

Embracing The Lessons Learned From COVID-19: Predicting Factors of Effective Online Remote Learning

Azila Akmar Romzi^{1*}, Wardatul Hayat Adnan²

¹Faculty of Communication & Media Studies, Universiti Teknologi MARA (UiTM), 40450 Shah Alam, Selangor, Malaysia.

Email: work.azilaakmar@gmail.com

²Faculty of Communication & Media Studies, Universiti Teknologi MARA (UiTM), 40450 Shah Alam, Selangor, Malaysia.

Email: wardatul@uitm.edu.my

ABSTRACT

CORRESPONDING AUTHOR (*):

Azila Akmar Romzi
(work.azilaakmar@gmail.com)

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The unprecedented event of COVID-19 pandemic altered the traditional face-to-face learning to online remote learning (ORL). The abrupt transition raised concerns about the effectiveness, particularly in relation to students' motivation, knowledge, and skills. This research examines the predictive factors that contribute to effective ORL during COVID-19 by adopting the individual factors of Computer-Mediated Communication Competence (CMC) Model. A quantitative research design was employed, a set of structured questionnaires distributed to undergraduate students from public and private universities in Malaysia. A total of 384 valid responses were collected and statistically analysed using Pearson correlation and multiple regression analyses. The findings revealed significant and strong correlations between motivation and ORL effectiveness ($r = .877$), knowledge and ORL effectiveness ($r = .884$), and skills and ORL effectiveness ($r = .881$). Multiple regression analysis results further demonstrated that individual factors of students' motivation, knowledge and skills collectively exhibited strong predictive power explained 85% of the variance in ORL effectiveness ($R^2 = .850$). The empirical findings suggest that students who are motivated, possess adequate knowledge, and are equipped with relevant skills are more likely to experience effective ORL. Although the pandemic has subsided and academic delivery has resumed to conventional face-to-face learning, the lessons learned from the implementation of ORL remain relevant for future educational practice. The findings contribute to better understanding of the determinants of effective online learning that may assist educational stakeholders in enhancing the quality of learning to support inclusive, equitable and sustainable education beyond times of crisis, particularly in an increasingly digital-driven world.

Contribution/Originality: This study extends the Computer-Mediated Communication (CMC) Competence Model application in online remote learning (ORL)

context among undergraduates in Malaysian public and private universities. The findings provide empirical evidence on the predictive factors of students' motivation, knowledge, and skills in determining online learning effectiveness, offering insights for higher education stakeholders to enhance online learning quality and support inclusive, equitable, sustainable education beyond crisis periods.

