Student's Needs and Development of an Online Teaching and Learning Management Model during the pandemic in Guangdong Mao Ming Agriculture & Forestry Technical College

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Abstract

The objectives of this study were (1) to investigate undergraduate students' needs regarding online teaching and learning management and (2) to develop and evaluate an appropriate management model during the pandemic at Guangdong Mao Ming Agriculture & Forestry Technical College. A quantitative research design was employed, with a sample of 400 undergraduate students selected using the Taro Yamane formula. Data were collected via a structured questionnaire measuring students' needs and perceptions toward the appropriateness of the online model across three stages: pre-learning, during-learning, and post-learning. The results revealed that students' needs and the appropriateness of the developed model were at a high level. Correlation and regression analysis highlighted that clear learning objectives and stable platforms were essential for satisfaction. The study concludes that an integrated online management model effectively supports academic continuity during crisis periods.

Keywords: Online Learning Management, Students' Needs, Pandemic Pedagogy, Higher Education, Guangdong

Introduction

The COVID-19 pandemic triggered an unprecedented global transition from face-to-face instruction to online and emergency remote teaching formats (Crawford et al., 2020; Hodges et al., 2020). International organizations emphasized the urgent need for institutions to establish sustainable digital learning systems to ensure academic continuity (OECD, 2020; UNESCO, 2020). However, research indicates that effective online learning management requires more than technological availability; it demands systematic instructional design, learner-centered planning, and interactive pedagogical strategies (Anderson, 2011; Bates, 2019).

Theoretical frameworks in online education emphasize the importance of structured learning environments. The Community of Inquiry (CoI) framework highlights cognitive, social, and teaching presence as core elements of meaningful online learning experiences (Garrison et al., 2000; Akyol & Garrison, 2011). Similarly, the theory of Transactional Distance posits that clear structure and dialogue reduce psychological distance in virtual environments (Moore, 1993). These perspectives suggest that effective online management must integrate preparation, interaction, and evaluation in a coherent system.

Instructional design theory further stresses that clearly articulated objectives and systematic planning are foundational to learning effectiveness (Tyler, 1949; Bruner, 1966). During online delivery, multimedia learning principles and cognitive load management become essential to avoid learner overload (Mayer, 2009; Mayer & Moreno, 2003). Moreover, student engagement in digital environments is strongly associated with interaction quality and instructor facilitation (Bernard et al., 2009; Swan, 2001).

For vocational and technical colleges such as Guangdong Mao Ming Agriculture & Forestry Technical College, these theoretical insights are particularly relevant. Students in

applied disciplines require interactive and practice-oriented instruction, which must be carefully redesigned for digital contexts (Bao, 2020; Zhu & Liu, 2020). Therefore, this study aims to investigate students' needs and develop an online teaching and learning management model grounded in established educational theories, focusing on three operational stages: Pre-learning (Preparation), During-learning (Interaction), and Post-learning (Evaluation).

Research Methodology

Design: This research followed a quantitative approach focused on model development and evaluation.

The development of the online teaching and learning management model followed a theory-informed and data-driven process.

First, foundational theoretical frameworks—including the Community of Inquiry model (Garrison et al., 2000), Multimedia Learning Theory (Mayer, 2009), and Transactional Distance Theory (Moore, 1993)—were reviewed to identify essential dimensions of effective online learning environments. These theories informed the conceptual structuring of the three-stage model (Pre-learning, During-learning, Post-learning).

Second, empirical evidence from prior online education research emphasizing instructional preparation, interaction quality, and assessment feedback (Bernard et al., 2009; Gibbs & Simpson, 2004; Arbaugh, 2014) was synthesized to generate measurable indicators within each stage.

Third, students' needs were collected via questionnaire and analyzed descriptively. The dimensions with the highest mean scores were prioritized in the final model refinement. Finally, regression analysis was employed to identify significant predictors of satisfaction, ensuring that the model's structure reflected statistically supported relationships rather than theoretical assumptions alone.

