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Assessing the Impact of eLearning and Learning Management Systems on Undergraduate Education: Insights from the Appalachian Region

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Abstract:
The COVID-19 pandemic necessitated a shift in educational approaches, compelling institutions to adopt e-learning systems for remote teaching. This study evaluates the effectiveness of these systems in undergraduate courses, focusing on factors such as student preferences, experiences, and the role of prior exposure to e-learning. The theoretical framework highlights the evolution of e-learning and its increased importance during the pandemic. Efficiency was analyzed based on variables like prior experience and convenience, with hypotheses formulated to assess their impact on improving efficiency. The research was conducted as a cross-sectional study involving students from the Appalachian region (Eastern Kentucky, USA) and utilized an online survey. Regression analysis was employed to examine the relationship between the independent variables (prior experience and convenience) and the dependent variable (efficiency improvement). The results revealed a statistically significant model, with "convenience" emerging as a strong predictor of efficiency enhancement. "Prior experience with e-learning systems" also showed significance, though to a lesser extent. The study recommends prioritizing user convenience and encouraging early exposure to e-learning systems to optimize efficiency. It suggests implementing continuous improvement initiatives, training programs, and further research into additional influencing factors. These strategies aim to create a more effective e-learning environment, ensuring a seamless and efficient educational experience for students as the landscape of education continues to evolve.

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1. INTRODUCTION

The COVID-19 pandemic caused alterations in educational practices, particularly during lockdowns aimed at containing the global virus epidemic. This led many educational institutions to adopt learning management systems such as Moodle, Blackboard, and others to support e-Learning and remote learning for the benefit of the educational process, students, and teachers, to stay up to date with technological advancements, and to take advantage of them in the classroom (Al-Shboul et al., 2023). This in turn reflected the effectiveness, usefulness, and convenience of e-learning systems for some of the courses by each student group.

Furthermore, the concept of distance learning and e-learning enriches the fundamentals and ideas of educational technology by combining individual education and offering learning chances to every student based on their aptitudes and competencies. Also, a lot of students in the 21st century believe that online learning is better over traditional learning**1.** because it is more flexible, accessible, has a wider variety of**2.** learning resources, is personalized, self-paced, allows for global interaction, is more affordable, and provides immediate feedback - all of which help students succeed academically and professionally (Saxena K., 2020).

1.1 Background Problem

With advancements in technology, accessibility, and the recent impact of the COVID-19 pandemic, students' choices in their primary mode of instruction have evolved. This shift in preferences has raised questions about the implications for educational institutions, teaching and learning strategies, equity, access, and the long-term trends in education. Understanding the historical context and student preferences has been vital for institutions to adapt to changing educational landscapes and ensure quality learning experiences. In sum, the evolution of students' preferences regarding eLearning systems and traditional classroom methodologies has been a multifaceted phenomenon.

1.2 Objective

Assessing Student Preferences: The objective of this research study is to understand the student's perspective of how efficient eLearning systems are and if they prefer

eLearning systems over traditional textbooks and classroom learning methodologies.

Analyzing variation of efficiency among students within different fields of study: This objective explores any differences in efficiency perceptions and preferences among students within different fields of study.

1.3 Research Question

The potential research question addressed with the given research is "What has been the prevailing preference among students for either eLearning systems or traditional classroom methodologies as the primary mode of completing their course of study?"

1.4 Potential Contributions

E-learning offers students greater access to educational resources and courses, regardless of location. It facilitates better comprehension by customizing learning experiences to fit each learner's preferences and pace. In today's tech-driven society, the digital skills obtained through e-learning are becoming more and more valuable. Flexibility in scheduling makes education more accessible, especially for those with other commitments. Also, it cultivates a mindset of perpetual learning, advancing ongoing personal and professional development. Simultaneously, for a more effective enhancement of e-learning contributions, attention should be directed towards improving content quality, interactivity, and personalization.

