A STUDY TO DEVELOP AN ONLINE LEARNING ENVIRONMENT FOR IMPROVING COGNITIVE PEDAGOGY PRINCIPLES AND INSTRUCTIONAL STRATEGIES

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Abstract

This study aimed to create an online learning environment; the secondary goal was to improve cognitive pedagogy ideas and instructional strategies by means of the internet. The study comprised a representative sample of undergraduate students engaged in a controlled online learning program intended to enhance active learning, metacognitive skills, and critical thinking. The study was conducted with a quantitative research methodology. The digital environment includes the interactive modules, the real-time feedback, and the group projects connected with cognitive learning theories. Data were gathered following the intervention using questionnaires distributed both before and following the intervention. Then statistical techniques were applied to look at changes in teaching effectiveness and student involvement. Simultaneity with the results showing a significant increase in the degree of cognitive involvement displayed by the students, they also showed the application of effective teaching strategies. The students claimed increased degrees of autonomy, better conceptual knowledge, and more significant degrees of interaction with both the topic and their peers. The results provide proof in favour of the theory that a well-planned online learning environment may effectively enhance the quality of education as well as the cognitive ability development. Research shows that adding cognitive pedagogy into online environments improves the general calibre of the instructional and learning opportunities. For teachers and instructional designers trying to raise the efficacy of digital learning, this offers a better awareness of the circumstances.

Keywords: *Cognitive Pedagogy, Digital Learning, Instructional Designers, Effective Teaching, Instructional Strategies.*

Introduction

One reasonable explanation for the great use of online learning environments was that both fast technology development and the increasing need for adaptable educational solutions acted as motivating agents. Although accessibility and convenience were perfect traits of these systems, it was probably not always how these approaches encouraged meaningful learning or enhanced cognitive function. Many of the current online courses concentrated mostly on giving facts and data, instead of motivating students to participate in critical thinking, problem-solving, and information retention. Online learning environments had to be anchored in cognitive pedagogy ideas if the researcher were to properly handle these problems. Strong focus on the three basic domains of knowledge acquisition, processing, and application is given by cognitive pedagogy. The researcher underlined cognitive skills like metacognition, memory, attention, and reasoning ability. In online learning, fundamental pedagogical techniques for implementing these ideas were scaffolding, adaptive feedback, student agency, active involvement, and group projects. Using these techniques helped students to apply their knowledge, make pertinent judgements, and assess their comprehension. Even while cognitive-based education is becoming more and more important, online platforms still lacked appropriate application of these ideas. This disparity remained even as online learning became very popular (Nguyen et al., 2023). Initiated with a goal-built online platform meant to support cognitive pedagogy ideas and teaching strategies, the project aimed at helping to close this gap. The study aimed to assess

how learner engagement, cognitive information processing, and academic performance changed with the surroundings. The results were to give teachers, instructional designers, and academic institutions practical ideas for including cognitive learning frameworks into use, therefore improving the quality of online learning. The investigation was successful in reaching this objective at last. All things considered, the findings provide insightful direction for the creation of more dynamic, learner-centred online learning environments (El-Sabagh, 2021).