This multi-step approach enhances methodological transparency and ensures that the developed model is grounded in both established theory and empirical data.

Population and Sample: The target population comprised all undergraduate students enrolled at Guangdong Mao Ming Agriculture & Forestry Technical College during the 2021–2022 academic year, totaling approximately 4,800 students across multiple faculties. Stratified random sampling was employed to ensure proportional representation across year levels and academic programs. The required sample size was calculated using the Taro Yamane formula at a 95% confidence level and a margin of error of 5%, yielding a minimum sample of 370 respondents. To account for potential non-responses or incomplete questionnaires, 420 questionnaires were distributed, of which 400 were returned complete and valid, representing a response rate of 95.2%. Among the respondents, 216 (54.0%) were female and 184 (46.0%) were male, spanning first-year through third-year students.

Instrument: A structured questionnaire using a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree) was developed to measure two key constructs: (1) students' needs regarding online teaching and learning management, and (2) the appropriateness of the developed management model across three operational stages: Pre-learning (Preparation), During-learning (Interaction), and Post-learning (Evaluation). The questionnaire comprised 45 items in total: Part 1 included 5 items on demographic information; Part 2 contained 20 items measuring students' needs (Pre-learning: 7 items; During-learning: 8 items; Post-learning: 5 items); and Part 3 included 20 items assessing the appropriateness of the developed model across the same three stages. Content validity was verified by five subject-matter experts in online education, instructional design, and educational technology using the Index of Item-Objective Congruence (IOC). All items achieved IOC values between 0.60 and 1.00, and items falling below 0.50 were revised or excluded. Reliability was assessed through a pilot test with 30 students (not included in the main sample), yielding an overall Cronbach's Alpha coefficient of 0.91 for the needs scale (Pre-learning: α = .88; During-learning: α = .89; Post-learning:

α = .85) and 0.93 for the model appropriateness scale (Pre-learning: α = .90; During-learning: α = .91; Post-learning: α = .87), all exceeding the acceptable threshold of 0.70.

Data Analysis: All data were coded and analyzed using SPSS Version 26.0. Descriptive statistics, including frequency, percentage, mean ($\overline{X}$), and standard deviation (S.D.), were computed to summarize respondents' demographic profiles and to describe the level of students' needs and model appropriateness across all three stages. Mean scores were interpreted using the following scale: 1.00–1.80 = Very Low; 1.81–2.60 = Low; 2.61–3.40 = Moderate; 3.41–4.20 = High; 4.21–5.00 = Very High. Pearson product-moment correlation analysis was conducted to examine the relationships between students' needs dimensions and the perceived appropriateness of the model. Stepwise multiple regression analysis was subsequently employed to identify the significant predictors of overall model effectiveness, with Variance Inflation Factor (VIF) values checked to confirm the absence of multicollinearity among predictors.

Result

The results are organized in response to the two research objectives: (1) investigating students' needs regarding online teaching and learning management, and (2) evaluating the appropriateness of the developed three-stage model. Findings from both descriptive and inferential analyses are reported, with mean scores interpreted using the five-level scale described in the methodology. The results are presented through five thematic findings reflecting quantitative patterns and their educational significance.

Theme 1: High Level of Students' Needs toward Online Learning

The findings indicate that students' needs regarding online teaching and learning management were at a high level overall ($\overline{X}$ = 4.08, S.D. = 0.54). Analyzed by stage, the Pre-learning dimension recorded the highest mean ($\overline{X}$ = 4.19, S.D. = 0.51), followed by During-learning ($\overline{X}$ = 4.06, S.D. = 0.57) and Post-learning ($\overline{X}$ = 3.98, S.D. = 0.60). These results reflect students' strong and consistent expectations for well-structured, accessible, and interactive online learning environments across all phases of instruction.

