DIGITAL PEDAGOGY AND STUDENT ENGAGEMENT: A COMPARATIVE STUDY OF ONLINE AND TRADITIONAL TEACHING METHODS

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Abstract

This empirical research aims to examine the differential impact of digital pedagogy from face-to-face teaching on students' engagement and perceived effectiveness of teaching and learning. A quantitative cross sectional research design was adopted in this study, with data obtained from 400 students at the university (201 online, 199 traditional) from public and private universities. The questionnaire used for the measurement consisted of six constructs: cognitive engagement, behavioural engagement, emotional engagement, perceived effectiveness of learning, self-regulated learning, and quality of interaction with the instructor. Descriptive statistics, independent samples t-tests, multiple regression analysis, structural equation modelling (SEM), and mediation analysis (based on bootstrapped confidence intervals) were used for analysis of data. The findings show that online instruction significantly improves cognitive engagement, SRL, and PL, and traditional instruction significantly improves EI and IIQ. There was a slight higher level of behavioural engagement in traditional settings. The quality of instructor interaction was the most significant predictor of the perceived outcomes for both modalities. The results have implications for higher education policy, course design, and the implementation of blended learning both theoretically and practically.

Keywords: Digital pedagogy, student engagement, online learning, traditional teaching, higher education, blended learning, self-regulated learning

1. INTRODUCTION

Over the last 20 years, digital technologies have dramatically changed the nature of higher education. The rise of learning management systems, digital platforms (synchronous and asynchronous), artificial intelligence-supported learning, and the open educational resources has challenged basic beliefs about pedagogy, student involvement and academic outcomes (Bates, 2019; Selwyn, 2016). The COVID-19 pandemic brought about a massive global shift from face-to-face to virtual classrooms (Hodges et al., 2020), accelerating this change.

Although the emergency remote teaching was a crucial stopgap, it also produced an unprecedented set of naturalistic evidence on the relative effectiveness and limitations of online and in-person methods of instruction. Later studies have tried to separate temporary pandemic-related learning gaps from the features of digitally-mediated pedagogy (Ali, 2020; Means et al., 2013). But the empirical findings are still not uniform, contextually fluid, and methodologically diverse, which makes it difficult to draw clear comparisons.

Student engagement is generally considered to be a multi-dimensional phenomenon with three components: cognitive, behavioral and emotional (Fredricks et al., 2004; Appleton et al., 2008). Cognitive engagement is the psychological effort students invest in learning; behavioural engagement is characterized by participation, attendance and task completion; and emotional engagement is characterized by students' affective reactions to school, teachers and peers. These dimensions are dynamically related to the instructional context, and pedagogical modality can have different impacts on engagement across these dimensions.

Although the literature on e-learning and digital pedagogy has paid significant attention to teaching and learning online, few studies have used systematic quantitative designs to compare online and face-to-face

teaching and learning on a number of dimensions at the same time, while keeping the same students in the same institution. Samples of existing research are small, nonrandom, or the studies do not account for important factors like prior digital literacy and instructor quality (Bernard et al. 2004; Xu & Jaggars 2014). The present study aims to fill these gaps with a large-scale, quantitatively rigorous and multi-construct comparative study.

The main purpose of this study is to explore and compare student engagement and the effectiveness of the learning outcomes perceived when using online and traditional instructional approaches in university context in a developing country. Specifically, the study examines differential effects across six constructs, the mediation of the self-regulatory dimensions and the relative predictive power of the instructional modality and the engagement-related predictors regarding academic outcomes.

2. LITERATURE REVIEW

The three theoretical frameworks that this study rests on are complementary. The Community of Inquiry (CoI) model (Garrison et al., 2000) theorizes that significant learning experiences in digital learning are created when the teaching, social, and cognitive presences converge. The framework has been used to a great extent in the study of online learning and can be used conceptually to explain how digital pedagogies can emulate or mimic the interactive aspects of face-to-face teaching. Second, Self-Determination Theory (SDT) (Deci & Ryan, 1985) suggests that the psychological needs of autonomy, competence, and relatedness are key to deep learning and engagement in academic tasks. Some of the needs may be met differently in digital environments than in traditional classrooms, for example, the need for autonomy may be better met in online environments with flexible schedules and pacing, or the need for relatedness may be better met in traditional settings with immediate interpersonal interaction.