This study evaluates the effectiveness of implementing e-Learning and distance learning within educational institutions during the COVID-19 pandemic, focusing on students' viewpoints. It considers the impact of utilizing these resources in public universities and their continued role in the1. distance education system under varying circumstances. 2.

1.5 Theoretical Background

While assessing eLearning in today's education system specifically for undergraduate students, a brief analysis of the distance education system is conducted. Distance education is the utilization of communication media to expand learning beyond traditional classroom settings, disseminate expert3. instruction on a broader scale than individual teachers or4. schools could achieve (Schramm, 1982, as cited in Philson, R. M., 1983). Most such courses seem to depend largely on radio and/or television as the chief medium of instruction. To understand why, it might be worthwhile to look at some of the reasons these media are chosen for language teaching.

With the growth in information technology there is a drastic change in the eLearning system. The e-learning systems' theoretical framework contains the three main components of information systems. These components are people, technologies, and services (Aparicio et al., 2016). These new technologies help in interacting with different users.

In the early 2000s, eLearning was not widely adopted, but there was a notable surge in its popularity among students. However, the landscape dramatically changed in early 2020 when the global outbreak of COVID-19 led to the suspension of various activities, including academic pursuits. As a result, eLearning became the sole viable option for university undergraduates during this period. The COVID-19 pandemic has produced an unprecedented change in the educational system worldwide. Besides the economic and social impacts, there is a dilemma of accepting the new educational system "e-learning" by students within educational institutions. University students have to handle several kinds of environmental, electronic and mental struggles due to COVID-19 (Al-Okaily et al., 2020).

The analysis takes into consideration the efficiency of undergraduate students who have used eLearning systems during COVID-19 and if they have prior experience with eLearning systems before COVID-19. The efficiency results collected during the COVID-19 period will be compared between two groups: students who were using eLearning system services before and those who recently started using them.

1.6 Project Implementation

1.6.1 Dependent Variable

Enhances Efficiency
This is the variable that is being measured or observed in the study. It represents the level or degree of efficiency improvement. In this case, it's the outcome or result that might be influenced by changes in the independent variables.
Scale Interpretation
1: Strongly Disagree
2: Disagree
3: Neutral
4: Agree
5: Strongly Agree

1.6.2 Independent Variables

Prior experience with E-Learning system:
This variable considers individuals familiarity with e-learning systems. It might be hypothesized that those with more experience in e-learning systems could potentially exhibit higher efficiency due to their familiarity with such tools.
Prior experience with E-Learning system codes
0: No
1: Yes

Convenient:
This variable assesses the convenience factor in the context of e-learning. The hypothesis posits that individuals who find e-learning convenient may demonstrate increased efficiency. This convenience could stem from user-friendly interfaces, accessibility, or other factors that make the e-learning experience more convenient for the participants.
Convenient variable codes
1: Strongly Disagree
2: Disagree
3: Neutral
4: Agree
5: Strongly Agree

1.7 Hypothesis Development

The following assumptions will be tested for the research:

1. Prior – Experience:

- Null Hypothesis (H0): Prior experience with e-learning systems has no significant impact on enhancing efficiency in students.
- Alternative Hypothesis (H1): Prior Experience with e-learning systems significantly influences the enhancement of efficiency in students.

This hypothesis assumes that prior exposure to e-learning might or might not play a role in how efficiently students engage with the system. Testing this will clarify the significance of prior experience.

2. Convenience:

- Null Hypothesis (H0): There is no significant relationship between the convenience of the e-learning system and its ability to enhance efficiency.
- Alternative Hypothesis (H1): There is a significant positive relationship between the convenience of the e-learning system and its ability to enhance efficiency.

The alternative hypothesis suggests that an easier-to-use e-learning system (more convenient) will likely lead to increased user engagement and, consequently, improved efficiency in learning tasks. Conversely, the null hypothesis assumes that the convenience level has no significant effect on the system's efficiency, implying that convenience doesn't play a substantial role in influencing learning efficiency. Different fields might demand varying levels or types of engagement with e-learning systems. This hypothesis whether the area of study affects how effectively students utilize these systems.

