Article

Analysis of the effectuality of Online Teaching - Learning Process – A Pilot Study

Johnsy Mary Johnson*

NMK Bhatta**

Abstract:

The entire global learning terrain has seen an important move regarding online knowledge, especially after the COVID-19 global outbreak. The rise of the internet and qualified personnel establish the progress and formation of any country's humanity. To remain viable, an institution of learning must meet the expectations of the age of technological advances. Recent advances in technology have raised the standard of contemporary schooling. As a result, reworking how we provide knowledge and instruction for end individuals is critical to staying pertinent and maintaining the importance of learning during the current digitising era. The proposed investigation uses a methodical strategy, combining quantitative data collection to offer an in-depth analysis of the impact of online education on students. Research identifies key reasons for establishing such effectiveness: technologically human and course elements. The framework for determining effectuality is suggested with perceived satisfaction using the three dimensions listed above. This pilot study investigates how well they work with online learning methods, focusing on the statistical aspect of the study, which involved administering a planned questionnaire to 60 participants of different educational environments and degrees to verify the proposed models for measurement. The Structural Equation Modelling (SEM) assessment was carried out, and the findings indicate that the models of measurement comply with the pilot study requirements, namely validity of content, convergence validity, reliability, and discriminant validity. It validates the estimation designs and paves the way for a complete data collection and analysis to verify the proposed model.

Keywords: *Online learning, E-learning, educational effectiveness, Online pedagogy, Educational technology, Pilot study*

How to cite: Johnson, J. M., & Bhatta, N. M. K. (2024). Analysis of the effectuality of online teaching-learning process: A pilot study. Journal of Management and Entrepreneurship, 18(2), 116–131

* Research Scholar, Xavier Institute of Management & Entrepreneurship, Bangalore (A recognised Research Centre of the University of Mysore), Email: johnsonjohnsy.018@gmail.com, johnsy@xime.org

** Dean Research, Xavier Institute of Management & Entrepreneurship, Bangalore (A recognised Research Centre of the University of Mysore) Email: nmbhatta@xime.org

1. Introduction

The growth of technology for communication and information is being revised, particularly in the wake of Industry 4.0, by learners from the past generations and Generation Z taking part. The establishment of online study platforms requires particular consideration. According to the Ministry of Higher Education, "Higher learning institutions, both public and state, there is an apparent link between the rise of industries and virtual learning. Because in the era of learning through the internet, there will be no room for confinement.

In modern times, education cannot occur in educational settings that lack printed teaching aids. However, the focus has shifted to multimedia, commonly known as online instruction. Learners in the current cohort are particularly skilled at using gadgets. Technological developments make it much easier to find educational materials, and the data stipulated is accessible to a wider audience. The swift progress in academia necessitates proficient modern technology to obtain a greater depth of knowledge. Mastering the usage of digital platforms, also known as electronic instruction, is an advancement in educational opportunities.

Arias and Clark (2004) discuss how instruction techniques are defined differently in five domains of mastering technological advances: construction, creation, usage, administration, and examination. The instructional design space encompasses learning methods, instructional architecture, communication fashion, and characteristics of learners. Learning efficiency is the extent to which a specific set of assets improves execution. Efficiency does not always imply efficiency because it is not comparable to the usage of resources or price. According to deliberate research, numerous conventional educational assets in advanced nations fail to enhance students' achievement (Lockheed & Hanushek, 1988). Many learners contend that when we discover any strategies which appear to be productive, we ought to create regulations to implement them. However, it failed to account for the expenses of offering input from the user, so it cannot continue inner efficacy. While tracked by measures of solely academic worth (in the form of assess ratings), a policy evaluation is typically confined to different applications of assets inside the learning industry (Lockheed & Hanushek, 1988). Educational ingredients consist of both physical and virtual supplies. The second one was employed to refer to instructional methods, educational institutions' organisational structure, and instructor space and competence. The material contained manuals, instructional resources, workstations, and school settings. As a result, the phrase participation in this context does not refer solely to knowledge that might be conveyed as an actual volume or Geld. Lockheed and Hanushek (1994) primarily considered the intricate relationships among learners and educators as participation factors, and their own inner efficacy is strongly associated with what analysts call "scientific gains." Organising the materials on hand is officially operational to generate optimal feasible results (Lockheed & Hanushek, 1988). Similar to the "greatest the inside efficacy" of an array of data. Useful indicates that it was worthwhile or whatever was accomplished appropriately laboured. Academic dictionaries define efficacy as uniformity in consumption, utility, or enabling goals. Handayaningrat (1994) defines efficacy as "the efficacy is an indicator in the context of accomplishing set-in-stone targets." According to certain perspectives on efficiency, performance is a measurement that indicates whether or not the objectives (the amount, excellence, and duration) were successfully met. Effectiveness is the degree to which an arrangement, management, or execution attains its set initial targets or goals. A greater outcome or outcome regarding a particular objective indicates greater efficacy. The idea is frequently utilised in various areas, including industries, schools, and the administration of projects, to assess the effectiveness of campaigns, techniques, and choices. Those who recognise the connections between results and goals may recognise parts for betterment and make apprised decisions regarding how to enhance its accomplishments (Joy & Garcia, 2000)

.(Joy & Garcia, 2000; Sahasrabudhe & Kanungo, 2008) Vital learning acquisition and building are key features of successful educational operations. Bowen et al. (2013) discovered that, in the era of internationalisation and information and communication technologies growth, technologically driven and virtual education is fervently favoured. The administration of instructional procedures ought

to be imaginative and inventive in order to promote collaboration among educators and learners. Through collaborating online, teachers and trainers stay engaged with their learners despite being located in unconventional whereabouts (Hussin, 2017). Centred around technology, education methods ought to be implemented in educational institutions. These techniques ought to be applied to the specifications for online education, and those who participated deserve regular interactions minus the demand for in-person interaction (Duff, 2008). According to Wargadinata et al. (2020), The virtual educational frameworks utilised throughout the COVID-19 global outbreak offered learners an understanding like traditional classroom instruction. Nevertheless, online instruction offers greater exposure to the value of learning procedures that reconcile a mix of technology with time through autonomous features that every learner possesses.

COVID-19 has prompted various novel instructional approaches and distance instructional tools that encourage attaining instructional objectives (Schneider & Council, 2021). Creativity within the education sector must ensure such progress continues without interruption (Nofrianto et al., 2020). According to Wargadinata et al. (2020), guidelines implemented through an instructive facility's leadership are essential when offering online learning (Saidon et al., 2020). Learners bear abreast of societal developments by adjusting to the readily accessible modern technology. Adapting is critical because contemporary existence is heavily reliant on technological advancements. When these competencies are mastered, learners can adjust to evolving situations and react to an influx of either fresh or acquainted challenges.

As a result, learners will have diverse digital abilities that they may employ in the years to come. This situation has promoted the adoption of information and communication technologies and web-based functions as an essential tool for young people and learners to participate in distance education. Instructors continue to steer their pupils to study online by employing social networks and cutting-edge interaction apps (Ratheeswari, 2018).

2. Research Objective

This study attempts to verify the effectiveness of online learning processes. To achieve the objective, the following sub-dimensions are identified from the literature.