Third, the Technology Acceptance Model (TAM) (Davis, 1989) can be used to explain the students' perceptions of the ease of use and usefulness of digital tools to support their use of and engagement with online learning platforms. In the context of technology adoption in education, perceived usefulness has been a consistent strong predictor (Venkatesh et al., 2003).

The connection between online learning and engagement is a longstanding topic of research and there are conflicting findings. Means et al. (2013) conducted a meta-analysis of online learning and concluded that overall, online education resulted in modestly better learning outcomes than did face-to-face education, especially when combined with learner control and self-pacing. The analysis also identified significant variability between studies, indicating that a large amount of variability is due to contextual moderators, such as course design, learner factors, and instructional approach.

In the online learning environment, cognitive engagement is often gained through the use of interactive multimedia, adaptive learning systems and discussion-based platforms which foster higher order thinking (Bransford et al., 2000; Sung et al., 2017). But critics claim that without immediate feedback from the instructor in an asynchronous classroom, the question-and-answer cycles and clarifications that promote deeper thinking are stunted (Murphy et al., 2011).

The situation is more complicated with emotional engagement. Social isolation and a diminished sense of belonging have been identified as ongoing issues in online learning environments in research (Tinto, 1993; Garrison & Vaughan, 2008). In fully-asynchronous courses, students often feel less connected to teachers and fellow students. These results are consistent with SDT's focus on relatedness as a primary psychological need when frustrated, it reduces intrinsic motivation.

2.5 Research Gaps and Study Hypotheses

Although a variety of literature concerning online and traditional pedagogy is available, there are several areas that lack substance. First, most comparative studies look at engagement as a whole, rather than at

the cognitive, behavioural and emotional components of engagement separately. Second, the mediation of learning outcomes through the engagement dimensions of instructional modality has been under-researched. Third, research in contexts from low- and middle-income countries is underrepresented in the global literature, as the effect of digital infrastructure, internet reliability, and prior e-learning exposure is likely to be significant and moderate.

Objectives

- To compare the behavioural and emotional aspects of student engagement in online learning with those who are learning in the traditional classroom.
- To compare the effectiveness of online and conventional teaching methods on learner's perception of effectiveness and self-regulated learning.
- To assess the quality of instruction–student interaction in online and traditional settings.
- To measure how much students are mentally involved in and engaged with their online and traditional learning experiences.
- Exploration of the mediating role between the instructional modality and perceived learning effectiveness in terms of engagement dimensions (cognitive, behavioural, and emotional engagement) and self-regulated learning.

HYPOTHESIS

- H1: Online instruction is associated with higher cognitive engagement compared to traditional instruction.
- H2: Traditional instruction generates much higher levels of behavioural and emotional engagement than online instruction.
- H3:Online learning is perceived as more effective than traditional learning in terms of perceived learning effectiveness and self-regulated learning.
- H4: The interaction quality of the teacher and the student is higher in the traditional method of teaching than in the online method.
- H5:The hypothesis is that engagement dimensions and self-regulated learning are the mediators between the instructional modality and perceived learning effectiveness.

3. RESEARCH METHODOLOGY

3.1 Research Design

This study is quantitative with a cross sectional survey design. Using a comparative research approach, it was possible to examine differences between the online and traditional learners on various dependent constructs in a systematic manner. The design is consistent with that of well-established practices in educational research (Creswell & Creswell, 2018), and is suitable for testing directional hypotheses generated from theories.

3.2 Population and Sampling

The target groups were students of undergraduate and post graduate level studying in higher education institutions that are recognized by the Ministry of Education. The stratified random sampling technique was used to ensure the proportional representation across institution type (public vs. private), level of academic study (undergraduate vs. postgraduate) and method of instruction (online vs. traditional). All 450 questionnaires were handed out and 412 were returned. A final analytical sample of 400 participants was used (88.9% response rate), after screening out inconsistent or incomplete answers.

To determine the statistical power of the planned regression analyses (six predictors, alpha level = 0.05), we used the program G*Power 3.1 (Faul et al., 2007), and calculated it to be 0.95 ($1 - \beta$), which indicated a medium effect size ($f^2 = 0.15$).