Background of the study

The shift towards online learning has seen a notable quickening during the past several years. Advances in technology as well as global events like the COVID-19 epidemic have brought about this shift. Virtual learning platforms are becoming more and more popular as a way of preserving continuity and accessibility in educational institutions as they help to reach this aim. Conversely, the great majority of the already available platforms have mostly concentrated on the distribution of material and sometimes overlook the cognitive and pedagogical roots needed for effective learning. Studies have demonstrated that although online settings enhanced accessibility and flexibility, they sometimes failed to inspire critical thinking, learner involvement, and deep knowledge inside their pupils. When educational tactics were applied in virtual environments, the lack of cognitive pedagogy concepts provided a difficulty to their efficacy. Under this area are several ideas like scaffolding, metacognition, reflective thinking, and adaptive feedback. Given this, the redesign of online learning environments has been much sought after to bring them into harmony with the cognitive processes supporting the acquisition, retention, and application of information. This need has been growing. Inspired by a virtual learning platform designed especially on cognitive pedagogy, this project was developed with the goal of overcoming these constraints (Wei et al., 2025). The project was started with an intention of fixing these flaws. Among the main instructional elements meant to be included into the platform when it was first planned are learner autonomy, interactive modules, timely feedback, and group projects. In this specific research, improved teaching tactics and cognitive pedagogy enhancement were the investigated dependent variables. Considered as the independent variable, the virtual learning environment was investigated for effects on both variables. This study aimed to assess the ways in which the course's structure affected the degree of cognitive engagement and the effects of learning by means of educational psychology and instructional design ideas. The study sought specifically how the course's organisation impacted the learning results. Establishing a link between the theoretical educational models and the real-world digital implementations was ultimately the aim. The development of learner-centred virtual experiences that not only provided knowledge but also promoted higher-order thinking and sustainable learning practices would be made much easier. This basis set the framework for a research initiative aimed at enhancing the quality of online education by means of digital innovation with pedagogically sound approach (Were et al., 2023).

Purpose of the research

Under the context of an online learning environment, this study aimed to investigate how course design influences the effectiveness and efficiency of instructional tactics. The main objective of the study was to investigate how deliberate design components like scaffolding, feedback systems, organised content distribution, and interactive learning activities helped cognitive pedagogy-based instructional methodologies. The study team set out to investigate how educators may employ a well-designed virtual classroom to support more active learning, more critical thinking, and more interesting class discussions. The researcher achieved this by combining course design and instructional strategies with an eye on the link between the two. With empirical data able to guide instructional designers' and teachers' best practices, the

researchers set out to address the issue, "What works when it comes to creating online courses?" This would ensure that instructional plans were anchored in a cognitive paradigm and applied with efficacy. This study was conducted with the intention of tying theoretical course design with actual instructional implementation so helping to improve the quality of knowledge acquired through online education.

Literature review

Research that was conducted in the past brought to light the important relevance that cognitive pedagogy principles have in terms of boosting the effectiveness of online learning environments. It was demonstrated through study that learners had a significant improvement in their capacity to participate in critical thinking and an increase in their level of engagement when they were using online platforms that combined cognitive strategies such as scaffolding, metacognitive prompts, and adaptive feedback. Researchers found that active learning techniques and interactive course components contributed to a more profound degree of cognitive processing and promoted higher information retention when compared to more conventional forms of educational material distribution. This was revealed when the researchers evaluated these various approaches to the distribution of educational content. Additionally, research has shown that instructional approaches that promote learner autonomy and self-regulation are connected with higher levels of academic accomplishment and motivation in virtual settings. This is the case in virtual environments. In addition, despite these findings, a significant number of online learning systems lacked a deliberate design that was founded on cognitive theories. Because of this, students were only able to acquire information on a superficial level, rather than gaining genuine grasp of the material studied. As a result of the rapid shift towards online education that occurred during the COVID-19 epidemic, there was a surge in the demand for efficient instructional models that encourage cognitive growth in a distant setting. As a result, there was an increase in the number of studies that were carried out to investigate fresh online teaching strategies (Garcia et al., 2021). Furthermore, research has highlighted the value of social and collaborative learning components in virtual environments for the aim of enhancing metacognitive control and problem-solving abilities. This is done with the intention of enhancing the ability to problem-solve. In addition, it was found that the implementation of cognitive pedagogy in technology-enhanced learning environments required the course to be purposefully designed in order to reduce the amount of mental work that was required of the students and to develop higher-order thinking skills. Individually and collectively, the findings of these studies laid the groundwork for the development of online learning environments that not only supply students with content but also actively engage them via the implementation of instructional strategies that are well-structured and founded on cognitive pedagogy. For the purpose of this investigation, the existing body of literature served as a foundation for the objective of developing an online platform with the intention of enhancing cognitive engagement and instructional quality, which would ultimately result in improved learning outcomes for students who are immersed in virtual environments (Lopez & Zhang, 2023).