3. Literature Support for the Dimensions

a) Technology

Technology such as multimedia plays a vital part in learner participation and engagement in online discourse. The results of that study showed that social media tools aided respondents in creating interactive instructional settings and developing cooperation abilities required for effective computer-supported shared learning (Kumi-Yeboah et al., 2020).

Many study paradigms examining the impact of online studying technology on improved results are still yet to specifically identify their function and significance (Ellis & Bliuc, 2019). When using technology in teaching, it is important to guarantee that enough infrastructure for technology and technical assistance are provided inside the learning processes (Batdı et al., 2021). An impression of the complicated nature of the selected technological tools for online learning and an absence of understanding of both security and ethics aspects of utilising online learning apps is another stone under the light (Šramová, 2023). When compared to the conventional technique, teaching using modern technologies poses a significant challenge for instructors (Bisht et al., 2022). Technological advances are meant to aid in practising skill-intensive, hands-on experience-required courses (Schneikart & Mayrhofer, 2022). Instructors need to grasp how technological advancements, the setting of institutions, and phenomena like winners-take-all systems may impact the responsibilities of instructors (Whitaker, New, & Ireland, 2016).

b) Human

During the pandemic, educators and learners were protected from educational decline by accessing and using educational platforms. When we analyse the impact that online learning has created, we could elaborate on many aspects of humans, considering both teachers and students in terms of their attitude, perception, and, majorly, the teacher element (Zulfiqar, Ajmal, & Bano, 2023). Educational settings will keep shifting, maybe in manners that have not yet been recognised. Conventional instruction and including subjects and concepts might become supplementary objectives compared to roles such as instructor of learning and the examiner of learning outcomes, with instructor-to-learner and interactions between students being significant contributors to online educational outcomes (Hwang, 2018). Teachers who are purposeful, aware, scheduled, and composed in their personality and educational endeavours boost the probability that learners will recognise the value of ethics and feasible insight, even though there is no assurance that high-quality online instruction and facilitating will result in the development of the qualities sought (Harrison & Laco, 2022). Through continuous and unambiguous interaction, instructors may train learners on such goals so that they are not left alone, which results in dissatisfaction instead of feeling autonomy and liberty, which builds confidence (Heflin & Macaluso, 2021). The educational method students choose is determined by their feelings about interactions with other learners and teachers (Spencer & Temple, 2021). It is equally crucial to provide clear direction for navigating the learning process and increase interaction and student participation in online courses more consciously and openly (Li et al., 2021).

c) Course

To improve online education encounters, teachers build instructional courses around group projects and participatory online platforms (Erragcha et al., 2022). Experience-based learning necessitates thorough activity planning, designing, and teaching assistance in an online learning environment (Leyer et al., 2023). The teacher should look into the materials selected to meet the learning goals that are accessible and available to all students with no undue technological, economic, or administration obstructions (Debattista, 2018). College education provides the necessary prerequisites for enhancing the quality of existence and resolving issues, vital for maintaining the country's economic growth and democratic values. University education has shifted its focus from 'nationwide learning' to 'worldwide education,' from 'yet another education for few' to a 'long life understanding of everything,' and from 'trainer-centeredness learning to student-centeredness learning (Chauhan & Research, 2016). The overnight shift from in-person to online classrooms due to the COVID-19 epidemic and social distance limits provided an enormous obstacle to the educational system. This shift may be abrupt and uncomfortable and linger for a bit, but the quality will not suffer. Online classes comparable to the level of instruction students get in a traditional in-person session must be provided (Ozfidan et al., 2021). Instructors' and students' experiences and perspectives on online education are crucial to understanding the different factors that can affect it; moreover, resources, accessibility to technology, satisfaction and quality of the content are the major ingredients to fetch a better online learning environment for teachers as well as learners (Weldon et al., 2021).

4. Construct for the Effectuality

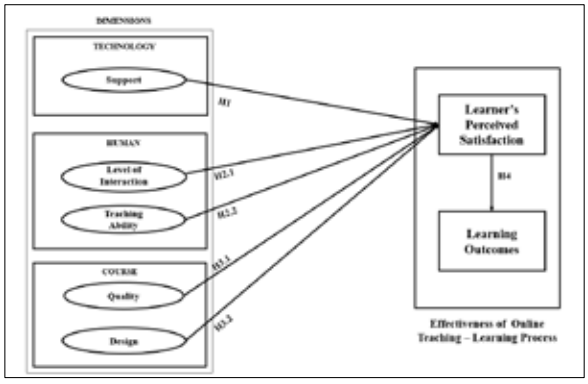


Figure 1: Research Construct

5. Research Methodology

The following hypotheses are proposed to verify the construct proposed in Fig.1.

H1: Technological Infrastructure significantly influences the learners' perceived satisfaction.

H2.1: Level of Interaction as a Human Aspect component significantly Impact the Learners' Perceived Satisfaction in the online teaching-learning Process.

H2.2: Teaching Ability as a Human Aspect component significantly Impact the Learners' Perceived Satisfaction in the online teaching-learning Process.

H3.1: Quality contents as a Course Aspect component significantly Impact the Learners' Perceived Satisfaction in the online teaching-learning Process.

H3.2: Curriculum Design as a Course Aspect component significantly Impact the Learners' Perceived Satisfaction in the online teaching-learning Process.

H4: Learners' Perceived Satisfaction has a significant relationship with learning outcome

The empirical study is proposed to verify the above-proposed hypotheses, and the following methodology will be adopted**:**

a. Questionnaire design

b. Sampling

c. Pilot Data Analysis

d. Full-fledged data collection

e. Full data analysis.

This paper presents the Pilot study and its results up to step (c) shown above. The measurement models will be recommended for analysing full-fledged data based on the pilot study's results.

a) Questionnaire design

The following questions are designed as a measurement tool to measure each sub-construct. The questionnaire is given below:

Chart I – Questions under each dimensions influencing Online teaching-learning process

Variable (question) Description	**Dimension**
My institution has an up-to-date ICT infrastructure (TEC_INFA_1)	Technological Infrastructure
Online learning interface used by my institution is easy to use (TEC_INFA_2)	
I can reach out to expert technicians for technical support (TEC_INFA_3)	
I can access the library website and search for relevant materials (TEC_ INFA_4)	
Various online resources and materials provided in my course are compatible with my device at campus and residence (TEC_INFA_5)	
Sessions of the enrolled online course are engaging and active (LEV_INT_1)	Level of Interaction
Enrolled online course gives me opportunities to collaborate with other learners for group projects or assignments (LEV_INT_2)	
Instructors respond to my queries or comments raised during the course (LEV_INT_3)	
Enrolled online course gives me a platform to interact with professionals (LEV_INT_4)	
Instructors encourage me to participate in online tasks, activities (TEC_AB_1)	Teaching Ability
Instructors regularly provide feedback on online activities conducted during the course (TEC_AB_2)	
Instructors attend to my inquiries during online discussion forums in a timely manner (TEC_AB_3)	
Instructors employ different teaching approaches in online learning (TEC_ AB_4)	
Discussions with the instructor is very helpful for my learning (TEC_AB_5)	