3.3 Measurement Instrument

A structured self-administered questionnaire was used for collecting data. It was an instrument consisting of two parts. The data collected in Section A were demographic and background data such as gender, age, academic level, institutional type, and instructional modality. Section B consisted of 36

Likert-type items (1 = Strongly Disagree to 5 = Strongly Agree) for six theoretical constructs. The items were modified from validated scales used in the higher education and e-learning field.

The Cognitive engagement items were adapted from the works of Fredricks et al., (2004) and Rotgans and Schmidt (2011). Items to measure behavioural and emotional engagement were selected from the Student Engagement Instrument (Appleton et al., 2006). Items from the self-regulated learning scale were adapted from Pintrich, et al., (1991). Items regarding quality of interaction between the student and the instructor were selected from Chickering and Gamson (1987) and Picciano (2002). The items on the perceived learning effectiveness scale were modified from Sun et al. (2008) and Selim (2007). Two independent academic experts in educational psychology reviewed all scale adaptations for content validity.

3.4 Pilot tests and reliability.

The instrument was pretested with 45 (not included) students before the full data was collected. All constructs had an alpha coefficient greater than 0.80, which was considered as having good internal consistency. The item-total correlation was calculated and three items exhibiting low correlations (below 0.40) were revised or eliminated from the instrument before finalization.

3.5 Data Analysis

The IBM SPSS Statistics 27 and AMOS 26 software were used for data analysis. Descriptive statistics (mean, SD, Cronbach's alpha) were calculated for all constructs by instructional modality group. Independent samples t-tests were used to evaluate mean differences between online and traditional learner groups on the mean scores for each engagement construct. Multiple regression analysis was used to investigate the combined predictive effect of the engagement constructs and instructional modality on perceived learning effectiveness. Structural equation modelling (SEM) with maximum likelihood estimation was used to test the hypothesised structural relationships. The bootstrapped confidence interval method (5,000 bootstrap samples) implemented as described in the Hayes (2018) PROCESS macro methodology was used for mediation analysis.

4. RESULTS

4.1 Demographic Profile of Respondents

The demographic characteristics of the 400 participants in the study are shown in Table 1. The sample was somewhat gender balanced with a higher proportion of females (51.3%). Most of the participants were in the age of 18–22 (53.5%), which is in line with the common profile of undergraduate enrollee. The online learner groups were almost as large as the traditional learner groups. About two-thirds of the sample consisted of undergraduate students.

Table 1: Demographic Profile of Respondents (N = 400)

Characteristic	Category	Frequency (n)	Percentage (%)
Gender	Male	186	46.5
	Female	205	51.3
	Non-Binary	9	2.2
Age Group	18–22 years	214	53.5
	23–27 years	121	30.3
	28–35 years	65	16.2
Instruction Mode	Online	201	50.3

	Traditional (Face-to-Face)	199	49.7
Academic Level	Undergraduate	267	66.8
	Postgraduate	133	33.2
Institution Type	Public University	228	57.0
	Private University	172	43.0

4.2 Descriptive Statistics and Reliability

All six constructs are presented in Table 2, broken down by instructional modality. The Cronbach's alpha coefficients of all items were between 0.832 and 0.889, which is good for internal consistency. Results showed that online learners had higher mean scores for cognitive engagement (M = 3.84), perceived learning effectiveness (M = 3.91) and self-regulated learning (M = 3.72). Traditional learners scored higher in the means for the variables of behavioural engagement (M = 3.89), emotional engagement (M = 3.79) and quality of interactions with the instructor (M = 3.97).