1. **Research questions**
   - What is the impact of Course Design on Instructional Strategies?
2. **Research methodology**

a. **Research design**:

The quantitative data analysis used SPSS version 25. The odds ratio and 95% confidence interval were used to determine the degree and direction of the statistical association. The researchers established a statistically significant criteria at $p < 0.05$. A descriptive analysis was conducted to identify the main features of the data. Quantitative methods are often used to

assess data collected via surveys, polls, and questionnaires, as well as data altered by computing tools for statistical analysis.

b. Sampling:

A convenient sampling technique was applied for the study. The research relied on questionnaires to gather its data. The Rao-soft program determined a sample size of 80. A total of 120 questionnaires were distributed; 112 were returned, and 16 were excluded due to incompleteness. In the end, 96 questionnaires were used for the research.

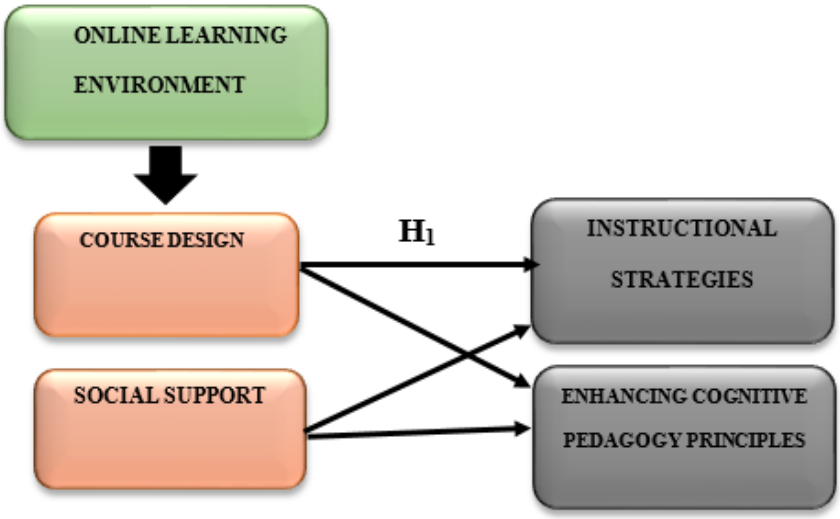
c. Data and Measurement:

The primary method of collecting data for research was questionnaire surveys. In section A, participants were requested to provide fundamental demographic data; in section B, they were instructed to evaluate the significance of many channels, both online and offline, using a 5-point Likert scale. A diverse array of secondary sources, including online databases, was meticulously examined to get the necessary information.

6.4 Statistical Software: The statistical analysis was conducted using SPSS 25 and MS-Excel.

6.5 Statistical Tools: To grasp the fundamental character of the data, descriptive analysis was used. The researcher is required to analyse the data using ANOVA.

3. Conceptual framework



4. Result

- **Factor Analysis**

One typical use of Factor Analysis (FA) is to verify the existence of latent components in observable data. When there are not easily observable visual or diagnostic markers, it is common practice to utilise regression coefficients to produce ratings. In FA, models are essential for success. Finding mistakes, intrusions, and obvious connections are the aims of modelling. One way to assess datasets produced by multiple regression studies is with the use of the Kaiser-Meyer-Olkin (KMO) Test. They verify that the model and sample variables are representative. According to the numbers, there is data duplication. When the proportions are less, the data is easier to understand. For KMO, the output is a number between zero and one. If the KMO value is between 0.8 and 1, then the sample size should be enough. These are the permissible boundaries, according to Kaiser: The following are the acceptance criteria set by Kaiser:

A pitiful 0.050 to 0.059, below average 0.60 to 0.69

Middle grades often fall within the range of 0.70-0.79.