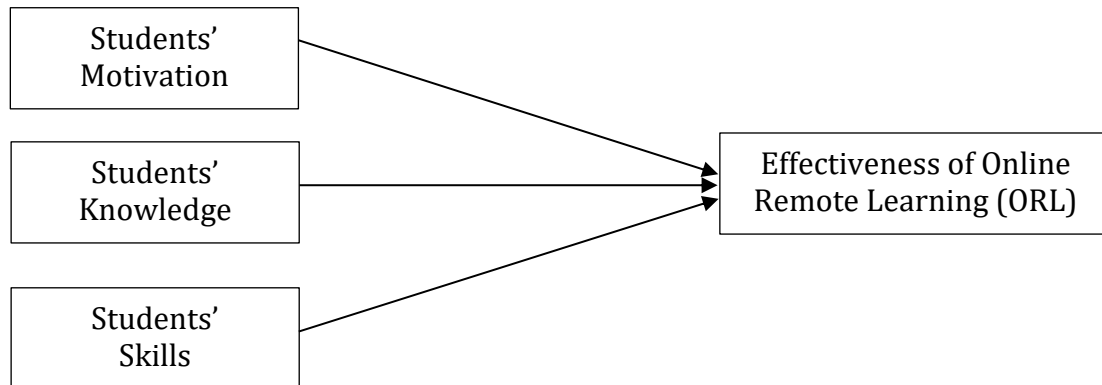
1. Introduction

The enforcement of Movement Control Order 1.0 (MCO 1.0) which effective immediately on 18 March 2020 bound under the Prevention and Control of Infectious Diseases Act 1988 and the Police Act 1967, addressed the mandatory closure of all academic institutions included higher learning (JAPEN, 2020). Thus, to safeguard the delivery of all academic programmes, new mode of learning was introduced as per advisory guidelines to acknowledge Higher Education Provider (HEPs) to prepare for the extension plan of academic programmes through online remote learning, ORL (Malaysian Qualifications Agency [MQA], Advisory Note No. 4/2020). ORL was refer to the mode of academic programme being delivered in higher education context during MCO. Meanwhile, lower subordinate of academic curriculum like primary and secondary school referred as home-based teaching and learning (Pengajaran dan Pembelajaran di Rumah [PdPR]). Asides, literature confirmed that there are a few other terms that previous researchers used to refer to academic delivery during COVID-19. Several other terms included Emergency Remote Learning, *Emergency Remote Learning*, *Emergency Online Learning*, *Online Learning during COVID-19*, and *COVID Online Learning (COL)*. By January 2021, UNESCO data demonstrated two-thirds of academic year lost. As the crisis enters its second year, UNESCO reported that more than 1.5 billion students worldwide affected by the historic disruption of the COVID-19 pandemic (UNESCO,2021). Although most of the academic programmes have since resumed conventional traditional face-to-face learning, but education is still in need of recovery by assessing the damage done and lessons learned from pandemic and drawing lessons from the implementation of emergency online learning (UNESCO, 2021).

In complying with the social distancing requirements, Higher Education Institute (HEIs) introduced Online Remote Learning (ORL) by adopting an approach of Online Distance Learning (ODL). The transition of teaching and learning to ORL somehow does not conventionally fully convert the method of ODL (Malaysian Qualifications Agency [MQA], Advisory Note No. 4/2020). Some research acknowledged online learning during COVID-19 is unprecedented event (Chung et al., 2020). For many students, it was their first experience participating in ORL (Mahyoob, 2021) Consequently, students were compelled to adapt quickly to online learning during the COVID-19 pandemic (Mustapha & Devarajoo, 2021), often without adequate preparation or prior experience. As ORL relies heavily on computer technologies and digital device, students' knowledge and skills are essential for effective participation. Students who accustomed to conventional face-to-face learning were required to familiarise themselves with the online learning mode and digital technologies (Salas-Pilco et al., 2022). According to the The Computer-Mediated Communication Competence (CMC) Model effective communication through computer-mediated platforms—including WhatsApp, Google Meet, and Zoom—requires individuals to possess motivation, knowledge, and communication skills (Spitzberg, 2006). Guided by this theoretical framework, the present study examines students' motivation, knowledge, and skills as individual factors influencing the effectiveness of Online Remote

Learning. A conceptual framework for the present study was developed to achieve the study objectives as per Figure 1 below.

Figure 1: Conceptual Framework



1.1. Research Objectives

The present study aims to achieve the following objectives.

- i. Research objective 1: To examine relationships between students' motivation and the Online Remote Learning (ORL) Effectiveness.
- ii. Research objective 2: To examine relationships between students' knowledge and the Online Remote Learning (ORL) Effectiveness.
- iii. Research objective 2: To examine relationships between students' skills and the Online Remote Learning (ORL) Effectiveness.
- iv. Research objective 2: To determine whether students' motivation, knowledge and skills significantly predict the Online Remote Learning (ORL) Effectiveness.

2. Literature Review

2.1. Online Remote Learning

Online Learning in Malaysia had established since 1996, denoted by previous term of Open and Distance Learning (ODL) practice (MIDA, 2021). Unlike ODL, Online Remote Learning (ORL) was introduced by Higher Education Institutions (HEIs) as an emergency approach to safeguard academic delivery during COVID-19 pandemic. Although ORL adopted many features of ODL, the transition does not conventionally fully convert the method of delivery to ODL (Malaysian Qualifications Agency [MQA], Advisory Note No. 4/2020, 2020). ORL refers to the mode of academic programme delivery in higher education context during Movement Control Order (MCO) to maintain balance between reassurance of academic continuity and at the same time considering prevention measure and limiting morbidity during pandemic. Scholars highlights that the rapid transition to an online learning under emergency circumstances should not be equated with properly planned online education, which is supported by appropriate technological infrastructure, instructional design, and pedagogical planning. (Hodges et al., 2020; Fuchs, 2022; Misiejuk et al., 2023). Consequently, students were compelled to adapt quickly to online learning during the COVID-19 pandemic (Mustapha, 2020). The implementation of ORL differed substantially from the conventional ODL as the practice immediately effective with limited guidelines which requiring students to adapt to an unfamiliar learning environment with lack of preparation. Unlike systematically planned