2. METHODOLOGY

2.1 Research Design

The study utilized a cross-sectional design to gather data from University and college students from the Eastern Kentucky Appalachian Area. The data was collected through an online survey distributed via universities' and college portal. The survey comprises questions related to prior experience with e-learning, gender, field of study, Convenience, and the level of agreement on statements reflecting efficiency enhancement in e-learning systems.

2.2 Data Collection

The dataset contains individuals' responses to the survey. It includes variables such as Student ID, Gender, Field of Study, Prior Experience with e-learning system, Convenient and the dependent variable - enhancement of efficiency. The respondents used a five-point range scale to indicate their level of agreement, with 1 denoting "Strongly Disagree" and 5 indicating "Strongly Agree". Demographic information was also gathered, revealing the distribution of students across genders and various fields of study.

2.3 Data Analysis

A regression model is employed to analyze the data. The regression analysis aimed to assess the relationship between the independent variable (Prior Experience and Convenient) and the dependent variable (Enhancement of Efficiency). Specifically, this approach allows understanding the extent to which these variables predict efficiency enhancement in e-learning systems among University and college students in the Eastern Kentucky Appalachian area.

2.4 Rationale Behind Employing Regression Model

The statistical method known as regression analysis is used based on the dataset and hypotheses developed. Regression analysis accommodates multiple predictors, offering insights into how these variables predict efficiency enhancement simultaneously. Its ability to handle interactions between predictors makes it the optimal choice for this multi-variable scenario, unlike other models that might focus on single relationships or struggle with multiple predictors.

In our instance, we tested the overall significance of the regression model using ANOVA while accounting for the predictor variables "Convenient" and "Prior experience with e-learning systems." The findings of the regression indicate that at least one of these predictor variables has a substantial impact on improving the effectiveness of the University's e-learning systems.
The whole hypothesis is statistically significant if the p-value for the ANOVA test is less than 0.05 (Significance F < 0.05). This indicates that the null hypothesis—which states that none of the predictor variables significantly affects efficiency enhancement—is rejected by the evidence.

In summary, the use of regression analysis to handle interactions between predictors makes it the optimal choice for this multi-variable scenario, unlike other models that might focus on single relationships or struggle with multiple predictors.

Table 1. ANOVA results

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.746562095							
R Square	**0.557354962**							
Adjusted R Square	0.555799092							
Standard Error	0.93153382							
Observations	572							
ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	2	621.7070487	310.8535	358.2271864	2.0083E-101			
Residual	569	493.7527415	0.867755					
Total	571	1115.45979						
	Coefficients	***Standard Error***	***t Stat***	***P-value***	***Lower 95%***	***Upper 95%***	***Lower 95.0%***	***Upper 95.0%***
Intercept	0.386299338	0.083633728	4.618942	4.77361E-06	0.222030828	0.550567849	0.222030828	0.550567849
Convenient	0.718072766	0.027065678	26.53075	1.4776E-101	0.664911933	0.771233599	0.664911933	0.771233599
Prior Experience with E-Learning System	0.205922946	0.077943826	2.64194	0.008470017	0.052830211	0.359015681	0.052830211	0.359015681

3. RESULTS

The overall model, as indicated by the ANOVA, demonstrates significance (Significance F < 0.05), implying that at least one predictor significantly influences efficiency enhancement. Notably, "Convenient" exhibits statistically significant impacts on efficiency enhancement, supported by its p-value being below 0.05. Additionally, "Prior experience with e-learning systems" has a relatively low p-value, indicating statistical significance, though not as pronounced as "Convenient." This suggests a positive association, indicating that students with both prior experience and convenience tend to display improved efficiency through e-learning systems.

The regression model's R-square is 55%, signifying that 55% of the variability in the dependent variable can be explained by the combination of all independent variables.