Students emphasized several key needs, including:

- Clear learning objectives
- Easy access to learning materials
- Interactive teaching activities
- Timely feedback from instructors
- Stable and reliable online platforms

At the item level, the highest-rated need was "Clear learning objectives are provided before each online session" ($\overline{X}$ = 4.31, S.D. = 0.48), followed by "Online platforms are stable and easy to access" ($\overline{X}$ = 4.28, S.D. = 0.52) and "Instructors provide timely feedback on assignments" ($\overline{X}$ = 4.22, S.D. = 0.55). The lowest-rated need was "Online assessments accurately reflect my learning progress" ($\overline{X}$ = 3.84, S.D. = 0.68). These findings collectively suggest that students require not only content delivery but also structured learning experiences, reliable technological infrastructure, and responsive instructional support to engage effectively with online education during the pandemic.

Theme 2: Effectiveness of the Developed Management Model

The developed online teaching and learning management model was evaluated as highly appropriate across all three stages, with an overall appropriateness mean of 4.12 (S.D. =

0.52). Stage-level scores were as follows: Pre-learning ($\overline{X}$ = 4.23, S.D. = 0.49, classified as "Very High"), During-learning ($\overline{X}$ = 4.10, S.D. = 0.55, classified as "High"), and Post-learning ($\overline{X}$ = 4.02, S.D. = 0.58, classified as "High"). Pearson correlation analysis further confirmed that students' overall needs were positively and significantly correlated with the overall model appropriateness rating (r = .61, p < .001), indicating that higher levels of expressed student needs were associated with more favorable evaluations of the developed model. This alignment suggests that the model was designed in a manner that closely reflects the learning priorities and expectations of undergraduate students at the college.

- Pre-learning
- During-learning
- Evaluation

These results collectively indicate that the model successfully aligns with students' expectations and supports effective online learning processes across preparation, interaction, and evaluation phases, addressing Research Objective 2 of this study.

Theme 3: Pre-learning Stage as the Highest Rated Component

Among the three stages, the **pre-learning stage** received the highest mean score for both students' needs ($\overline{X}$ = 4.19, S.D.= 0.51) and model appropriateness ($\overline{X}$ = 4.23, S.D. = 0.49), both classified as "Very High." The highest-rated pre-learning item for needs was "Clear learning objectives are communicated prior to each session" ($\overline{X}$ = 4.31, S.D. = 0.48), while the highest appropriateness item was "The model clearly outlines what students are expected to achieve before class" ($\overline{X}$ = 4.35, S.D. = 0.46). These findings indicate that structured preparation activities—including the provision of clear instructions, explicit learning objectives, pre-class reading materials, and access to the online platform—are essential prerequisites for successful online learning experiences during the pandemic.

Students value structured preparation because it helps reduce uncertainty and cognitive overload at the start of online sessions, increases academic readiness and self-directed learning behavior, and enhances confidence and motivation to engage with subsequent learning activities. This finding is consistent with instructional design theory, which posits that clearly articulated objectives and organized pre-class preparation are foundational conditions for effective learning (Tyler, 1949; Bruner, 1966), and with the Community of Inquiry framework's emphasis on teaching presence as a prerequisite for meaningful online educational experience (Garrison et al., 2000).

Theme 4: During-learning Stage as the Strongest Predictor

Although pre-learning received the highest descriptive score, the **during-learning stage** was identified as the strongest predictor of overall model effectiveness in the multiple regression analysis. The full regression model was statistically significant (F(3, 396) = 52.14, p < .001) and explained 28.3% of the variance in overall model appropriateness (R^2 = .283, Adjusted R^2 = .277). Among the three predictors, the During-learning dimension yielded the largest standardized regression coefficient (β = .41, t = 8.73, p < .001), followed by Pre-learning (β = .29, t = 6.12, p < .001) and Post-learning (β = .18, t = 3.84, p < .001). All VIF values were below 3.0, confirming the absence of multicollinearity. Additionally, Pearson correlation showed a strong positive relationship between During-learning needs and model appropriateness (r = .55, p < .001).