With a quality point score ranging from 0.80 to 0.89.

They marvel at the range of 0.90 to 1.00.

Table1: KMO and Bartlett's Test

Testing for KMO and Bartlett's

Sampling Adequacy Measured by Kaiser-Meyer-Olkin 0.90

The results of Bartlett's test of sphericity are as follows: approx. chi-square

df=190

sig.=.000

This establishes the validity of assertions made only for the purpose of sampling. To ensure the relevance of the correlation matrices, researchers used Bartlett's Test of Sphericity. Kaiser-Meyer-Olkin states that a result of 0.90 indicates that the sample is adequate. The p-value is 0.00, as per Bartlett's sphericity test. A favourable result from Bartlett's sphericity test indicates that the correlation matrix is not an identity matrix.

Table: KMO and Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.90
Bartlett's Test of Sphericity	**Approx. Chi-Square**	3252.968
	df	190
	Sig.	.000

The first stage in exploratory factor analysis (EFA) is to ascertain the data's appropriateness for factor analysis. Kaiser advised postponing factor analysis until a sample adequacy coefficient over 0.5 is achieved, as shown by the KMO (Kaiser-Meyer-Olkin) measure. The KMO value derived from the data used in this analysis is 0.90. Bartlett's test of sphericity yielded a significant result of 0.00.

❖ **Independent variable**

- **Online Learning Environment**

The term "online learning environment" refers to a digital platform or ecosystem that has been specifically designed to facilitate the process of teaching and learning via the utilisation of technology that is implemented online. It is possible for instructors and students to work together, share ideas, and evaluate one another in an environment that is both regulated and engaging, with the purpose of learning and education. This is possible regardless of the location

of the students and teachers. The majority of the time, these environments are developed with the assistance of Learning Management Systems (LMS) like Google Classroom, Moodle, or Blackboard. The capabilities of these systems include, but are not limited to, video conferences, discussion forums, quizzes, e-books, electronic books, multimedia materials, and virtual labs. In addition to provide students with the necessary content for the course, effective online courses are designed to encourage students to engage in active involvement, intellectual growth, and genuine touch with one another besides. Active learning technologies like as adaptive materials, self-paced courses, group projects, and real-time feedback are among the educational resources that are utilised in their classrooms. Not only do they offer flexibility in terms of when, where, and how education is given, but they also fulfil a wide range of learning styles and requirements, which is another reason why they are crucial. Participating in an online learning environment and implementing concepts from cognitive pedagogy and instructional design can be beneficial to the development of talents such as critical thinking, problem-solving, and metacognition. Students will have access to materials from all over the world, they will be able to personalise their educational experience, and they will be able to interact with the material in a manner that is comparable to that of a traditional classroom, all of which will contribute to an improvement in their education. Additionally, it is of utmost importance in contemporary classrooms, particularly in situations when students are required to enrol in hybrid or online classes (Kim & Park, 2021).

❖ **FACTOR**

- **Course Design**

The practice of meticulously organising, structuring, and organising the components of a learning process in order to aid an individual in accomplishing particular educational goals is referred to as course design. If the learning goals, teaching approaches, evaluation criteria, and course materials are all linked in a planned manner, then it is ensured that students will acquire the essential information, abilities, and competencies within the course. The requirements of the students, the relevancy of the content, and the kind of teaching (in-person, online, hybrid, etc.) are all taken into consideration when designing a course that is well-crafted. This is done in light of the most recent research and the most effective methods in the field of education. Each and every other aspect of a course that has been thoughtfully planned has to be guided by learning objectives that are not just articulated in a straightforward manner but also specific and measurable. In order to make an informed decision on a certain educational approach, it is essential to take into consideration the ways in which it has impacted the levels of motivation, involvement, and cognitive processes of the pupils. By driving the construction of both formative and summative assessments, these objectives serve as a road map for evaluating the performance of students and identifying areas in which instructors may demonstrate growth with regard to their teaching. In addition, accessibility, engagement, and flexibility are elements that are taken into account throughout the design process of the course in order to cater to a diverse variety of students. Because it requires substantial training on how to use digital technology to duplicate or enhance the pedagogical benefits of in-person meetings, course design is significantly more crucial in online learning. This is because online learning is a relatively new phenomenon. Online learning is a relatively new kind of education, which is the reason for this conclusion. Resources such as self-paced learning courses, online forums, feedback systems, and multimedia materials are all examples of the kinds of tools that fall under this category. One of the goals of a good course design is to produce learning experiences that are not only relevant but also comprehensible, enjoyable, and focused on the desired outcomes (Zawacki-Richter et al., 2020).

