.225	0.009	Reject
9	Moderating Effect (LP*TU) -> SL	0.038	0.053	0.829	0.408	-0.050	0.153	0.003	Reject

Note: TP=Teaching Presence; CP= Cognitive Presence; SP=Social Presence; LP=Learner Presence; TU= Technology Use; SL= Student Learning; N=462; ***<0.001; **<0.05; *<0.1

Figure 2

Structural Model in SMART-PLS

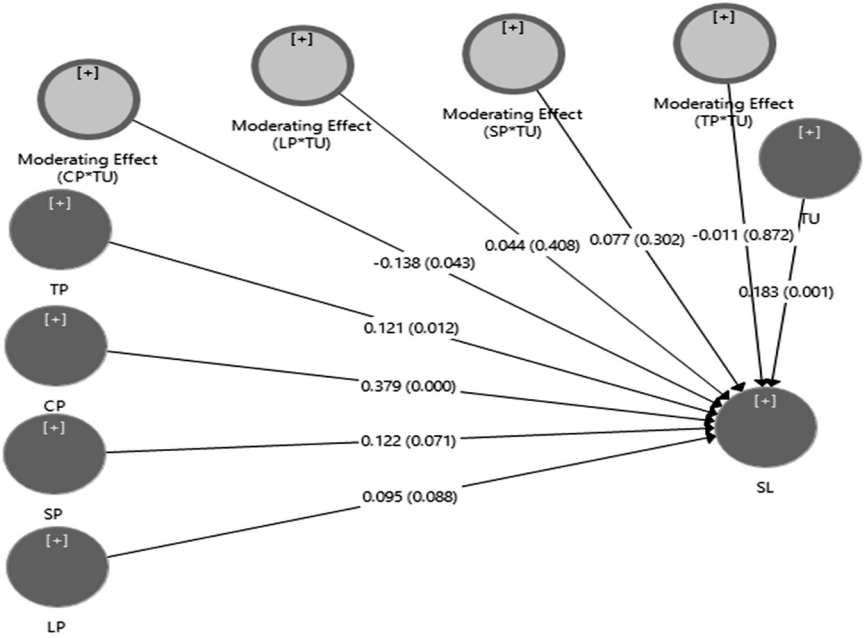
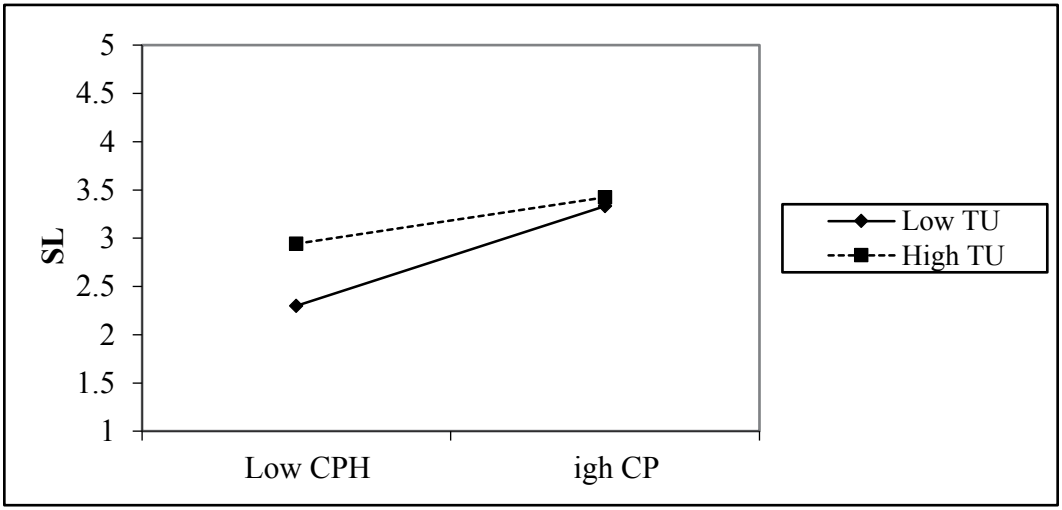


Figure 3

Interaction Effect of Technology Use (TU) between Cognitive Presence (CP) and Student Learning (SL)



Discussion

This study found that teaching presence, social presence, cognitive presence, and learner presence directly and positively affect student learning thus research question RQ1 is satisfied. It was also found that technology use (LMS) directly and positively affects student learning thus research question RQ2 is also satisfied. However, as for the research question RQ3, technology use (LMS) only moderates the relationship between cognitive presence and student learning, such that cognitive thinking decreases as technology involvement increases. As per this study, technology does not moderate the relationship between learner, teaching, and social presence, and student learning. The significant and strongest relationship was found between cognitive presence and student learning in this study with a beta coefficient of 0.378. The only recent study conducted by Pool, et al, (2017) on RCoI found that time-management, coordination, and task management skills influence the learning presence and increase learning in a blended teaching environment effectively.

University students are now using an online learning management system (LMS) mostly due to Covid-19 Pandemic. The participants in the study showed a positive attitude towards using technology (LMS) in a blended course. Young (2002) found high levels of student and teacher satisfaction in blended courses. Also, he found that students' knowledge was higher in online teaching as compared to face-to-face classroom teaching. Similarly, this study also supports the findings of Reasons et al., (2005) which suggested that online courses support student learning as compared to any other format due to course participation, grades, and interaction with the learning management system. Ocuaman, (2010) found that students in blended and face-to-face classrooms indicated a positive attitude towards the use of technology.

The aim of this research has been realized and it has confirmed the findings of Kim, et al, (2014); Kim, et al, (2017) and Pool, et al, (2017) that RCoI plays an important role in blended learning environments. Kim, et al, (2014) proposed a design framework and 9 design principles using the RCoI framework as a theory-driven base in a flipped classroom model. They identified how these principles affect student learning in a blended setting. Hence these studies support the findings of these studies.

Conclusion and Recommendations

Based on the results of this study, blended courses can be as effective as classroom-based courses. The students in a blended course experience a new way to enhance their learning. The perception of students indicated positive learning experiences and consider a blended course as an alternative to face-to-face classroom teaching. This study highlighted the use of technology in a blended learning environment. Technology helps in the integration of technology in the learning environment. As LMS is a platform where learning material is shared, communications and interaction, take place. LMS frees the learners from time constraints, the social pressure of the classroom, the need for instant reflection/ reaction or response, etc. It is accessible and available to students and faculty to expand their teaching and learning experiences.

Educators and policymakers must provide training programs on the use of LMS for effective blended learning. Universities must also hire support staff to train teachers about the software tools and key pedagogical concepts. This will increase the teacher-student communication for effective learning.

This study has used the role of technology with the tool known as a learning management system. The role of assistive technologies and applications like online spelling and grammar checkers; computational writing tools such as automatic critiques, automatic text summarizers, automatic abstract generators have not been taken into consideration in this study. These applications help students and may slow down their cognitive capability. Future studies may measure the impact of technology using the aforementioned assistive technologies on the cognitive development or cognitive retardation of the learners or students.

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