This highlights that:

These regression findings underscore that what transpires during live online instruction exerts the most decisive influence on students' overall perceptions of model effectiveness. Specifically, interactive teaching methods, real-time communication between instructors and

students, peer-to-peer collaboration, and active engagement strategies collectively play the most critical role in determining students' learning satisfaction and perceived quality of the online management model. This result aligns with Transactional Distance Theory (Moore, 1993), which argues that meaningful dialogue during instruction is the primary mechanism for reducing psychological distance in virtual learning environments, and with meta-analytic evidence demonstrating that learner-instructor and learner-learner interaction are the strongest predictors of online course effectiveness (Bernard et al., 2009).

Theme 5: Importance of Systematic Learning Stages

The findings confirm that an effective online teaching model must integrate:

- Preparation (pre-learning)
- Interaction (during-learning)
- Evaluation (post-learning)

A fragmented approach to online teaching management leads to disjointed learning experiences and reduced student satisfaction, while a structured, sequentially integrated model ensures pedagogical consistency, instructional coherence, and learning quality. The Pearson correlation coefficients between all three stage-level needs scores and overall model appropriateness were statistically significant: Pre-learning ($r = .52$, $p < .001$), During-learning ($r = .55$, $p < .001$), and Post-learning ($r = .47$, $p < .001$). These results confirm that a systemic, three-stage approach to online learning management—where preparation, real-time interaction, and post-session evaluation are deliberately integrated—is more effective than implementing any single stage in isolation, consistent with systems theory perspectives on educational design (Picciano, 2017; Sun & Chen, 2016).

Discussion and conclusions

Regarding Research Objective 1, the findings confirm that undergraduate students' needs during the pandemic extend substantially beyond basic digital access and reflect structured, multi-dimensional expectations for organized, interactive, and responsive online learning environments. The overall high level of students' needs ($\overline{X}$ = 4.08, S.D. = 0.54) is consistent with international evidence documenting that learners in emergency remote teaching contexts urgently require systematic instructional guidance and reliable support structures (Crawford et al., 2020; Hodges et al., 2020). Specifically, the high rating of the Pre-learning stage ($\overline{X}$ = 4.19, S.D. = 0.51) supports instructional design theory, which emphasizes that clearly defined objectives and well-organized preparation activities are foundational for effective learning (Tyler, 1949; Bruner, 1966). In online contexts, such clarity reduces learner uncertainty and cognitive overload (Mayer, 2009), while strengthening teaching presence—a key dimension in the Community of Inquiry framework (Garrison et al., 2000)—before formal instruction begins.

Addressing Research Objective 2, the developed three-stage online teaching and learning management model was evaluated as highly appropriate overall ($\overline{X}$ = 4.12, S.D. = 0.52), with the Pre-learning stage receiving the highest appropriateness rating ($\overline{X}$ = 4.23, S.D.= 0.49). The strong predictive power of the During-learning stage ($\beta = .41$, $p < .001$) in the regression analysis aligns with substantial research demonstrating that real-time interaction is the most critical determinant of perceived online course effectiveness (Bernard et al., 2009; Swan, 2001). According to Transactional Distance Theory (Moore, 1993), structured and meaningful dialogue during instruction is the primary mechanism for reducing the psychological distance inherent in virtual learning environments. The significant regression coefficient for Pre-learning ($\beta = .29$, $p < .001$) further supports studies indicating that instructor planning, clearly communicated objectives, and pre-session preparation materials significantly

enhance online student satisfaction and engagement (Arbaugh, 2014; Wang et al., 2013). The positive contribution of Post-learning (β = .18, p < .001) corroborates evidence that timely, constructive feedback and structured assessment close the instructional loop and reinforce learning consolidation (Gibbs & Simpson, 2004; Angelo & Cross, 1993).

