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Original Research Article

Teaching and learning developmental anatomy: exploring google classroom engagement through preferred usage, behavioural intentions, and actual practices

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ABSTRACT

Background: In the 21st century researchers, trainers and teachers have begun to design and implement variety of teaching methodologies using online technology to improve traditional face-to-face teaching. Blended learning improves student engagement. In education, blended learning environment offers the convenience of the online environment without losing face-to-face teaching, and interaction with the learners. Objectives of the study were: to compare/estimate the difference the effective learning between the traditional pedagogy blended learning activities through eLearning; and to know the perception of the blended learning experience through eLearning in using google classroom site.
Methods: Regular classroom was used for traditional lecture and digital library for blended learning for the 1st MBBS students.
Results: In our study we found digital learning did improve students test score significantly. Students found blended learning helpful for learning the topics chosen in embryology. About 95% of the students strongly agreed to the fact that blended learning in digital library is conducive for learning the developmental anatomy.
Conclusions: During the study we found that blended learning environment is effective in teaching-learning embryology on students in terms of impact on learning and their perceived satisfaction. In the current study suggest that both preferred easy to use and preferred use positively affect the behavioral intention by undergraduates' students who perceive the use of Google classrooms as easy and useful, and they are highly motivated toward the incorporation of such pedagogical tools in their learning process of developmental anatomy.

Keywords: Google classroom, Blended learning, Developmental anatomy, SDL, Path analysis

INTRODUCTION

Digital technology has influenced many aspects of our life. Education through digital technologies is not new in the present era, understanding the technology its implications, and use in medical education at the level of pedagogical engagement will provide us valuable insights on learning and teaching relationships. The emerging technology of classroom engagement systems and learning management systems provide a wide range of computer-based activities that offer a promising tool like Google suite and Web 2.0 for helping instructors create an interactive, student-centered classroom. The process of teaching-learning using computer applications is effective as it helps the students to develop critical thinking, and reasoning while using the blended activities during the learning process.[1]

Web 2.0 technologies help the faculty by providing students group to collaborative learning experiences, the current era of students are already using the connectivism principle of adult learning without even realizing it, Free online collaborative tools play a major role in helping

students acquire the learning skills and Web2.0 tools such as blogs, wikis, google site, google suites, provide content sharing which are user/ learner centric information infrastructure that emphasizes participation, focused conversation, innovative explorations experimentation and purposeful tinkering.[2] The Use of google classrooms is cost-effective. Its usage can neither impose extra cost to students nor to the institution. No additional cost for creation of e-learning resources. it does help the educators suit for large and repeating no of teaching sessions for the prospective academic batches with modification to cater to the needs of size and the branch of health sciences.[3] Google Classroom is very simple to create and to use and there are features to integrate and engage students in real time. it helps to create modules for students for repeated usage with activities like quizzes and self-assessments like any other learning management system (LMS) platform. it does allow streaming for instructors to know the student's progress of the usage of the modules under intervention. The instructor can link all files saved in Google Drive. He or she can grade, attach YouTube or any link for instructional purposes.[4] The use of Google classroom is not only for teaching-learning methods, it can be used as a medium for electronic portfolio assessment as an alternative to the implementation of traditional portfolios which assess to measure students' abilities in accordance with the digital era.[5] The instructors can see summary of their entire class's activity and track the assignment submission status and individual activity levels to assess their progress through the workspace. This helps the teachers use Google classroom in a professional learning setting and ease the pressure of maintain the analysis of the students' progress.[6,7] Google classroom with its features can be used in synchronously and asynchronous which aligns with continuous learning in a learner.

There has been innumerable ongoing research on student engagement in blended learning activities using various online platforms, since the pandemic. With the growing use of the LMS in medical schools there is limited research data available on the effectiveness of Google classroom and factors that can influence the students' acceptance of Google classroom in medical schools. The effective usage of the Google classroom platform for learning developmental anatomy modules is unexplored. There is a limited number of research articles that examined the factors that affect Google classroom acceptance among university students in general.

This study seeks to investigate the use of Google classroom in blended learning activities for teaching developmental anatomy, its effectiveness and the perception of acceptance of the usage of the platform among the students.

In the present study, the technology acceptance model (TAM) is adopted for measuring the students' acceptance of Google classroom as a technology in their daily academic lesson. In this respect, TAM provides a solid background for the effectiveness of a new technology. There are many factors can influence their acceptance decision. Based on that, we are interested in testing the following hypotheses - H1: perceived ease of use positively influences the perceived usefulness of Google classroom, H2: perceived usefulness positively influences the behavioural intention to use Google classroom, and H3: behavioural intention to use influences the actual use of Google classroom.