ODL programmes, adapting ORL for first time posed a major challenge for university students, many of whom had no prior experience with online learning (Mahyoob, 2021).

As the implementation of ORL was unprecedented, the implication raised uncertainty particularly related to students' motivation to adapt and engage in ORL. Students who were unprepared for the sudden transition experienced significant psychological pressure with numerous adverse effects in which can be understand and describe in various terms included anxiety, fear, and worry asides others (Cao et al., 2020). Some presented symptoms of anxiety and depression (Campos et al., 2021), while more severe case involved suicidal ideation, severe distress, and high levels of perceived stress (Wathelet et al., 2020). Furthermore, students were likely to experience anxiety about their ability to succeed in an unfamiliar learning environment, which could adversely affect their motivation (Abdous, 2019). Given the abrupt shift, many students had insufficient time to adapt to the new mode of learning, resulting in lower levels of motivation during online classes throughout the pandemic (Fridkin et al., 2023; Gómez-García et al., 2022). In addition, unequal access to appropriate essential infrastructure, such as compatible device and reliable internet connectivity, emerged as significant barrier for students to implement ORL as students come from diverse socioeconomic background (Azman, 2021). further intensified existing educational inequalities, disproportionately affecting students from lower socioeconomic backgrounds, and highlighting differences in students' capacity to adapt to online learning (Ivanov et al., 2025). Consequently, these inequalities may widen learning disparities and compromise the principle of equitable education. Moreover, access alone is insufficient. L. Limited digital literacy further complicates students' ability to successfully adapt to ORL (Mansor, 2021). Effective participation in ORL requires students to adequate fundamental knowledge and skills to utilise digital tools, navigate online learning platforms and actively engage in learning activities mediated through computer tools. Without these individual competencies, students may encounter substantial difficulties in participating effectively in ORL thereby adversely reduce the overall effectiveness of ORL.

2.2. Online Remote Learning

The conceptual understanding of effectiveness has evolved from measuring the relationships between attainable goals and achieved outcomes. One of earliest definition was proposed by Fraser (1994), who defined effectiveness as the degree of alignment between predetermined goals and actual achievements. Similarly, Erlendsson (2002) described effectiveness as the extent to which intended objectives are successfully accomplished. Although both definitions provide valuable conceptual insights, neither explicitly addressed effectiveness within educational context. A more education-specific perspective was offered by UNESCO (2004) which highlights effectiveness as the extent to which educational institutions achieve predetermined requirements of educational objectives and quality standard. Likewise, Blicher (2009) associated learning effectiveness with the successful attainment of learning goals and quality of Internet-based teaching and learning mediated through technology. Subsequently, the concept of effectiveness expanded emphasizing not only the achievement of intended outcomes but also continuous quality improvement. Despite these established definitions of effectiveness from previous scholar, the implementation of ORL during COVID-19 pandemic making the effectiveness of ORL a continuing concern educational stakeholders and highlighting the need to explore its determinants.

As the concept of effectiveness closely associated with educational quality, the implementation of ORL presented markedly different atmosphere in which students raised concerns regarding the quality of their learning experience. Mustapha and Devarajoo (2021) found that Malaysian undergraduate students reported mixed experiences with online learning during the pandemic. Similar concerns on maintaining quality of teaching during ORL were also expressed by lecturer, many of whom were conducting fully online classes for the first time. Likewise, parents and general public also questioned the quality and effectiveness of ORL during the crisis time. Consequently, ORL effectiveness is therefore required extensive empirical investigation as previous existing literature have focused and reported conventional online learning effectiveness rather than emergency online learning implemented during the COVID-19 pandemic. Tsang et al. (2021) highlights the distinctive different of COVID-19 Online Learning which referred as (CoOL) in the research from traditional online learning due to immediate implementation and limited preparation time. As the time factor may influence the effectiveness thus it is necessary to investigate other factors that may have adverse effect on ORL effectiveness to address the concerns raised. While previous scholar primarily focused solely on external factors, such as technological infrastructure, institutional support, and teaching strategies, thus may underestimated the role of students as the primary participations in the ORL. Therefore, examining students' individual factors is fundamental in understanding predictive factors of ORL effectiveness.