The emphasis students placed on stable and reliable online platforms ($\overline{X}$ = 4.28, S.D. = 0.52) and the high needs ratings for accessible learning materials reflect the critical role of technological infrastructure in online learning effectiveness. These findings resonate with principles of Cognitive Load Theory and Multimedia Learning (Mayer, 2009; Mayer & Moreno, 2003): poorly structured or technically unstable online content imposes extraneous cognitive load that diverts mental resources away from learning itself, whereas well-designed, consistently accessible digital materials reduce unnecessary burden and enhance both comprehension and information retention. This dimension is especially relevant in vocational and technical education contexts, where applied and practice-oriented content requires reliable digital delivery to sustain instructional fidelity (Bao, 2020; Zhu & Liu, 2020).

Importantly, the significant positive correlations observed across all three stage-level needs dimensions and model appropriateness—Pre-learning (r = .52, p < .001), During-learning (r = .55, p < .001), and Post-learning (r = .47, p < .001)—confirm that aligning instructional design with learner-expressed needs enhances both satisfaction and perceived model effectiveness. The integration of Pre-learning, During-learning, and Post-learning stages into a unified model mirrors the systemic approach advocated by digital education scholars (Picciano, 2017; Sun & Chen, 2016), who argue that coherent instructional sequencing, rather than isolated technological interventions, is the foundation of sustainable online pedagogy. These results collectively affirm that the developed model is not merely structurally sound in theory, but is empirically validated as appropriate by the students it was designed to serve, responding directly to the stated need for systematic, learner-centered online management during crisis-driven educational transitions.

In conclusion, this study successfully addressed both research objectives. With respect to Objective 1, the findings reveal that undergraduate students at Guangdong Mao Ming Agriculture & Forestry Technical College demonstrated high-level needs ($\overline{X}$ = 4.08) for structured, interactive, and technologically reliable online learning management across Pre-learning, During-learning, and Post-learning phases, with Pre-learning needs rated highest ($\overline{X}$ = 4.19). With respect to Objective 2, the developed three-stage online teaching and learning management model was evaluated as highly appropriate ($\overline{X}$ = 4.12), with the During-learning stage identified as the strongest predictor of overall model effectiveness (β = .41, p < .001), accounting for 28.3% of the total explained variance alongside the other two stages. The model's effectiveness lies not in technological sophistication alone, but in its theoretically grounded and empirically validated alignment with students' actual learning needs. This study contributes to the broader discourse on sustainable digital pedagogy by offering a three-stage management model—integrating preparation, real-time engagement, and systematic evaluation—that can serve as a replicable framework for institutions navigating future episodes of educational disruption.

Suggestion

1. Recommendations for Educational Practice and Administration:

Standardizing Digital Preparation: Institutions should establish a standard "Preparation Protocol" for all online courses. This includes ensuring that all learning objectives, reading materials, and technical guides are uploaded at least one week before the course begins to satisfy the high "Pre-learning" needs identified.

Enhancing Interaction Tools: Given the importance of the "During-learning" phase, teachers should be trained to use diverse interactive tools such as live polls, breakout rooms, and collaborative whiteboards to maintain engagement and prevent "Zoom fatigue".

Feedback and Evaluation Systems: The "Post-learning" phase should be strengthened by implementing automated yet personalized feedback systems. Timely quizzes and project evaluations help students monitor their own progress and increase their confidence in an online setting.

Infrastructure Support: Administration must prioritize the stability of the online learning platform. Technical support should be available 24/7 during peak exam or submission periods to ensure that the "Resourcing" needs of the students are met.

2. Recommendations for Future Research:

Long-Term Impact Study: It is recommended to conduct a follow-up study to evaluate how students who learned primarily through this online model perform in subsequent face-to-face advanced courses.

Digital Literacy Correlation: Future research should investigate the relationship between a student's prior digital literacy level and their satisfaction with the online management model to tailor support for less tech-savvy students.

Qualitative Insight: Incorporating focus group interviews with both teachers and students would provide a deeper understanding of the "hidden" challenges of online management, such as mental health issues or domestic distractions during a pandemic.

Hybrid Model Development: As schools return to normalcy, research should focus on how this online management model can be integrated into a "Blended" or "Hybrid" learning format to capitalize on the benefits of both digital and physical classrooms.

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