Quality/quantity of the study materials provided to me are satisfactory (QUAL_1)	Quality contents
Contents and activities conducted in the enrolled course enhances the quality of the learning (QUAL_2)	
Quality of open content (Self Study Topics) remains a challenge in the enrolled online course (QUAL_3)	
Level of detail available for each topic is adequate (QUAL_4)	
Enrolled online course is user friendly and convenient (QUAL_5)	
Enrolled online course is user friendly and convenient (CUR_DEG_1)	Curriculum Design
Enrolled online course has adequate information about the curriculum (e.g. duration, list of books, topics covered etc. (CUR_DEG_2)	
Contents of the enrolled online course creates more interactive sessions during classes (CUR_DEG_3)	
Quiz, Assignments that promote achievement of course objectives (CUR_DEG_4)	
Enrolled online course has relevant industry-oriented topics (CUR_DEG_5)	
Integration of case studies helps me to understand concepts better (CUR_DEG_6)	
I am satisfied with my online interaction with my instructor (PER_SAT_1)	Perceived Satisfaction
I am satisfied with my teachers' accessibility and availability (PER_SAT_2)	
I am satisfied with the feedback provided on my performance on assessments, activities (PER_SAT_3)	
I am satisfied with learning contents (PER_SAT_4)	
I am satisfied with the multiple interaction opportunities provided during the course (PER_SAT_5)	
I am satisfied learning the course online has served my needs and helped me meet my objectives (PER_SAT_6)	
Interaction with instructors/ peers enriched my online learning experience (ON_LRN_1)	Learning Outcome
The online assessments (Quizzes, presentations etc) conducted for my course effectively measure mastery of the subject matter (ON_LRN_2)	
Online learning experience enhances my ability to manage job interviews (ON_LRN_3)	
The online teaching methods used in the course contributes to my overall understanding of the course (ON_LRN_4)	
Online learning helps to prepare well for competitive exams (ON_LRN_5)	

The data needs to be collected for the above items using Likert scale of 1-5. 1- Strongly Disagree, 2- Disagree, 3- Neither agree nor disagree., 4- Agree 5- Strongly Agree

b) Sampling:

- **Sample Design:** McQuitty (2004) claimed that if employing SEM, establishing the minimal number of samples necessary for attaining the necessary statistical magnitude over the construct prior to obtaining data is vital. Although the amount of respondents necessary varies by the degree of normalcy of the information and the approach that investigators are going to employ, the widely accepted value stipulates that presently, there ought to be ten test subjects for each free variable to be predicted (Schreiber et al., 2006). Regardless of the lack of consensus on the ideal size, every time SEM is implemented, an "essential sample size" of two hundred is suggested (Hoelter & Research, 1983). Based on the 10:1 generalisation rule, which states that ten respondents are required for each question, the desired number of samples is 350 participants. A total of 60 participants is considered for this present pilot investigation.
- **Sampling Technique**

  This study identified simple random sampling as the most appropriate method for selecting respondents. Simple random sampling is a fundamental method where every individual in the population has an equal chance of being selected. This technique was chosen because it minimises selection bias, ensuring that the sample accurately represents the broader population of students engaged in online learning.
- **Sampling Approach**

  The target population for this study consisted of students who have enrolled in or are currently undergoing any form of online learning. This population was considered due to the increasing prevalence of online education and its impact on the learning experience. A simple

random sampling approach was utilised to achieve a representative sample.

Defining the Sampling Frame: The sampling frame included a comprehensive list of students enrolled in online courses across various educational institutions in Bangalore.

Random Selection Process: 60 students were randomly selected from the sampling frame.

- **Data Collection for the Pilot Study**

  Data was collected through a structured questionnaire to capture students' experiences and perceptions of online learning. The questionnaire utilised a Likert scale format, allowing respondents to express their agreement or disagreement with various statements related to their online learning experiences.

1. **Questionnaire Development:** The questionnaire was developed based on existing literature and theoretical frameworks relevant to online learning. It included a range of questions covering topics such as course quality and design, Technological infrastructure, Level of interaction and Teaching ability of the instructors, learning outcomes and perceived satisfaction with the online learning process.
2. **Administration of the Questionnaire:** The final version of the questionnaire was distributed electronically to the 60 participants. Given the study's online nature, the electronic distribution facilitated easy access and encouraged participation.

c) Pilot Data – Analysis

A pilot data of 60 samples is considered for the pilot study. The collected data was analysed using AMOS 20.0 software, which allowed for sophisticated statistical analyses and modelling. The software performed confirmatory factor analysis and structural equation modelling, providing insights into the relationships between different variables and validating the measurement model. The measurement model is built as shown in the figure 2 below. This measurement model needs to be verified for (i) Content validity, (ii) Convergent validity, (iii) Reliability, and (iv) Discriminant validity using the pilot data sample of 60. SEM Analysis is conducted using AMOS 20.0 software.

3. Results

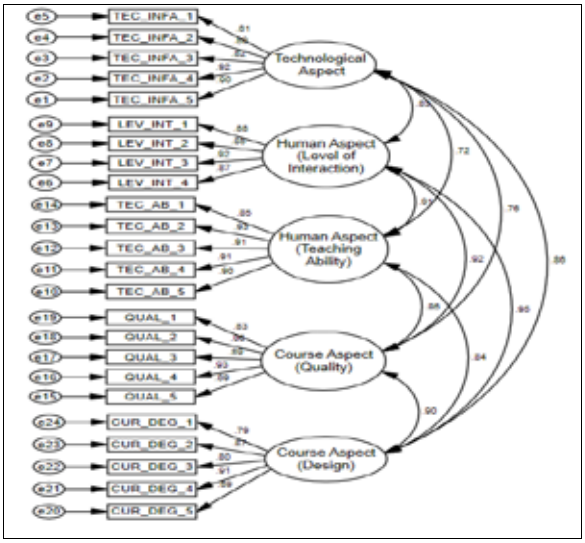
The proposed model has been investigated for two measurement models divided by the study's hypotheses. Both measurement models are checked for validity using content, convergent, reliability, and discriminant validity.

a) Content Validity: The content validity of both the measurement models and the questionnaire is achieved through expert validation of the items. The items are also based on the sub-constructs, each with its elements supported by the literature

1. Measurement Model 1: Dimensions Influencing Online teaching-learning process:

Test the measurement model (Fig 2) for dimensions influencing the online teaching-learning process - pilot data.

Figure 2: Measurement Model 1 showing the various dimensions influencing the Online teaching-learning process with standard regression estimates - pilot data



b) Convergent Validity

Convergent validity has three indicators with certain threshold values and conditions, such as the model should have high and significant standardised loadings, high composite reliability, and an AVE value

of 0.50 or higher. Meeting these criteria ensures that the indicators consistently and accurately measure the intended construct, providing confidence in the validity of the measurement model used in the research.