2.3. Computer Mediated-Communication

Computer-Mediated Communication (CMC) refers to communication that is established through computer-mediated technologies, including email, online learning platforms, video conferencing, and other digital communication tools. Walther and Parks (2002) were among the scholars who provided an early conceptual definition of CMC, emphasising communication that occurred primarily through text-based interactions in which meaning was exchanged through computer-mediated messages. The definition however solely reflects earlier stage of computer-mediated communication when communication technologies were largely limited to text-based platforms. Subsequently, rapid advancement in communication technologies expanded the scope of CMC broader beyond text-based interactions to include synchronous two-way simultaneous audio and video communication. Bubas (2003) argued that CMC should not be limited to specific technologies interaction such as email because computer-mediated communication increasingly encompasses wide range of interaction. Therefore, from fundamental context, CMC primarily understood as the process of exchanging messages between individuals or groups communication through computer-mediated technologies. The concept is reflected in CMC through implementation of ORL during teaching and learning, where interaction between students and lecturers are facilitated via online platforms such as WhatsApp, Google Meet, and Zoom and mediated through computerized tools. These platforms enable communication and learning through computer-mediated technologies, making the CMC model an appropriated underlying theoretical framework. The model proposes that effective communication in computer-mediated environments depends on individuals possessing adequate motivation, knowledge, and skills (Spitzberg, 2006). Therefore, these three individual competencies are examined as the key predictors of ORL effectiveness among undergraduate students.

2.4. Computer Mediated-Communication Competence (CMC) Model

The theoretical foundation of Computer-Mediated Communication Competence (CMC) Model originated from the work of Brian H. Spitzberg who sought to explain effective communication in the context of computerized environments. The model was derived from theoretical discussion on communication competence, which proposes that effective communication through computer-mediated technologies depends on individuals' motivation, knowledge, and skills within a given appropriate communication context. Spitzberg subsequently integrated the three components as individual factors that interact to influence communication effectiveness. In the CMC Model (Spitzberg, 2006), motivation, and knowledge are conceptualised as the primary individual factors that contribute to effective communication in computer-mediated environments. Although the complete model of CMC incorporates other factors such as conceptual, media, and message-related factors that may influence the outcomes, the present study focused exclusively on the individual factors of motivation, knowledge, and skills for conceptual understanding of effective communication. This focus is consistent with the research objectives of examining how these factors contribute to the effectiveness of ORL among university students.

As this study implements CMC Model within the context of higher education, the CMC Model has been widely applied and adapted by scholars since early stage of development. During the preliminary development, several studies had tested its applicability across different contexts. Harper (2000), for example, employed CMC Model among African American college students and found that some components were not statistically significant, resulting in subsequent modifications of the model. Similarly, Bunz (2001), in developing the Computer-Email-Web (CEW) Fluency Scale, eliminated several contextual and message-related factors due to low reliability. Later, Bubas (2003) adapted the application of CMC Model within a higher educational setting involving Croatian university students. The overall findings concluded that the framework of CMC could be tailored to support competencies required for online learning and training. Subsequent studies continued to implement the model in computer-mediated learning environments. For instance, Sherblom et al. (2013) highlighted the importance of knowledge as a key competency for successful collaborative online learning. Collectively, all prior research demonstrates the relevance, adaptability and empirical applicability of the CMC Model as the underlying theoretical framework for examining the effectiveness of Online Remote Learning among undergraduate university students across different contexts.