Objectives

Objectives of the study were: to compare/estimate the difference the effective learning between the traditional (T) pedagogy intervention-BL1 and intervention-BL2 as blended learning activities through eLearning; to know the perception and the feasibility of the blended learning activities through eLearning in using Google classroom (free version); to explore the extent to which students' preferred usage of Google classroom (e.g., features they wish to use) influences their behavioural intention to use the platform; and to examine how students' behavioural intention to use Google classroom predicts their actual usage of the platform in a real learning environment.

METHODS

The study was conducted at East Point College of Medical Sciences and Research Center Bidarahalli Bangalore. The study subjects were 1st MBBS students admitted to academic year 2023, they were informed and the study methodology was explained to them before formal consent was taken and the ethical clearance taken from the Institutional Ethical Committee. The study period for the current study was November 2023 to March 2024. The Sample size was 150 students. The study type was sequential adaptive exploratory mixed method which included quantitative and qualitative descriptive study. we used a Regular classroom setting for traditional pedagogy and digital library for blended learning activities through eLearning. The study design used in the present study is depicted in Figure 1.

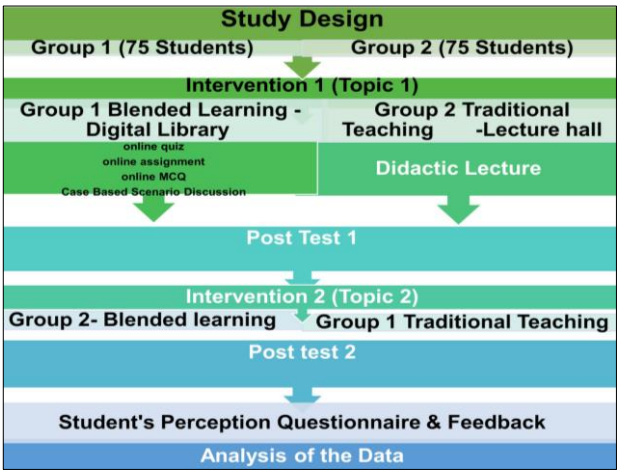

Figure 1: Study design.

To know the student perception and acceptance of the use of Google Classroom was done using survey questions with TAM factors. These factors include: the perceived usefulness (PU), the behavioural intention (BI), and the actual use (AU). The items used for this study were adopted with further adjustment to fit the scope of this study.[8] The tool used for the analysis was path analysis using smart PLs.

RESULTS

Quantitative analysis

Among the students of 1st MBBS total strength of 150, 147 of them consented, three were absent on the day of the interventions a quantitative analysis was performance in class tests scores using independent sample t test.

The scores from the post tests of the traditional and blended learning groups were subject to statistical analysis using independent t sample test.

In the Table 1 and 2 below are the results of the traditional pedagogy (T) and interventional blended learning (BL) activities through eLearning. The results of the post-test the interventional blended learning was found to be statistically significant (p value<0.000), it also was significant, when compared it within the teaching methodologies too.

Table 1: Comparisons of the post-tests between the blended learning (BL) and traditional pedagogy (T).

Post tests	Mean	Standard deviation	P value
BL 1	7.05	1.84	0.00*
T1	5.3	2.11	
BL 2	8.11	1.21	0.00*
T 2	4.53	1.81	

*Statistically significant here the p value is <0.01, two tailed test

Table 2: Comparisons of the post-test within the teaching methods blended learning (BL) and traditional (T).

Post tests	Mean	Standard deviation	P value
BL 1	7.05	1.84	0.00**
BL 2	8.11	1.21	
T 1	5.3	2.11	0.02**
T 2	4.53	1.81	

**Statistically significant here the p value is <0.01, two tailed test

Descriptive analysis

Since this study is an exploratory based-research, correlational analysis is considered the suitable approach. To assess the internal consistency and reliability Cronbach's alpha was used for the scales or survey items used to measure preferred usage, behavioural intention, and actual usage. A value above 0.7 was observed which indicates acceptable and reliability of all the construct used. It also suggests that constructs' are reliable and has intent to be used for the hypothesis being tested. Table 3 shows the measurement construct model results. The behavioural intention to use construct includes three items with loadings ranging from 0.886 to 0.894. Its Cronbach's alpha value of 0.812 indicates acceptable reliability, while the composite reliability of 0.776 is slightly below the ideal threshold of 0.8. However, the average variance extracted (AVE) value of 0.762 surpasses the acceptable threshold of 0.5, confirming good convergent validity.

The BI construct appears to be adequately measured, though further refinement of its items could improve composite reliability. The construct actual use comprises three items with loadings from 0.836 to 0.926. The Cronbach's alpha is 0.814, indicating reliability, and the composite reliability value of 0.923 reflects excellent consistency. Moreover, the AVE value of 0.814 confirms that the construct is well-represented by its items. These metrics demonstrate the strength and validity of the AU construct.