Table 1: Item-wise Unstandardized and Standardised Regression coefficients of dimensions of various aspects influencing Online teaching-learning process - pilot data

Latent Variable	Indicators	Standardized loadings (β)	Un standardized loadings (B)	C.R	P-value
Technological Aspect (TEC_INFA)	TEC_INFA_1	0.809	0.900	8.252	***
	TEC_INFA_2	0.890	0.968	10.145	***
	TEC_INFA_3	0.819	0.937	8.455	***
	TEC_INFA_4	0.916	1.087	10.895	***
	TEC_INFA_5	0.899	1.000		
Human Aspect (Level of Interaction) (LEV_INT)	LEV_INT_1	0.877	0.926	9.293	***
	LEV_INT_2	0.848	0.933	8.676	***
	LEV_INT_3	0.924	1.057	10.405	***
	LEV_INT_4	0.869	1.000		
Human Aspect (Teaching Ability) (TEC_AB)	TEC_AB_1	0.850	0.970	9.229	***
	TEC_AB_2	0.926	1.096	11.392	***
	TEC_AB_3	0.911	1.058	10.885	***
	TEC_AB_4	0.908	0.995	10.805	***
	TEC_AB_5	0.898	1.000		
Course Aspect (Quality) (QUAL)	QUAL_1	0.835	0.871	8.715	***
	QUAL_2	0.957	1.004	12.034	***
	QUAL_3	0.891	0.954	10.018	***
	QUAL_4	0.931	0.986	11.167	***
	QUAL_5	0.885	1.000		
Course Aspect (Design) (CUR_DEG)	CUR_DEG_1	0.790	0.892	7.894	***
	CUR_DEG_2	0.873	1.024	9.681	***
	CUR_DEG_3	0.800	0.859	8.079	***
	CUR_DEG_4	0.905	1.006	10.574	***
	CUR_DEG_5	0.894	1.000		

*** Significant at 1 % level, ** Significant at 5 % level

It was suggested by Biswas and Varma (2007) and (Byrne, 2001) that the regression estimate's critical ratio (CR) determines the significance level in SEM. The statistically significant levels are 99% (0.01) if the ratio (CR) is more than or equal to 2.58 and 95% (0.05) when the CR worth is higher than or comparable to 1.96 but below 2.58. As a result, Table 1 shows that almost all of the items' critical ratios were beyond 2.58 and significant at 0.01. Regression weights for items like TEC_INFA_5, LEV_INT_4, TEC_AB_5, QUAL_5, and CUR_DEG_5 were fixed at 1.0 and were not predicted.

Table 2: Correlation (Covariance) result of dimensions of various aspects influencing Online teaching

	TEC_INFA	LEV_INT	TEC_AB	QUAL	CUR_DEG
TEC_INFA	-	0.832	0.717	0.759	0.857
LEV_INT	-	-	0.907	0.924	0.955
TEC_AB	-	-	-	0.859	0.840
QUAL	-	-	-	-	0.897

Table 2 displays the results of the inter-item correlation coefficients (the covariance) analysis for each parameter of different factors shaping online instruction for the pilot study data. The dimensions of different factors impacting online instruction have a significant correlation (> 0.80).

c) Reliability of Measurement Model

For the study's reliability, Values of Standardised loadings above 0.70 indicate a good level of indicator reliability, and Cronbach's Alpha measure of internal consistency is analysed, with values above 0.70

considered acceptable. The Cronbach's Alpha values for all latent variables are identical to their composite reliability, confirming their internal solid consistency.

Table 3: Reliability and Item Loadings of dimensions of various aspects influencing Online teaching - pilot data

Latent Variable	Indicators	Standardized loadings (β)	Composite Reliability	Cronbach Alpha	Average Variance Explained (AVE)
Technological Aspect (TEC_INFA)	TEC_INFA_1	0.809	0.938	0.938	0.753
	TEC_INFA_2	0.890			
	TEC_INFA_3	0.819			
	TEC_INFA_4	0.916			
	TEC_INFA_5	0.899			
Human Aspect (Level of Interaction) (LEV_INT)	LEV_INT_1	0.877	0.932	0.932	0.774
	LEV_INT_2	0.848			
	LEV_INT_3	0.924			
	LEV_INT_4	0.869			
Human Aspect (Teaching Ability) (TEC_AB)	TEC_AB_1	0.850	0.955	0.955	0.808
	TEC_AB_2	0.926			
	TEC_AB_3	0.911			
	TEC_AB_4	0.908			
	TEC_AB_5	0.898			
Course Aspect (Quality) (QUAL)	QUAL_1	0.835	0.955	0.955	0.811
	QUAL_2	0.957			
	QUAL_3	0.891			
	QUAL_4	0.931			
	QUAL_5	0.885			
Course Aspect (Design) (CUR_DEG)	CUR_DEG_1	0.790	0.931	0.931	0.729
	CUR_DEG_2	0.873			
	CUR_DEG_3	0.800			
	CUR_DEG_4	0.905			
	CUR_DEG_5	0.894			

Regarding the reliability factor related to various factors affecting the delivery of online instruction and delivery (pilot data), Table 3 shows that the TEC_INFA build includes a total reliability value of 0.938 as well as a Cronbach alpha of 0.938; the LEV_INT The developed construct has a combined reliability value of 0.932 and a Cronbach alpha of 0.932; the TEC_AB construct has a combined reliability value of 0.955 and a Cronbach coefficient alpha of 0.955; the QUAL construct has combined reliability of 0.955 when a Cronbach alpha of 0.955; along with the CUR_DEG construct has a combined reliability value of 0.931 and a Cronbach alpha of 0.931. The results show that most constructs exhibit greater reliability than necessary. Therefore, it is possible to conclude that every item in the group fully converges to its corresponding sub-dimension and should be considered for future investigation. Additionally, all of the dimensions shown in the previously mentioned table have Cronbach alpha values greater than 0.70, meaning that they are once more above the minimum required value, suggesting that the data is consistent and focused on pertinent participants.

d) Discriminant Validity of Measurement Model

Discriminant validity assesses the extent to which a construct is distinct from other constructs. Each construct's square root of the Average Variance Extracted (AVE) is compared with the correlations between constructs. To establish discriminant validity, each (AVE) should be greater than any value in its row or column. If not, then the Chi-Square test of discriminant validity is conducted using Confirmatory Factor Analysis for the model, considering no correlation between constructs and CFA for a new model where the correlation between constructs is considered. The Chi-square of both models are analysed, and the difference between the values and the difference between the degrees of freedom are calculated. P-value of the model is calculated using the pdf and the chi-square difference. The model can be cleared for discriminant validity if the p-value is less than 0.01 (99% sig). The model has been

tested based on the study investigated by Zaiț and Bertea (2011).

Table 4: Discriminant Validity result for dimensions of various aspects influencing Online teaching

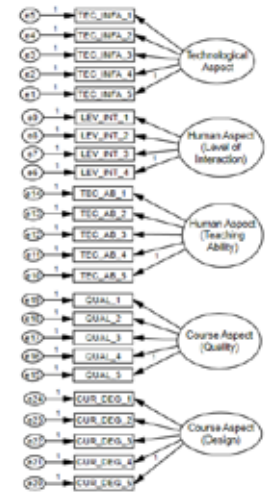
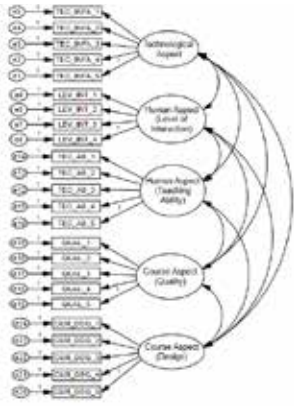
	TEC_INFA	LEV_INT	TEC_AB	QUAL	CUR_DEG
TEC_INFA	**0.868***				
LEV_INT	*0.832*	**0.880***			
TEC_AB	*0.717*	*0.907*	**0.899***		
QUAL	*0.759*	*0.924*	*0.859*	**0.901***	
CUR_DEG	*0.857*	*0.955*	*0.840*	*0.897*	**0.854***

* Square root of original AVE values shown in Table 1.