3. Research Methods

3.1. Population and Sampling

This study employed a quantitative research design. As quantitative research required the collection and analysis of numerical data from a representative group of respondents, the identification of an appropriate population and sample was essential. According to the sample size tables developed by Krejcie and Morgan (1970) and Cohen, Manion, and Morrison (2001), a minimum sample of 384 respondents is sufficient for a population exceeding approximately 600,000. Two set of samples drew from population of undergraduate students of both public and private university in Malaysia using stratified random sampling technique which give the division of 226 sample represent 59.78% undergraduates from public university and 158 sample represent 41.22% of undergraduates from private university. Table 1 presented the proportional distribution of the sample.

Table 1: Sample Size Proportion of Undergraduate Students of Public and Private University in Malaysia

Category	Public University	Private University	Total
Undergraduate Population	375,904	263,555	639,459
Proportion (%)	58.78	41.22	100
Sample Size (N)	226	158	384

3.2. Research Instrument

A structured questionnaire was developed to examine the predictive factors contributing to the effectiveness of Online Remote Learning during the COVID-19 pandemic by adopting individual factors of Computer-Mediated Communication Competence (CMC) Model. Guided by research conceptual framework, the questionnaire was adapted from the original CMC Model to suit the context of this study and align with research objectives. The questionnaire comprised of 5 sections. Section A collected respondent's demographic information of gender, age, race, and educational background of enrolled university and course disciplines. Section B, C, D and E, employed a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Section B, C and D each consisted of ten items measuring the constructs of motivation, knowledge, and skills, respectively. Section E consisted of items measuring the effectiveness of ORL, which served as the dependent variable in this study.

Prior to actual data collection, a pilot test involving 30 undergraduates was administered to establish the instrument reliability and validity of the variables measured are within acceptable ranges. Specifically, the reliability coefficient for the variables is greater than 0.50, suggesting that the measurements are consistent and reliable for this preliminary phase. Additionally, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy is 0.774, which is well above the minimum threshold of 0.6, indicating that the data is suitable for factor analysis and that the sampling is adequate for the study's purposes. Furthermore, The result of skewness and kurtosis exhibits the value for all variables ranged in between -1.18 to -0.67 which show that the distribution are negatively skewed. This mean that the respondents tend to choose higher value as respond for statement in survey items. All four constructs of motivation, knowledge, skills, and effectiveness tend to distribute normally based on kurtosis values that ranged from 0.33 to 1.02. Both skewness and kurtosis value for the data fall within acceptable range of ± 3 , which is a critical assumption for many statistical analyses.

Table 2: The Value of The Cronbach's Alpha Coefficient for the Internal Consistency of Each Dimension of The Study Variables

Section	Variable	Cronbach's Alpha	Internal Consistency
B	Motivation	0.952	Excellent
C	Knowledge	0.956	Excellent
D	Skills	0.977	Excellent
E	Effectiveness	0.961	Excellent

To ascertain the internal reliability of these instruments, a reliability analysis, specifically using Cronbach's Alpha, was conducted. Table 2 illustrates the result of Cronbach's Alpha

for each variable in the study. The study refers to general acceptable rule of Cronbach's Alpha in which 0.7-0.8 considers acceptable level of reliability, meanwhile 0.8 and above indicates good and any value above 0.9 is very excellent. This finding shows that all the Cronbach's Alpha (α) value for each section is more than 0.7 which surpass the minimum interpretation value for variable to be accepted (Edelsbrunner et al., 2025). Result from all sections show excellent reliability denotes by the value of 0.952 for Section B (Motivation), 0.956 for Section C (Knowledge) and highest value of 0.977 for Section D (Skill) and 0.961 for Section E (Effectiveness). Hence, it shows that items under all sections are highly reliable. Following the completion of data collection, the data were analysed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics, Pearson correlation analysis, and multiple regression analysis were performed to address the research objectives and test the proposed hypotheses.

4. Results

4.1. Finding for relationships between students' motivation, knowledge, and skill with the effectiveness of online remote learning.

Correlation is statistical procedure that enable researcher to explore relationships between variables. Thus, a possible prediction can be made from one variable in terms of other variables. The relationships can be described as either strong, weak or no relationships at all. The discussion in this section indicates the correlation coefficients, (r) value where values closer to 1 indicate stronger positive relationships. The results are presented according to Research Objective 1, 2, and 3 and correlation coefficients, (r) value for each variable tabulated in Table 3.