4. CONCLUSION

The study utilized a cross-sectional research design involving university students and an online survey to explore factors influencing the efficiency of e-learning systems. Regression analysis, supported by ANOVA, proved effective in examining the relationship between predictor variables and the dependent variable. The analysis highlighted the significance of "Convenience" and "Prior experience with e-learning systems" in enhancing efficiency.

The findings reveal that the overall model is statistically significant, as indicated by the ANOVA test (Significance F < 0.05), confirming that at least one predictor has a meaningful impact on efficiency enhancement. Specifically, "Convenience" emerged as a strong predictor with a significant positive influence on efficiency. Additionally, "Prior experience with e-learning systems" demonstrated statistical significance, although its impact was comparatively less pronounced. These results suggest that students who find e-learning systems convenient and have prior exposure to such systems tend to experience greater efficiency in their learning.

The regression model's R-squared value of 55% indicates that 55% of the variability in efficiency enhancement is explained by the independent variables combined. While this represents a moderate level of explanatory power, it underscores the critical role of "Convenience" and "Prior experience with e-learning systems" in influencing e-learning outcomes.

To improve the effectiveness of e-learning, the study recommends enhancing the convenience of e-learning systems and encouraging early adoption among students. These measures could significantly contribute to fostering a more efficient and impactful e-learning environment.

Optimal Suggestions:

Enhance Convenience: Educational institutions and e-learning platforms should prioritize user-friendly interfaces, accessibility, and overall convenience in their e-learning systems. This may involve regular assessments and updates to ensure a seamless and efficient user experience.

Training and Familiarity Programs: Initiatives to provide training and familiarize students with e-learning systems should be implemented. This can contribute to increased prior experience, potentially improving overall efficiency.

Continuous Improvement: Institutions should engage in continuous improvement efforts, addressing feedback from students regarding the convenience and effectiveness of e-learning systems. Regular evaluations and adjustments can contribute to a more efficient e-learning experience.

Research on Other Influencing Factors: While the study has focused on "Convenient" and "Prior experience with e-learning systems," further research could explore additional factors influencing efficiency enhancement in e-learning. This may include aspects such as content quality, interactivity, and personalization, as mentioned in the theoretical background.

By implementing these suggestions, educational institutions can work towards maximizing the explained variability in efficiency enhancement, ultimately fostering a more effective e-learning environment for students.