From Table 4, The findings indicate that every single one of the constructs has discriminating validity since the square of the root of the average AVEs for each construct is larger than the inter-item relationships for any two latent variables considered.(Ab Hamid, Sami, & Sidek, 2017). The inter-correlation coefficient of TEC_AB & QUAL dimensions is 0.859, the AVE of TEC_AB dimensions is 0.899, and the inter-correlation of TEC_AB & CUR_DEG dimensions is 0.840, all of those values are lesser compared to the AVE of TEC_AB dimensions, that is 0.899. Due to their lack of statistical connection and convergence for both factors, these outcomes demonstrate the validity of discrimination among the latent variables.

Approach: Chi – Square Difference Test*:

Table 5: Chi-square difference test for discriminant validity

CFA of free model (No correlation between constructs	CFA with correlation between the constructs – MODEL – 2
	
CFA RESULTS	
MODEL -1	**MODEL - 2**
Chi –Square = 857.025 Degrees of freedom = 252 Probability Level = 0.000	Chi –Square = 539.825 Degrees of freedom = 242 Probability Level = 0.000
Chi – square difference = 857.025 – 539.825 = 317.200 Difference in degrees of freedom = 252 -242 = 10	

The p-value* for Chi Square value 317.200 with 10 d.f is **0.000.**

[* Calculation of p-value with chi-square value of 97.833 and with a d.f of 10 degrees of freedom is obtained from the website http://www.danielsoper.com/statcalc/calculator.aspx?id=11]

On the contrary, the AVE of the TEC_AB dimension (r=0.899) is lower than the Pearson correlation coefficient between the TEC_AB and LEV_INT (r=0.907). Comparably, the AVE coefficient for the LEV_INT dimensions (r=0.880) is smaller than the Pearson correlation value between the LEV_INT and QUAL (r=0.924). Subsequently, it is impossible to verify the discriminant validity because the association value is higher than the square of the root of the AVE value. However, Table 5 provides a substitute validity assessment approach to address this concern. We can state that each of the five of the STIMULI dimension's sub-constructs exhibits discriminating validity because their p-value of 0.00 is lower than the statistically important alpha value of 0.01 (99 % CI).

Table 6: Goodness-of-fit & Incremental Indices of Measurement model for dimensions of various aspects influencing Online teaching - pilot data

Fit Indices	Accepted Value	Model Value
Absolute Fit Measures		
χ2 (Chi-square)		539.825
df (Degrees of Freedom)		242
Chi-square/df (χ2/df)	< 5	2.231
GFI (Goodness of Fit Index)	> 0.90	0.894
RMSEA (Root Mean Square Error of Approximation)	< 0.10	0.078
Incremental Fit Measures		
AGFI (Adjusted Goodness of Fit Index)	> 0.80	0.817
NFI (Normed Fit Index)	> 0.90	0.864
CFI (Comparative Fit Index)	> 0.90	0.872
IFI (Incremental Fit Index)	> 0.90	0.884

*

RFI (Relative Fit Index)	> 0.90	0.896
Parsimony Fit Measures		
PCFI (Parsimony Comparative of Fit Index)	> 0.50	0.734
PNFI (Parsimony Normed Fit Index)	> 0.50	0.652

Table 6 presents a framework for measuring the progressive indicators of assessment and the goodness-of-FIT for different aspects that impact online learning and teaching based on data collected for a pilot study. It is evident from the result that the Goodness of Fit index (GFI) obtained is 0.894, contrary to the suggested threshold of higher than 0.90; the Modified Goodness of Fit Index (AGFI) is 0.817, in opposition to the suggested value of higher than 0.80 in addition. The Chi-square/df (χ2/df) is 2.231 (lower than 5). In contrast to the advised level of higher than 0.90, the Relative-Fit Index (RFI), Comparative Fit Index (CFI) and Normed Fit Index (NFI) are, respectively, 0.864, 0.872, and 0.896. The proposed limit of 0.10 is significantly exceeded by the RMSEA of 0.078. As a result, the model fits the data well throughout and has advantages.

II. Measurement Model 2: Learners' Perceived Satisfaction and Learning outcome:

Measurement model for Perceived Satisfaction and Learning Outcome—Pilot Data: The model is generated to understand the H4 Hypotheses and their validity.

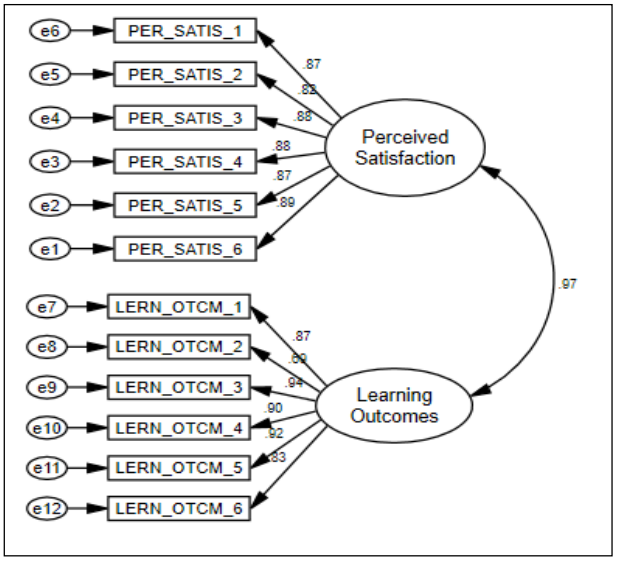


Figure 3: CFA Measurement Model of Perceived Satisfaction and Learning outcome - pilot data

a) Convergent Validity

Table 7: Item wise Unstandardized and Standardized Regression coefficients of Perceived Satisfaction and Learning outcome dimensions- pilot data

Latent Variable	Indicators	Standardized loadings (β)	Un standardized loadings (B)	C.R	P-value
Perceived Satisfaction	PER_SATIS_1	0.867	0.987	9.464	***
	PER_SATIS_2	0.817	0.983	8.361	***
	PER_SATIS_3	0.880	1.007	9.775	***
	PER_SATIS_4	0.882	1.075	9.829	***
	PER_SATIS_5	0.865	1.102	9.419	***
	PER_SATIS_6	0.889	1.000		
Learning Outcome	LERN_OTCM_1	0.868	0.988	8.261	***
	LERN_OTCM_2	0.691	0.817	5.892	***
	LERN_OTCM_3	0.945	1.041	9.590	***
	LERN_OTCM_4	0.896	0.997	8.716	***
	LERN_OTCM_5	0.922	1.036	9.171	***
	LERN_OTCM_6	0.826	1.000		

Table 8: Correlation (Covariance) result of Perceived Satisfaction and Learning outcome

	PER_SATIS
LERN_OTCM	0.966

Table 8 displays a strong inter-item correlation (covariance) result (r=0.966) between the pilot data's perceived satisfaction and learning outcome.

b) Reliability of Measurement Model

Table 9: Reliability and Item Loadings of Perceived Satisfaction and Learning outcome dimensions- pilot data

Latent Variable	Indicators	Standardized loadings (β)	Composite Reliability	Cronbach Alpha	Average Variance Explained (AVE)
Perceived Satisfaction	PER_SATIS_1	0.867	0.948	0.948	0.752
	PER_SATIS_2	0.817			
	PER_SATIS_3	0.880			
	PER_SATIS_4	0.882			
	PER_SATIS_5	0.865			
	PER_SATIS_6	0.889			
Learning Outcome	LERN_OTCM_1	0.868	0.945	0.945	0.743
	LERN_OTCM_2	0.691			
	LERN_OTCM_3	0.945			
	LERN_OTCM_4	0.896			
	LERN_OTCM_5	0.922			
	LERN_OTCM_6	0.826			

Regarding the Reliability factor for the Perceived Satisfaction axnd Learning Outcome dimensions (pilot data), Table 8 shows that the Learning Outcome construct has a Cronbach alpha of 0.945 and a composite reliability of 0.948, and the Perceived Satisfaction construct has a Satisfaction of 0.948 and a Cronbach alpha of 0.948.