Table 2: Descriptive Statistics and Reliability by Instructional Modality

Construct	Mean	SD	Alpha (α)	Instruction Mode
Cognitive Engagement	3.84	0.72	0.874	Online
	3.61	0.78	—	Traditional
Behavioural Engagement	3.76	0.69	0.861	Online
	3.89	0.65	—	Traditional
Emotional Engagement	3.55	0.81	0.848	Online
	3.79	0.74	—	Traditional
Perceived Learning Effectiveness	3.91	0.66	0.889	Online
	3.68	0.71	—	Traditional
Self-Regulated Learning	3.72	0.75	0.856	Online
	3.48	0.80	—	Traditional
Instructor Interaction Quality	3.43	0.88	0.832	Online
	3.97	0.62	—	Traditional

4.3 Independent Samples t-Test Results

Independent samples t-tests were used to determine the significance of mean difference between online and traditional learner groups. The complete results are given in Table 3. Levene's test for the equality of the variances for each of the constructs was not significant ($p > 0.05$), which justifies the use of equal-variance t-tests. Statistically significant group differences were seen for 5 out of 6 constructs. The greatest effect size occurred with the quality of instructor interaction, in favour of the traditional teaching method

(Cohen's d = 0.68). There were moderate positive effects for perceived learning effectiveness (d = 0.34) and cognitive engagement (d = 0.31) in favour of online instruction.

Table 3: Independent Samples t-Test: Online vs. Traditional Instruction (N = 400)

Construct	t-value	df	p-value	Cohen's d	Significant Direction
Cognitive Engagement	3.14	398	0.002**	0.31	Online > Traditional
Behavioural Engagement	-1.99	398	0.048*	0.20	Traditional > Online
Emotional Engagement	-3.07	398	0.002**	0.31	Traditional > Online
Perceived Learning Effectiveness	3.41	398	0.001**	0.34	Online > Traditional
Self-Regulated Learning	2.92	398	0.004**	0.29	Online > Traditional
Instructor Interaction Quality	-6.79	398	< 0.001***	0.68	Traditional > Online

Note: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. Positive t-values indicate online group scored higher.

4.4 Multiple Regression Analysis

The dependent variable for the multiple regression analyses was perceived learning effectiveness on a hierarchical design. The instructional modality was entered in Block 1, followed by the five constructs for engagement in Block 2. The full model accounted for 61.2% of variance in perceived learning effectiveness ($R^2 = 0.612$; Adjusted $R^2 = 0.606$; $F(6, 393) = 103.41$, $p < 0.001$). Each of the predictors made a significant contribution statistically. The strongest predictors were quality of the instructors' interactions ($\beta = 0.31$, $p < 0.001$) and their cognitive engagement ($\beta = 0.29$, $p < 0.001$). The variance inflation factor (VIF) varied between 1.12 and 1.52, indicating that there was no multicollinearity.

Table 4: Multiple Regression Analysis — Predictors of Perceived Learning Effectiveness

Predictor Variable	β (Standardised)	t	p	95% CI	VIF
Instruction Mode (Online = 1)	0.18	3.44	0.001**	[0.08, 0.28]	1.12
Cognitive Engagement	0.29	5.82	< 0.001***	[0.19, 0.39]	1.47
Behavioural Engagement	0.22	4.41	< 0.001***	[0.12, 0.32]	1.39
Emotional Engagement	0.17	3.22	0.001**	[0.07, 0.27]	1.36
Self-Regulated Learning	0.24	4.89	< 0.001***	[0.14, 0.34]	1.28
Instructor Interaction Quality	0.31	6.14	< 0.001***	[0.21, 0.41]	1.52

R^2 = 0.612; Adjusted R^2 = 0.606; F(6, 393) = 103.41, p < 0.001

Note: ** p < 0.01; *** p < 0.001. Dependent variable: Perceived Learning Effectiveness.

4.5 Structural Equation Modelling

A structural path test was performed using SEM to test the hypotheses. Model fit indices were satisfactory: CFI = 0.948, TLI = 0.937, RMSEA = 0.056 (90% CI [0.041, 0.071]), SRMR = 0.063, confirming adequate model fit. Path coefficients are given in Table 5. Five hypothesised structure paths were statistically supported. The relationship between the quality of instructor interaction and emotional involvement had the highest beta (β = 0.41, p < 0.001), as did the relationship between online learning and the perceived effectiveness of learning (β = 0.34, p < 0.001).