Table 3: The Pearson Correlation Analysis

Hypothesis	Relationship	Pearson Correlation n (r)	Correlation Interpretation
H1	Motivation – Effectiveness	.877	Very Strong
H2	Knowledge – Effectiveness	.884	Very Strong
H3	Skills – Effectiveness	.881	Very Strong

Research Objective 1: To examine relationships between students' motivation and the effectiveness of Online Remote Learning.

H1: There is a significant relationships between students' motivation and the effectiveness of Online Remote Learning.

Research Question 1 sought to examine the relationship between students' motivation and the effectiveness of ORL. H1 proposed that there is a significant relationship between motivation and the effectiveness of ORL. The findings reveal the Pearson's correlation coefficient between students' motivation and the effectiveness was $r = .877$. This indicated very strong positive relationships. The finding suggests that students with higher levels of motivation are more likely to experience effective ORL. As the student

motivation higher, the effectiveness of online remote learning also improves. Thus, H1 is accepted.

Research Objective 2: To examine relationships between students' knowledge and the effectiveness of Online Remote Learning.

H2: There is a significant relationships between students' knowledge and the effectiveness of Online Remote Learning.

Research Question 2 examined the relationships between students' knowledge and the effectiveness of ORL. H2 proposed that there is a significant relationship between knowledge and the effectiveness of ORL. The Pearson correlation analysis revealed a correlation coefficient of $r = .884$, indicating a very strong positive relationship between student' knowledge and ORL effectiveness. This finding implies that students who possess greater knowledge regarding online learning and digital technologies are more likely to achieve effective learning in an ORL environment. Therefore, H2 was supported.

Research Objective 3: To examine relationships between students' skills and the effectiveness of Online Remote Learning.

H3: There is a significant relationships between students' skills and the effectiveness of Online Remote Learning.

Research Question 2 investigated the relationships between students' skills and the effectiveness of ORL. H3 proposed that there is a significant relationship between skills and the effectiveness of ORL. Result indicates there is very strong correlation between student s' skill and effectiveness of online remote learning with r value of 0.881. This finding suggests that students who are equipped with the necessary digital skills are more likely to engage effectively in ORL. As student is well equipped, the overall learning experience during ORL also improves along with the effectiveness perpendicularly. Hence H3 is also accepted.

Overall, the findings indicate that students' motivation, knowledge, and skills are all strongly associated with ORL effectiveness. Among the three variables, knowledge demonstrated the strongest relationship with ORL effectiveness ($r = .884$), followed by skills ($r = .881$) and motivation ($r = .877$). The results provide empirical support for the proposition of the CMC Competence Model that individual factors play an important role in determining the effectiveness of computer-mediated learning environments.

4.2. Finding for predicting factors of Online Remote Learning effectiveness.

The underlying factors that influence the effectiveness of Online Remote Learning among undergraduates are determine in this study. Regression analysis is performed to determine to what extent independent variable predicts dependent variable and the results yield the R-square value (R^2) to show predictive power. R^2 that is equal to absolute zero means no variability towards dependent variable. The higher the R^2 value or the closer the value to 1, the larger the proportion of the variance in dependent variable and vice versa. Lower value closer to 0, indicate smaller proportion. The data presents in the Table 4 of the next section discuss the finding of Research Objective 4.

Table 4: The Regression Analysis

Hypothesis	Relationship	(R ²)	Percentage (%)	Interpretation
H1	Motivation - Effectiveness	.770	77.0%	Strong
H2	Knowledge - Effectiveness	.781	78.1%	Strong
H3	Skill - Effectiveness	.776	77.6%	Strong
H4	Motivation, Knowledge, Skill - Effectiveness	.850	85.0%	Very Strong

Research Objective 4: To determine whether motivation, knowledge and skills significantly predict the Online Remote Learning (ORL) Effectiveness.

H4: Motivation, knowledge, and skills are good predictors to effectiveness of online remote learning.