Table 10: Goodness-of-fit & Incremental Indices of Measurement model of Perceived Satisfaction and Learning outcome dimensions – Pilot data

	(χ2/df)	GFI	RMSEA	AGFI	NFI	CFI	IFI	RFI	PCFI	PNFI
Accepted value	< 5	> 0.90	< 0.10	> 0.80	> 0.90				> 0.50	
Model value	1.723	0.868	0.094	0.859	0.889	0.949	0.950	0.862	0.762	0.714

The pilot study data's fit of goodness and gradual Indices for the subdimensions of the perceived Satisfaction and Learning Outcome parameters, as shown in Table 9, shows an overidentified model with a broadly suitable fit..

7. Discussion

A pilot study's main objectives are to validate the model fit and analyse the study's methodology; the results would indicate if the primary study's targets could be achieved. The pilot study's overall performance would demonstrate the primary study's viability (Hassan et al., 2006). This research intends to use pilot data for validating the measurement framework constructed for the concept proposed in (fig. 1). The use of the Critical Ratio (CR) in Structural Equation Modelling (SEM) facilitates the evaluation of the statistically significant relevance of the relationships between unknown variables. A CR value of more than 2.58 suggests that the observed relationship is likely real and cannot result from random chance. Therefore, a CR greater than 2.58 indicates that the association holds significance and warrants consideration in the comprehensive model assessment (Al-Gahtani, 2016).

The findings from the study are elaborated in Table 11, which shows the path to understanding the hypotheses and drawing conclusions about the model. The proposed model has been designed based on the robust literature review from various journals. The hypotheses were framed based on the research questions from the relevant gaps observed from various research done over the years where online learning has created an impact and changed the perspective of learning altogether. These hypotheses are modified based on the themes created during a systematic literature review. The four main hypotheses are the major constructs and the backbone of the study. The questionnaire was designed according to the model's constructs, validated by experts and circulated among the respondents. The proposed model (Fig 1) has been examined for its validity and fitness using various statistical tools and software, which has paved the way to expand the study and learn the influence of the constructs in depth. Table 11 shows each of the hypotheses, the validity tests that have been applied, and the criteria that suggest the significance of the hypotheses being proved.

This research indicates that, based on the model, there are some plausible hypotheses regarding the relationship between technology and learners' perceived satisfaction. It follows that, when it comes to online learning, technology greatly impacts students' feelings of satisfaction. This also holds true for interpersonal interactions, as a teacher's skill level greatly impacts a student's happiness in an online learning environment. The proposed model illustrates the same phenomenon, wherein instructors' ability to teach and their degree of interaction with students reveal an acceptance level that supports the relevance of the human dimension in the model. The curriculum determines the majority of the learning environment. Understanding concepts while studying online requires high-quality course materials and a pertinent framework. Online courses tend to be more informal, which may be a turnoff for some students who prefer to learn their material online. Thus, it is necessary to develop hypotheses to determine whether course dimensions impact students' perceived satisfaction.

Contrary Views: Further, the few literatures present several contrarian views challenging the established model that posits a significant influence of technology, human interaction, teaching ability, and course quality on learners' perceived satisfaction in online learning environments. According to (Green Tanner, 2021), technological tools are simply vessels of instruction, and learning efficiency depends more on instructional methods than the technology itself. (Clark) similarly believes that media, including technological infrastructure, are no different from the truck that brings groceries and their effect on learning. Works by Cheung and

Wang further demonstrate how the digital divide has remained a problem whereby unequal access to technology can increase, not reduce, educational inequalities. From this perspective, one can conclude that the anticipated positive influence of technology on learner satisfaction might not be generalisable and may vary greatly between various socio-economic strata.

Lampropoulos et al. (2022) view contradicts the belief that the frequency of the number of interactions is not important; instead, the quality of interaction is crucial, and sometimes unnecessary interactions annoy, leading to dissatisfaction among students. According to Selwyn, how much a learner enjoys interacting with others online is determined by the presence of a teacher, the facilitation skills and how the content is delivered. Larsen et al. (2023) found significant variability in the effectiveness of different online courses, questioning a general assumption about teaching's impact on satisfaction. The author insists that individual differences among instructors and peculiarities of course situations are key determinants. In contrast, Cleveland-Innes and Wilton (2018) question whether well-designed courses always bring satisfaction. Such authors suggest that inflexible curricula cause limitations, thus failing to cater for diverse student needs and preferences. It is suggested in a study by Bolliger and Halupa (2012) that, though the quality of a course matters greatly, practical issues such as scalability and limited resources can become obstacles to creating effective course designs with student-centred approaches. These alternative perspectives highlight the complexity and variability of online learning experiences, suggesting that more nuanced, context-specific approaches are needed to understand and improve learner satisfaction..