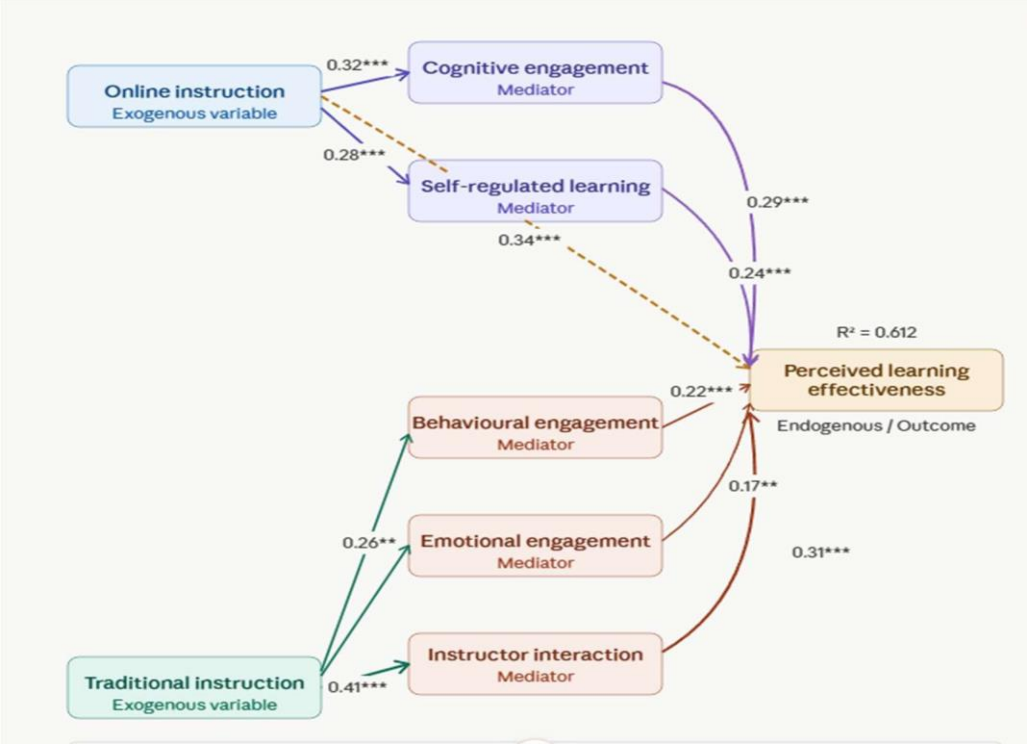

Figure1: SEM Diagram

Table 5: Structural Equation Model — Standardised Path Coefficients

Hypothesised Path	Outcome Variable	Path Coeff. (β)	p-value	Supported?
Online Learning → Cognitive Eng.	Student Engagement	0.32	< 0.001***	Supported
Digital Tools → Self-Regulated Learning	Academic Performance	0.28	< 0.001***	Supported
Instructor Interaction → Emot. Eng.	Student Engagement	0.41	< 0.001***	Supported
Traditional Methods → Behav. Eng.	Student Engagement	0.26	0.002**	Supported
Online Learning → Perceived Effectiveness	Academic Outcome	0.34	< 0.001***	Supported

Note: ** p < 0.01; *** p < 0.001. Model fit: CFI = 0.948; TLI = 0.937; RMSEA = 0.056; SRMR = 0.063.

4.6 Mediation Analysis

The bootstrapped mediation analysis was used to investigate the indirect effects of instructional modality on perceived learning effectiveness via engagement-related mediators. Results are given in Table 6. Non-zero bias-corrected 95% CIs were used to determine the statistical significance of all indirect effects. The indirect pathway with the quality of interaction in the role of the instructor had the highest indirect effect ($\beta = 0.14$), and was completely mediated in the traditional instruction group. The online instruction group partially mediated the relationship between teacher-school connection and cognitive engagement ($\beta = 0.09$).