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Appendix A

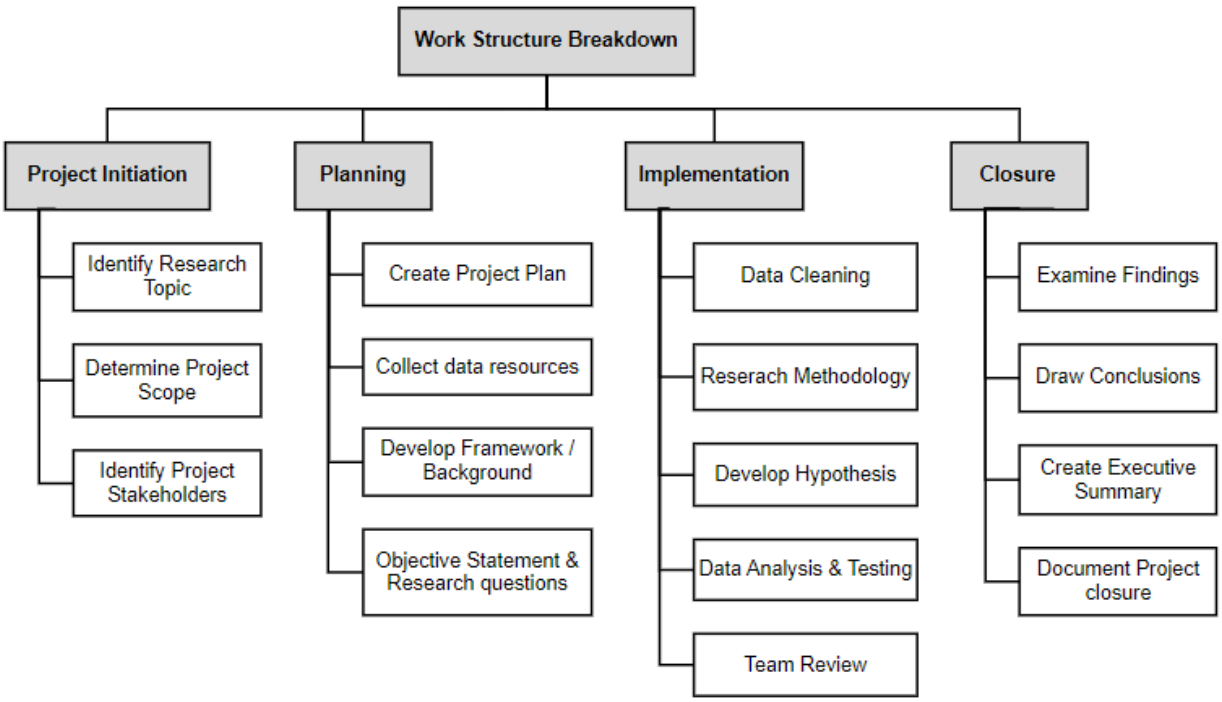
A1. Project Scope Statement

The scope of this research study has encompassed an investigation into students' perspectives on the efficiency of eLearning systems in relation to traditional textbooks and classroom-based learning approaches. It has extended to understanding their preferences regarding these modes of instruction. The scope has also included an analysis of potential variations in efficiency perceptions and preferences across students from different fields of study.

Stakeholder Register

Stakeholder	Main Interests	Category	Power and Influence	Classification
Students	Key participant in research	Internal	High	Leading
Educators/ Instructors/ Faculty	Efficiency of system and ease of use	Internal	High	Supportive
Educational Institutions and Management	Budget and efficiency	Internal	High	Leading
Educational Regulatory Boards	Ensure compliance with other institutes	External	High	Supportive
Learning Management System Providers	Technical system and support	External	Medium	Supportive

A2. Work Structure Breakdown (WSB)