Table 11: Showing the results of the Pilot Study

Hypotheses	Convergent Validity		Discriminant Validity	Reliability (Cronbach Alpha)	Conclusion
	Critical Ratio (CR)	Average Variance Extracted (AVE)			
H1 : Technological Infrastructure significantly influences the learners' perceived satisfaction.	The critical ratios of Technological Infrastructure (TEC_INFA) range from 0.825 to 10.895, all of which are above the recommended threshold of 2.58 (i.e CR >2.58) : Significant	AVE is 0.753 - **Good convergent validity.**	The square root of AVE (0.868) being higher than the correlations with other constructs. - **Strong discriminant validity with other constructs**	Cronbach's alpha for TEC_INFA is 0.938, indicating **high internal consistency.**	Technological Infrastructure significantly influences learners' perceived satisfaction, supporting H1.
H2.1: Level of Interaction as a Human Aspect component significantly impacts the learners' perceived satisfaction in the online teaching-learning process.	The critical ratios of Technological Infrastructure (LEV_INT) range from 8.676 to 10.405, all of which are above the recommended threshold of 2.58 (i.e CR >2.58) : Significant	AVE is 0.774 - **Good convergent validity.**	The square root of AVE for LEV_INT is 0.880, which is lower than its correlations with other constructs. - **Discriminant validity not confirmed** (Therefore, Chi-Square Discriminant Validity Test is conducted)	Cronbach's alpha for LEV_INT is 0.932, indicating **high internal consistency.**	Level of Interaction significantly impacts learners' perceived satisfaction, confirming H2.1.
H2.2: Teaching Ability as a Human Aspect component significantly impacts the learners' perceived satisfaction in the online teaching-learning process.	The critical ratios of Technological Infrastructure (TEC_AB) range from 9.229 to 11.392, all of which are above the recommended threshold of 2.58 (i.e CR >2.58) : Significant	AVE is 0.808 - **Good convergent validity.**	The square root of AVE for TEC_AB is 0.899, higher than its correlations with other constructs. - **Strong discriminant validity with other constructs**	Cronbach's alpha for TEC_AB is 0.955, indicating **high internal consistency.**	Teaching Ability significantly impacts learners' perceived satisfaction, supporting H2.2.
H3.1: Quality contents as a Course Aspect component significantly impact the learners' perceived satisfaction in the online teaching-learning process.	The critical ratios of Technological Infrastructure (QUAL) range from 8.715 to 12.034, all of which are above the recommended threshold of 2.58 (i.e CR >2.58) : Significant	AVE is 0.811 - - **Good convergent validity.**	The square root of AVE for QUAL is 0.901, higher than its correlations with other constructs. - **Strong discriminant validity with other constructs**	Cronbach's alpha for QUAL is 0.955, indicating **high internal consistency.**	Quality contents significantly impact learners' perceived satisfaction, supporting H3.1.
H3.2: Curriculum Design as a Course Aspect component significantly impacts the learners' perceived satisfaction in the online teaching-learning process.	The critical ratios of Technological Infrastructure (CUR_DEG) range from 7.894 to 10.574, all of which are above the recommended threshold of 2.58 (i.e CR >2.58) : Significant	AVE is 0.729 - **Good convergent validity.**	The square root of AVE for CUR_DEG is 0.854 - **Strong discriminant validity with other constructs**	Cronbach's alpha for CUR_DEG is 0.931, indicating **high internal consistency.**	Curriculum Design significantly impacts learners' perceived satisfaction, confirming H3.2.
H4: Learners' Perceived Satisfaction has a significant relationship with learning outcomes.	CR for (PER_SATIS) range from 8.361 to 9.829 and for (LERN_OTCM) range form 5.892 to 9.590, all of which are above the recommended threshold of 2.58 (i.e CR >2.58) : Significant	AVE is 0.752 for Perceived satisfactiona and 0743 for the Learning outcome : - **Good convergent validity.**	Weak discriminant validity	Cronbach's alpha for (PER_SATIS) is .0.948 and for (LERN_OTCM) is 0.945, indicating high internal consistency.	There is a significant relationship between perceived satisfaction and learning outcomes
	The Goodness-of-fit & Incremental Indices for sub dimensions of Perceived Satisfaction and Learning outcome dimensions for pilot data indicates an overall acceptable fit are within acceptable ranges, indicating a good model fit.				

Table 11 shows that all four hypotheses show significance, with the critical value greater than the p-value at 0.01. This indicates that the proposed model fits and can be further studied. The measurement framework has been verified and is suitable for comprehensive data analysis. The four hypotheses can be tested using SEM techniques with complete data, which is beyond the purview of the present investigation.

8. Conclusion

The pilot study with 60 respondents has successfully validated the model fit and methodology, confirming the potential to achieve the primary study's targets. The analysis supports all the hypotheses (H1, H2.1, H2.2, H3.1, H3.2, and H4) regarding the dimensions influencing learners' perceived satisfaction and its relationship with learning outcomes in the online teaching-learning process. The constructs exhibit strong convergent and discriminant validity and high reliability, affirming the robustness of the measurement model. The findings, detailed in Table 11, provide a clear understanding of the hypotheses and conclude the proposed model. Developed from an extensive literature review, the hypotheses address significant gaps observed in research on online learning's impact. The systematic literature review helped refine the themes underlying the hypotheses, ensuring they are well-grounded and relevant.

The primary constructs of the study, based on four main hypotheses, form the backbone of the research. The questionnaire, designed in alignment with these constructs and validated by experts, was circulated among respondents to gather data. Various statistical tools and software were employed to examine the model's validity and fitness, enabling a deeper exploration of the constructs' influence. The research indicates that technology significantly impacts learners' satisfaction with online learning. This impact extends to interpersonal interactions, where the instructor's teaching ability and level of interaction significantly affect student satisfaction. The proposed model reflects this phenomenon, underscoring the human dimension's relevance.

Moreover, the curriculum is a crucial determinant of the learning environment. High-quality course materials and a relevant framework are essential for understanding concepts in online learning. The informal nature of online courses may appeal to some students but can be a drawback for others. Therefore, developing hypotheses to assess the impact of course dimensions on students' perceived satisfaction is necessary.

Given these, we can say that the pilot study demonstrates the feasibility and robustness of the proposed model. The validated hypotheses confirm that technology, human interaction, teaching ability, and course quality are critical determinants of online learning satisfaction. These insights provide a solid foundation for a more comprehensive investigation, paving the way for future research into these constructs.

9. Limitations and Recommendations

The generalizability of the findings to other regions or educational institutions can be an associated limit, as the majority of respondents in this study are postgraduates and undergraduates from various tier colleges in Bangalore. These students are enrolled in or participating in online learning as part of their academic curriculum. Additionally, this study only gathers responses from students without examining the involvement of teachers. This area could be explored in greater depth in future research.

Future studies should consider narrowing the participant group so that the research can provide more targeted insights and increase its relevance and effectiveness in this specific academic domain. Future research can include teachers' perspectives to understand online learning comprehensively. Examining both student and teacher experiences can provide a more holistic view of the online education landscape and identify areas for improvement from multiple stakeholders. Expanding the study to include a wider range of educational institutions beyond tier colleges in Bangalore can enhance the generalizability of the findings. Including institutions from different regions and tiers can provide a more diverse dataset and reflect a broader spectrum of online learning experiences; also, including students from various academic disciplines can help identify

unique challenges and opportunities specific to each discipline.

References

Ab Hamid, M. R., Sami, W., & Sidek, M. M. (2017). *Discriminant validity assessment: Use of Fornell & Larcker criterion versus HTMT criterion.* Paper presented at the Journal of physics: Conference series.

Al-Gahtani, S. S. (2016). Empirical investigation of e-learning acceptance and assimilation: A structural equation model. *12*(1), 27-50.

Arias, S., & Clark, K. A. (2004). Instructional technologies in developing countries: A contextual analysis approach. *TechTrends, 48*(4), 52-55. doi:10.1007/BF02763445

Batdı, V., Doğan, Y., & Talan, T. (2021). Effectiveness of online learning: a multi-complementary approach research with responses from the COVID-19 pandemic period. 1-34.

Bisht, R. K., Jasola, S., & Bisht, I. P. (2022). Acceptability and challenges of online higher education in the era of COVID-19: a study of students' perspective. *Asian Education and Development Studies, 11*(2), 401-414. doi:10.1108/AEDS-05-2020-0119

Biswas, S., & Varma, A. J. E. R. (2007). Psychological climate and individual performance in India: test of a mediated model. *29*(6), 664-676.

Bolliger, D. U., & Halupa, C. (2012). Student perceptions of satisfaction and anxiety in an online doctoral program. *33*(1), 81-98.