Table 6: Mediation Analysis — Indirect Effects of Instructional Modality on Perceived Learning Effectiveness

Independent Variable	Mediator	Indirect Effect	Bootstrap 95% CI	Mediation Type
Online Instruction	Cognitive Engagement	0.09 (p = 0.004)	[0.03, 0.17]	Partial
Online Instruction	Self-Regulated Learning	0.07 (p = 0.011)	[0.02, 0.14]	Partial
Traditional Instruction	Instructor Interaction	0.14 (p < 0.001)	[0.08, 0.22]	Full
Traditional Instruction	Emotional Engagement	0.11 (p = 0.002)	[0.05, 0.18]	Partial

5. DISCUSSION

This study's results suggest there are unique strengths of online and traditional instructional modalities that affect various aspects of student engagement and effectiveness of learning. Based on the theoretical foundations of DLEs that also highlight the importance of cognitive presence and self-regulated learning (SRL), E1 and E3 were supported by online instruction, with cognitive engagement showing a significantly higher score and SRL showing a significantly lower score.Online instruction showed a significantly higher score of cognitive involvement and a significantly lower score of SRL, confirming H1 and H3, and in line with theoretical perspectives that emphasize the importance of cognitive presence and self-regulated learning (SRL) in digital learning environments. The use of online platforms, such as recorded lectures, digital materials, and interactive assessment tools, that offer the flexibility of asynchronous access to learning content seems to enhance cognitive processing and learner control over pacing, scheduling and content engagement. These attributes could aid in the development of self-regulatory skills that accompany autonomous motivation; however, self-selection effects among online learners should be noted. Conversely, the traditional instruction resulted in a significantly higher level of emotional engagement and instructor interaction quality, which was consistent with H2 and H4, and aligned with previous studies that have identified the relational benefits of face-to-face learning environments. The large effect found for the instructor interaction quality indicates that speech-to-speech interaction, nonverbal signals, immediate feedback and interpersonal interaction are challenging to fully replicate in an online environment. These results highlight that emotional involvement in learning is an important dimension of persistence, identity formation, and wellbeing of students and institutions should carefully examine the affective dimensions of greater use of online delivery. In addition, the mediation analysis showed that the relationship between traditional instruction and perceived learning effectiveness

was fully mediated by the quality of the instructor-student interaction, suggesting that the positive effect of traditional instruction is mainly mediated by the quality of interaction between teacher and student, which means that this positive effect is not directly from the traditional instruction itself. In the same way, perceived learning effectiveness is partially mediated in the relationship between online instruction and cognitive engagement, revealing that the benefits of online learning can be obtained directly from the modality-specific features of the instruction as well as indirectly through increased cognitive involvement. Together, these findings show that neither teaching method is clearly better than the other, with each having its own promise. While traditional instruction may be more effective in inducing emotional engagement and high-quality instructor interactions, online learning is more effective in inducing cognitive engagement, SRL, and perceived learning effectiveness. The results give empirical evidence for blended learning models with a strategic mixture of online, self-directed learning, and formative assessment components, along with face-to-face and/or synchronous ones where students can collaborate, discuss, be mentored, and enjoy emotionally enriching education and learning experiences, maximizing student engagement and learning outcomes on multiple levels.

6. CONCLUSIONS

This study also adds empirical evidence for the current scholarly and policy discussion about the relative benefits of digital pedagogy and traditional instruction in higher education. The study presents results of a large-scale quantitative design (N = 400) with students at a university, showing clear and partially overlapping online and traditional engagement patterns. The cognitive engagement, self-regulated learning, and perceived learning effectiveness of online instruction are significantly better than that of traditional instruction, while the emotional engagement and quality of instructor interaction of traditional instruction is superior. In the traditional setting, there is a slight higher level of behavioural engagement. The results of SEM and mediation analysis indicate that the quality of the instructors' interaction is the most important factor in determining perceived learning effectiveness, and is the sole mediator of the positive effect of traditional instruction on learning effectiveness. The results of this research reinforce the importance of the instructor in student learning, not only as a physical presence, but as a digitally mediated one as well, and point to the need for better development of online learning environments that can effectively support student-instructor interaction.

There are a number of limitations to the study. It is a cross-sectional survey, so does not allow for causal inferences between instructional modality and engagement outcomes. Self-report instruments measuring engagement and effectiveness of learning can be subject to social desirability and recall biases. Though the sample size was fairly small, it was taken from a specific national context and may not be applicable to other HESs. Future studies could utilize longitudinal study designs, objective measures of academic performance, and multi-national samples to expand and extend the current results. Causal evidence would be found more strongly from experimental or quasi-experimental designs using random assignment to instructional modality. Further, the moderating effects of digital literacy, prior academic performance, and discipline pedagogical norms on the relationships explored herein should be explored in future studies.

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