Overall, the analysis reveals that all four constructs exhibit high reliability and convergent validity. The composite reliability further confirms the constructs' robustness, particularly for PU, PE, and AU. Figure 2 shows the cross loadings and path analysis of the descriptive statistics of the variable to ensure the hypothesis testing.

In the Table 4, it can be noticed that all the hypotheses are supported, which in turn indicates that all the paths are significant between the independent and dependent variables. H1 (B=0.766, p<0.05) describes the path between perceived ease of use and perceived usefulness; indicating that the perceived ease of use enhances the behavioural intention to use Google classroom. H2 (B=0.199, p<0.03) shows the path between perceived ease of use and behavioural intention; H (B=0.673, p<0.05) describes the path between behavioural intention and actual usage; indicating that behavioural intention is significantly affecting the actual usage of Google classrooms.

Table 3: Measurements of the model results.

Constructs	Items	Loadings	Cronbach's alpha¥	Composite reliability	Average variance extracted
	PU1	0.793	0.939	0.892	0.749
	PU2	0.695			

Continued.

Constructs	Items	Loadings	Cronbach's alpha¥	Composite reliability	Average variance extracted
Perceived usefulness (PU)	PU3	0.875			
	PU4	0.950			
	PU5	0.988			
	PU6	0.942			
	PU7	0.960			
Perceived ease of use (PE)	PE1	0.840	0.920	0.937	0.714
	PE2	0.860			
	PE3	0.850			
	PE4	0.860			
	PE5	0.797			
	PE6	0.886			
Behavioural intention to use (BI)	BI1	0.886	0.812	0.776	0.762
	BI2	0.894			
	BI3	0.891			
Actual use (AU)	AU1	0.836	0.814	0.923	0.814
	AU2	0.913			
	AU3	0.926			

¥Cronbach's alpha for the construct is >0.7 (it confirms the constructs internal consistency and reliability)

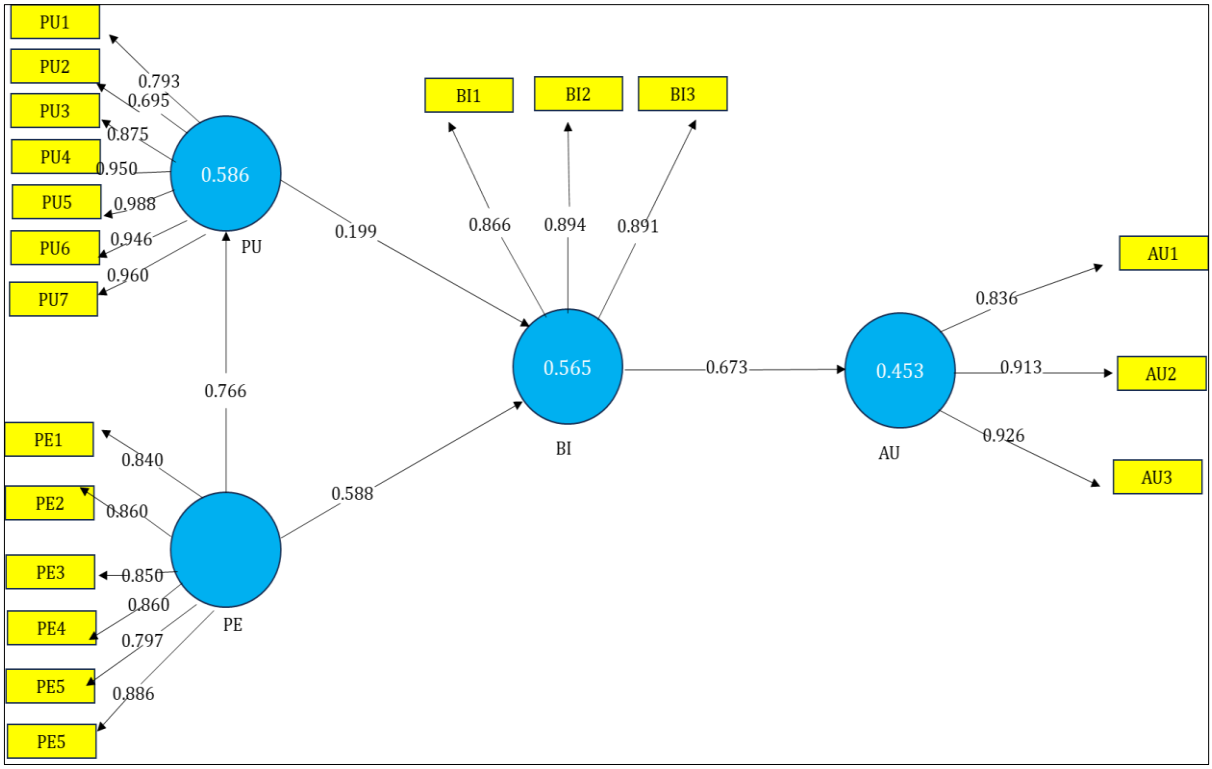

Figure 2: Path analysis results using partial least squares- structural equational modelling using variables of preferred used (PU); preferred ease to use (PE); behavioural intention (BI); actual use (AU) variables.