Research Question 4 determine whether students' motivation, knowledge and skills are good predictors to effectiveness of ORL. H4 proposed that motivation, knowledge, and skills are good predictors to effectiveness of online remote learning. The R² value for all predictors treat as individual factor shows strong interpretation. Knowledge scores the highest (R² = 0.781) suggesting that knowledge is a strongest predictor of effective ORL, as compared to skill (R² = 0.776) and motivation (R² = 0.770). All predictors have strong effect on dependent variable with more than 77% variance. Thus, each predictor is proven contribute substantially to the effectiveness of ORL. Meanwhile, when all the three independent variables are treated as combination factors, R² value increase to 85% (R = 0.850) which indicates higher predicting power, suggesting that ORL effectiveness is best understood through the combined factor of students' motivation, knowledge, and skills rather than any single factor alone. In other words, the integration of all predictors of students' motivation, knowledge, and skills collectively play a significant role in determining the ORL effectiveness. Thus, H4 is confirming to be accepted in both condition either motivation, knowledge and skill treat as individual factor that give impact of towards ORL effectiveness or integrated as one predictive factor to predict an effective remote learning.

5. Conclusion

5.1. Practical implications

The sustainability of online learning is expected to evolve towards more hybrid and flexible approaches as the challenges experienced during the Covid-19 pandemic are increasingly understood and transformed into opportunities (Adedoyin & Soykan, 2023). In this regard, the present study explored students' experiences with ORL and transformed these insights into meaningful implications for students, educational institutions, policymakers, and the broader education system. The findings indicate that motivation, knowledge, and skills are significant contributors to the effectiveness of Online Remote Learning (ORL). Therefore, students should continuously develop these competencies to enhance their learning experience and become more independent learners. For higher education institutions, the findings highlight the importance of providing adequate support, training, and resources to strengthen students' motivation, knowledge, and digital skills. Universities may also use these findings to develop more

effective online learning strategies and standardised practices that ensure quality, accessibility, and consistency in online and hybrid learning environments. In addition, the study supports Sustainable Development Goal 4 (SDG 4) by promoting quality, inclusive, and equitable education through effective online learning. The findings also provide useful evidence for policymakers in improving online education policies and strengthening the quality of higher education in an increasingly digital world.

5.2. Theoretical implications

This study provides an evident that ORL is different from the established ODL. Research findings contribute to the growing body of knowledge on online learning by providing empirical evidence on the role of students' motivation, knowledge, and skills in determining the effectiveness of ORL. Although previous studies have examined online learning effectiveness, limited research has investigated these three individual factors collectively as predictors of ORL effectiveness during the Covid-19 pandemic. The results confirmed that motivation, knowledge, and skills significantly contribute to effective ORL, suggesting that quality online learning can still be achieved despite the challenges associated with crisis-driven educational transitions. Furthermore, all three factors demonstrated strong relationships with ORL effectiveness, highlighting their importance even in an unprecedented learning environment. The study also validated the application of Spitzberg's Computer-Mediated Communication (CMC) Competence Model, with the three predictors collectively explaining 85% of the variance in ORL effectiveness. Overall, the findings address an important research gap and provide a useful framework for future online learning research and practice.

6. Conclusion

To conclude, the study revealed factors that contribute to effective online learning particularly in context of crisis where new method was implemented as an emergency approach. This contributes to the growing body of knowledge on online learning by addressing a research gap in the context of crisis-driven remote education. The findings offer practical insight for academic stakeholders includes students, educators, institutions, or policymakers in designing strategies to enhance quality of online learning for improvement. Regardless of the pandemic has largely subsides and the resumption of academic delivery to conventional face-to-face learning, the lessons learned remain relevant for future practice especially in the increasingly digital world.

Ethics Approval and Consent to Participate

The present study has obtained Ethic Approval from Research Ethics Committee Universiti Teknologi MARA, REC approval no: REC/08/2022 (PG/MR/185). All procedures performed in this study involving human participants were conducted in accordance with the ethical standards of the institutional research committee. Informed consent was obtained from all participants. Informed consent was obtained from all participants according to the Declaration of Helsinki.

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Conflict of Interest

The authors reported no conflicts of interest for this work and declare that there is no potential conflict of interest with respect to the research, authorship, or publication of this article.

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