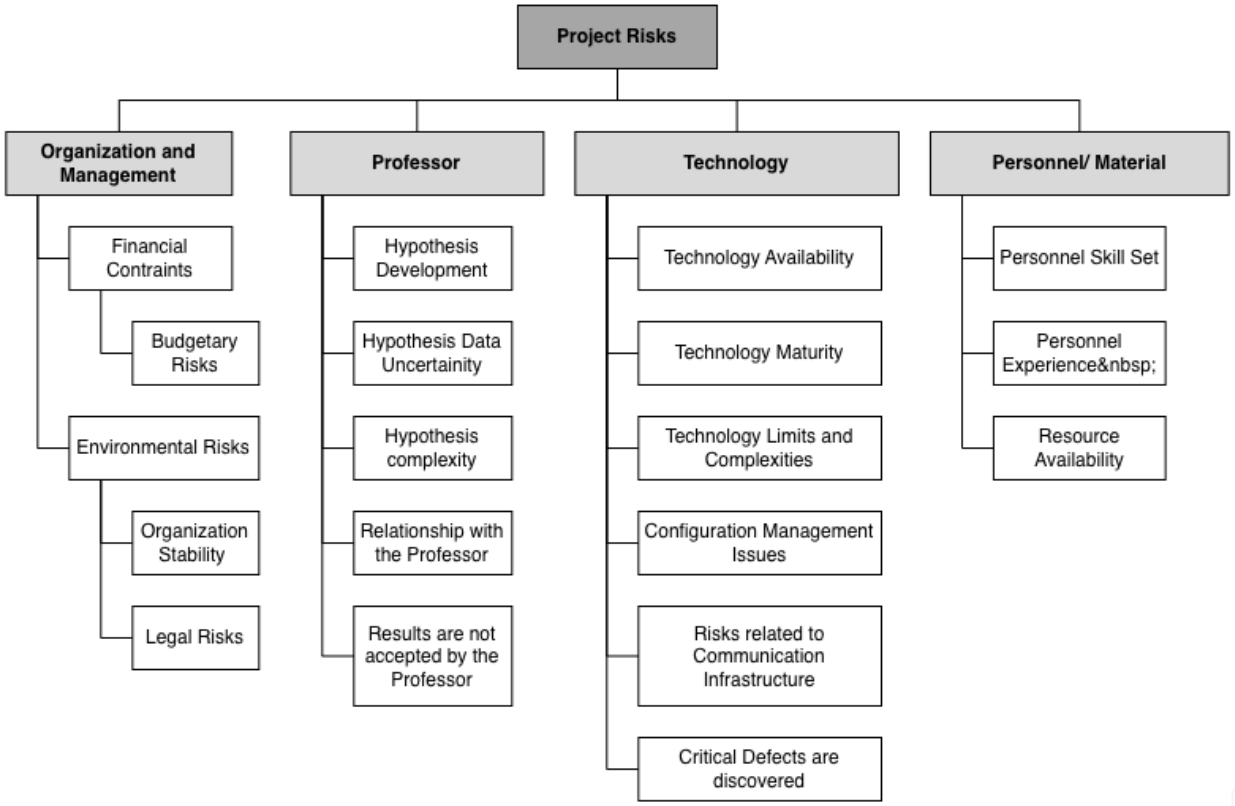


A3. Risk Breakdown Structure and Risk Register

The risk breakdown structure for the project is shown below, along with a list of the phases' categories and subcategories where risks could occur.

Risk Breakdown Structure

The project categories and subcategories that could present risk are shown below. The Risk breakdown structure is shown below.



A4. Risk Register

The project's potential risks are tracked in the risk register, which makes it easier to assess their impact and identify risk-resolution strategies.

Legends for understanding the Risk register

Response

Accept: The best course of action is to recognize the danger and its potential effects.

Mitigate: To reduce the risk, plan alternatives and workarounds in advance.

Control: Since these risks have serious repercussions, their impact needs to be under control. Effectively assess and monitor these risks on a frequent basis.

Transfer: Place the risk with another department or with a different person.

Cost

1. Low
2. Medium
3. High

Scope

1. Increase
2. Decrease
3. No impact

Quality

1. Positive
2. Negative
3. No Impact

Schedule

1. Delay
2. No impact
3. Early

Risk ID	Risk Statement	Probability	Impact				Score	Response
			Scope	Quality	Schedule	Cost		
R001	Project is over budgeted	0.9	1	3	1	3	0.9*0.05 = 0.045	Accept
R002	Legal Risks	0.1	3	3	1	3	0.1*0.8 = 0.72	Control
R003	Project is delayed	0.3	3	3	1	3	0.3*0.4 = 0.12	Control
R004	Risks related to interpretation of requirements	0.8	1	2	1	3	0.8*0.05 = 0.045	Mitigate
R005	New or updated requirement	0.1	1	1	1	2	0.1*0.1 = 0.1	Accept
R006	Risks related to communication with Professor	0.3	3	3	2	2	0.3*0.23 = 0.69	Control
R007	Results are not accepted by the professor.	0.9	1	2	1	3	0.9*0.1 = 0.90	Control
R008	Analysis Results incomplete	0.9	1	2	1	2	0.9*0.8 = 0.72	Control
R009	Not enough data	0.7	1	2	1	2	0.7*0.11 = 0.77	Control
R010	Configuration management issues	0.6	3	3	2	1	0.6*0.05 = 0.030	Accept
R011	Selected software tools are not suitable for task	0.4	1	3	1	3	0.4*0.1 = 0.40	Mitigate
R012	Risks related to communication infrastructure	0.5	3	1	1	2	0.9*0.5 = 0.35	Mitigate
R013	Risks related to hardware or infrastructure	0.3	3	1	2	2	0.3*0.05 = 0.015	Mitigate
R014	Risks related to the competence of management	0.2	3	3	2	1	0.2*0.06 = 0.012	Accept