❖ **DEPENDENT VARIABLE**

- **Instructional Strategies**

Teachers use instructional strategies—that is, logical, deliberate approaches—to support student learning, raise student involvement, and meet specific educational goals. Teachers apply these methods in order to achieve these goals. Among the various teaching techniques these strategies incorporate are problem-solving, inquiry-based activities, cooperative learning, direct instruction, and individualised education. Still another of these techniques is direct instruction. Each one of these strategies is deliberately designed to fit a wide range of learning styles and aptitudes. Successful instructional tactics are those developed in cognitive research and educational psychology to a great extent. The main focusses of these teaching strategies are the manner in which students understand, recall, and apply knowledge. They provide students controlled chances to study, consider, and apply new areas of information in order to promote critical thinking, creativity, and the growth of higher-order cognitive skills (Pulgar et al., 2022). Each one of these activities is carried out by giving pupils chances to apply recently gained knowledge. Important elements frequently included in educational strategies include scaffolding, which provides learners with gradual help as they acquire proficiency, and timely and constructive feedback, which advances development. Using scaffolding means giving students consistent help. Furthermore versatile enough to be fit for a range of learning environments—including face-to--face, mixed, and totally online environments—are instructional strategies This assures that students will always be able to obtain pertinent and easily available instruction. By use of instructional strategies, one may design a learning environment that not only stimulates and fascinates but also raises academic performance, motivation, and participation. The educational strategies used define what finally forms the foundation of effective teaching. By use of these approaches, teachers may create courses that not only impart knowledge but also improve the capabilities, ability, and comprehension of their students thereby enabling them to keep on learning all through their academic careers (Nguyen et al., 2023).

- **Relationship between Course Design and Instructional Strategies**

Course design and teaching strategies are intimately entwined. This is so because a good course design offers the structural framework within which instructional tactics are carried out to reach the specified learning objectives. This follows from the strong framework the course design offers. Included in the process of creating a course are organising the general layout of the content, learning objectives, activities, assessments, and technology utilisation. This helps to ensure that every element is in line so as to support student learning all through the course. Conversely, the instructional strategies are the particular approaches and strategies teachers use inside this framework to grab the interest of students, help them acquire knowledge, and boost the growth of abilities. Thoughtfully developed courses will have well defined objectives and sequencing that will direct the choice of pertinent instructional strategies—such as group projects, formative assessments, or interactive discussions—that are most fit for the course's contents and the needs of the learners. These approaches will be chosen in line with student needs. Conversely, the choice of teaching strategies affects the structure of the course, which includes the speed of the class, the way materials are disseminated, and the incorporation of support systems such scaffolding or feedback loops. When employed in tandem with one another, course design and instructional strategies provide an impact favourable for the learning process. On the other hand, good teaching techniques actively include students and change course to fit their changing needs, therefore bringing the course design alive. While good instructional strategies bring the course design to life, a thoughtful course of design assures that instructional tactics are meaningful and contextually appropriate. The dynamic interaction between the two parties results in the improvement of the whole learning process, the growth of cognitive engagement, and the support of the accomplishment of several educational goals.

Based on the above discussion, the researcher generated the following hypothesis to examine the link between Course Design and Instructional Strategies (Martínez-Cerdá et al., 2020).