Bowen, E. E., Bertoline, G. R., Athinarayanan, R., Cox, R. F., Burbank, K. A., Buskirk, D. R., & Küçükönal, H. (2013). Global Technology Leadership: A Case for Innovative Education Praxis. *Procedia - Social and Behavioral Sciences, 75*, 163-171. doi:https://doi.org/10.1016/j.sbspro.2013.04.019

Byrne, B. M. (2001). Structural equation modeling with AMOS, EQS, and LISREL: Comparative approaches to testing for the factorial validity of a measuring instrument. *1*(1), 55-86.

Chauhan, P. J. I. J. o. E. T. S., & Research. (2016). Challenges Facing the Current Higher Education System in India. *3*(4), 53-60.

Cheung, S. K., & Wang, F. L. Personalized Learning.

Clark, R. E. Reconsidering research on learning from media. *53*(4), 445-459.

Cleveland-Innes, M., & Wilton, D. (2018). Guide to blended learning.

Debattista, M. (2018). A comprehensive rubric for instructional design in e-learning. *The International Journal of Information*

Learning Technology, 35(2), 93-104.

Duff, P. (2008). Issues in Chinese language teaching and teacher development. *Issues in Chinese Education*, 5-48.

Ellis, R. A., & Bliuc, A.-M. (2019). Exploring new elements of the student approaches to learning framework: The role of online learning technologies in student learning. *Active Learning in Higher Education, 20*(1), 11-24.

Erragcha, N., Babay, H., Bchir, S., & Saidi, S. (2022). Impact of the Covid-19 pandemic on perceptions and behaviors of university student*s* in Tunisia. *E-Learning Digital Media, 19*(5), 456-474.

Handayaningrat, S. J. J. H. M. (1994). Introduction to the *S*tudy of Administration and Management Science.

Harrison, T., & Laco, D. (2022). Where's the character education in online higher education? Constructivism, virtue ethics and roles of online educators. *E-Learning Digital Media, 19*(6), 555-573.

Hassan, Z. A., Schattner, P., & Mazza, D. J. M. f. p. t. o. j. o. t. A. o. F. P. o. M. (2006). Doing a pilot study: why is it essential? *, 1*(2-3), 70.

Heflin, H., & Macaluso, S. (2021). Student Initiative Empowers Engagement for Learning Online. *Online Learning, 25*(3), 230-248.

Hoelter, J. W. J. S. M., & Research. (1983). The analysis of covariance structures: Goodness-of-fit indices. *11*(3), 325-344.

Hussin, N. J. O.-J. O. J. o. I. E. (2017). Penggunaan laman web sebagai transformasi dalam pengajaran dan pembelajaran pendidikan Islam. *1*(2).

Hwang, A. (2018). Online and Hybrid Learning. *Journal of Management Education, 42*(4), 557-563. doi:10.1177/1052562918777550

Joy, E. H., & Garcia, F. E. J. J. o. A. l. n. (2000). Measuring learning effectiveness: A new look at no-significant-difference findings. *4*(1), 33-39.

Kumi-Yeboah, A., Kim, Y., Sallar, A. M., & Kiramba, L. K. (2020). Exploring the use of digital technologies from the perspective of diverse learners in online learning environments. *Online Learning, 24*(4), 42-63.

Lampropoulos, G., Keramopoulos, E., Diamantaras, K., & Evangelidis, G. (2022). Augmented reality and gamification in education: A systematic literature review of research, applications, and empirical studies. *12*(13), 6809.

Larsen, E., Jensen-Clayton, C., Curtis, E., Loughland, T., & Nguyen, H. T. (2023). Re-imagining teacher mentoring for the future. 1-15.

Leyer, M., Yuan, B., Wang, M., & Moormann, J. (2023). Classroom or online learning? Impact of experiential learning in business process management education. *Knowledge Management E-Learning 15*(2), 214.

Li, Q., Zhou, X., Bostian, B., & Xu, D. (2021). How Can We Improve Online Learning at Community Colleges? Voices from Online Instructors and Students. *Online Learning, 25*(3), 157-190.

Lockheed, M. E., & Hanushek, E. (1988). Improving Educational Efficiency in Developing Countries: what do we know?[1]. *Compare: A Journal of Comparative and International Education, 18*(1), 21-38. doi:10.1080/0305792880180103

Lockheed, M. E., & Hanushek, E. A. (1994). Concepts of educational efficiency and effectiveness. In: World Bank Washington, DC.

McQuitty, S. J. J. o. B. R. (2004). Statistical power and structural equation models in business research. *Journal of Business Research, 57*(2), 175-183.

Nofrianto, H., Jama, J., Indra, A., Rahim, B., & Verawardina, U. J. S. R. i. P. (2020). Validity of Cooperative-Discovery Learning Model to Improve Competencies of Engineering Students. *11*(12).

Ozfidan, B., Fayez, O., & Ismail, H. (2021). Student perspectives of online teaching and learning during the COVID-19 pandemic. *Online Learning, 25*(4), 461-485.

Ratheeswari, K. (2018). Information communication technology in education. *Journal of Applied advanced research, 3*(1), 45-47.

Sahasrabudhe, V., & Kanungo, S. (2008). Relating E-Learning Effectiveness to Choice of Media for its Contents: A Quasi-Experimental Approach.

Saidon, N. H., Zaini, M. I. A., Sukry, M. A. A., & Ishar, M. I. M. (2020). Technological Addict among Today's Human. *Malaysian Journal of Social Sciences and Humanities, 5*(9), 49-55.

Schneider, S. L., & Council, M. L. J. A. o. d. r. (2021). Distance learning in the era of COVID-19. *313*(5), 389-390.

Schneikart, G., & Mayrhofer, W. (2022). Objectively measuring learning outcomes of information technology-assisted training courses. *The International Journal of Information and Learning Technology, 39*(5), 437-450.

Schreiber, J. B., Nora, A., Stage, F. K., Barlow, E. A., & King, J. J. T. J. o. e. r. (2006). Reporting structural equation modeling and confirmatory factor analysis results: A review. *99*(6), 323-338.

Selwyn, N. Digital degrowth: Toward radically sustainable education technology. *49*(2), 186-199.

Spencer, D., & Temple, T. (2021). Examining Students' Online Course Perceptions and Comparing Student Performance Outcomes in Online and Face-to-Face Classrooms. *Online Learning, 25*(2), 233-261.

Šramová, B. (2023). University students' experience with mobile learning during COVID-19 pandemic. *Interactive Learning Environments*, 1-15.

Wargadinata, W., Maimunah, I., Eva, D., & Rofiq, Z. (2020). Student's responses on learning in the early COVID-19 pandemic. *Journal of Education and Teaching Learning, 5*(1), 141-153.

Weldon, A., Ma PhD, W. W., Ho, I., & Li, K. L. (2021). Online learning during a global pandemic: Perceived benefits and issues in higher education. *Knowledge Management E-Learning, 13*(2), 161.

Whitaker, J., New, J. R., & Ireland, R. D. (2016). MOOCs and the Online Delivery of Business Education What's new? What's not? What now? *Academy of Management Learning and Education, 15*(2), 345-365. doi:10.5465/amle.2013.0021

Zaiț, A., & Bertea. (2011). Methods for testing discriminant validity. *9*(2), 217-224.

Zulfiqar, N., Ajmal, R., & Bano, A. (2023). MIMIC model of teachers and students attitudes towards online learning during Covid-19: A gender perspective. *Knowledge Management E-Learning, 15*(2), 174.