- ***"H_{01}: There is no significant relationship Course Design and Instructional Strategies."***
- ***"H_1: There is a significant relationship between Course Design and Instructional Strategies."***

Table 2: H_1 ANOVA Test

ANOVA					
Sum					
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Between Groups	39588.620	31	5385.399	1,016.880	.000
Within Groups	492.770	65	5.296		
Total	40081.390	96			

In this study, the result is significant. The value of F is 1,016.880, which reaches significance with a p-value of .000 (which is less than the .05 alpha level). This means the ***"H_1: There is a significant relationship between Course Design and Instructional Strategies."*** Is accepted and the null hypothesis is rejected.

Discussion

Within the context of an online learning environment, the findings of this study demonstrated that the course design had a substantial impact on the instructional tactics that were utilised. The manner in which instructional tactics were applied and the extent to which the virtual platform supported the learning process were directly derived from the architecture and components of the platform. When the course was carefully designed with distinct objectives, scaffolded learning paths, multimedia integration, and chances for interactive participation, the instructors were better able to implement a variety of teaching strategies that were centred on the student. It has been demonstrated that educators are more likely to implement instructional tactics such as inquiry-driven activities, project-based assignments, real-time feedback, and group learning when they experience online environments that have been thoughtfully created. Not only did these tactics adhere to the principles of cognitive pedagogy, but they also encouraged students to take an active role in the learning process and allowed them to have a greater sense of involvement. It was reported by educators that the implementation of components such as discussion forums, rapid feedback examinations, and modular resources assisted them in maintaining the flow of instruction and monitoring student growth in a more efficient manner. In addition to this, the framework of the course was designed in such a way that it made it easier to implement adaptive teaching tactics. By tailoring the content and activities of the training to the specific requirements of the students, teachers were able to provide training that was both more effective and more tailored to the students' needs. Based on the findings, one may draw the conclusion that instructional tactics were more effective when they were purposefully incorporated into the design of the course, as opposed to being offered separately. After conducting this experiment, the researchers came to the conclusion that the online learning environment did not only serve as a delivery medium; rather, it actively

moulded and improved teaching practices. The incorporation of pedagogical techniques into a course design that was consistent and interactive assisted the instructors in having a more significant influence on the educational experience of their students. Not only did these findings make it abundantly evident that instructional techniques should be included into the fundamental design and planning of courses, but they also made it abundantly clear that learning outcomes in virtual environments should be optimised.

Conclusion

Based on the findings of this study, one may draw the conclusion that the framework of an online learning environment had a significant impact on the formation and improvement of instructional practices. According to the findings, having course materials that are well-organised can provide instructors with the ability to employ more effective instructional tactics. There is an abundance of learner-centred activities, scaffolder learning, adaptive feedback systems, and interactive material in these course designs. Not only do these tactics align with the principles of cognitive pedagogy, but they also encouraged increased levels of student participation in group projects and critical thinking. When teaching tactics were incorporated into a course of study that had been constructed in an appropriate manner with pedagogical aims in mind, it became very obvious that they had a far greater impact on educational outcomes. The structure of the course served as a foundation that educators could use to help them in the process of developing, delivering, and assessing learning experiences. In addition, the incorporation of cognitive supports, which included formative assessments, cooperative tools, and metacognitive signals, contributed to the achievement of even more favourable outcomes for the students and the quality of instruction. A well-planned and pedagogically-based course design in an online environment was shown to be effective in increasing the application of instructional techniques, as established by the findings of the study, which corroborated this finding in general. The need of rigorous course preparation was brought to light by these realisations, which reinforced the necessity for instructional designers and teachers to give it high priority. As a result, this ensures that instructional methods are not considered separate components but rather integral components of the whole learning environment. The investigations offered a framework that might be utilised in the development of online courses that are both technically competent and attentive to the cognitive requirements of students.

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