Table 4: Hypothesis test results.

Hypothesis	Path	Path co-efficient	P value€	Remarks
H1	PE→PU	0.766	0.000	Supported
H2	PU→BI	0.199	0.003	Supported
H3	BI→AU	0.673	0.000	Supported

€ Statistically significant here the p value is <0.01

Thematic analysis

Thematic analysis was done for the open-ended question on which enquired the difficulty using the platform. The students' responses were clubbed into themes analyzed to derive the summary. The main challenges students face with online learning platform Google classroom, in our current study revolves around "technical issues" "time management" "content delivery" and "user experience" themes.

Technical issues and connectivity problems

One of the most pervasive challenges highlighted by students is poor internet connectivity. These technical difficulties severely disrupt the learning process, making it difficult to access course materials, participate in live sessions, or submit assignments on time.

Time management

This creates a sense of time scarcity, which not only affects academic performance but also impacts students' well-being.

User experience and navigation issues

Navigating online platforms like Google classroom is also challenging for some students. Those unfamiliar with digital tools often find it difficult to use these platforms effectively. Issues with uploading assignments, particularly images and documents, add another layer of frustration. The students were also asked which device is used most commonly for the Google classroom, 86% of the students said mobile device is most commonly used.

DISCUSSION

Post-COVID and during covid there is an exponential growth in the usage of many LMS platforms and digital technology-assisted tools for education. Acceptance of the google classroom as LMS is indeed an inevitable its usage have been supported by many researchers who used similar variables like perceived usefulness ($\beta=0.38$, $p<0.01$) explained 63.5% of the variance in intention to use Google classroom.[9-11] In another study which tested TAM with similar hypothesis showed that the operational ability of the users and acceptance to use the LMS had positive influence on the actual intention to use.[12] It suggests that the acceptance of the technology model by the user is an important in any interface. In a study which pursued social influence and behavioural intention to use the Google classroom using TAM found that there is positive influence and students' behavioural intention of Google classroom use as habit ($\beta=0.99$, $p<0.05$), implying that when testing a TAM and hypothesis testing the factors are behavioural intention to use the model has an influence on the Actual intention to use and like in the current study the tool used to asses and accepted tool.[13] In study done using importance-performance map analysis (IPMA) proved that habit was the most important factor in determining actual usage of Google classroom rather than behavioural intention.[14-16] The LMS devices, tools, websites have scaled up and it is an multi-million dollar business for the companies which are invested in them. To achieve economy of scale and which is suited for large and repeating classes, like in our setup, this Google classroom as an LMS can be effectively used.[3] The outcomes of the study highlights the significant role in using Google classroom for the blended learning activities. The descriptive analysis of the study outlines various factors in shaping both the behavioural intention and actual usage of Google classroom, particularly among undergraduate students. The findings reveal that students in MBBS program, they show an acceptance level of reliance on Google classroom, primarily because it is easy to use and highly useful for their educational needs. Two key factors—familiarity with its usefulness and ease of use—emerge as crucial elements that influence students' adoption of the platform when compared other LMS platforms, which high category and significant financial value for both students and institutions. These aspects play a vital role in how students perceive Google classroom as a facilitator of their learning activities. with many LMS and online platforms to choose from in a tertiary medical school with limited resources and induct blended learning for the developmental anatomy effectively, Google classroom does save the day for the instructor and learner. A study done by Shahinaz suggests that teacher acceptability of the technology model is more important in the blended learning environment, and in addition, there have been studies done where the students' levels of acceptance for using online learning platforms using Google classroom.[1,15,17,18] This observation carries important implications for decision-makers in academic institutions. It suggests that students who embrace Google classroom technology can leverage it as a powerful tool to enhance their educational experiences. For educational leaders, this presents an opportunity to integrate Google classroom more deeply into the academic system. Based on the study's findings, it is recommended that higher educational institutions recognize the value of these key features—ease of use and usefulness—and structure their technological infrastructure around them.[14,19]

In the current study supports all the hypothesis proposed, it further strongly confirms that both PE and PU positively affect the behavioural intention by undergraduates' students who perceive the use of Google classrooms as easy and useful, and they are highly motivated toward the incorporation of such pedagogical tools in their learning process.

However, the study does have a few limitations. One of the main constraints is that it primarily relies on the TAM without exploring additional factors that could influence the acceptance of Google classroom. Future research should look into other potential variables that might affect how students adopt and use the platform. Additionally, the data was collected exclusively from MBBS students,

which limits the generalizability of the results to other student groups in different fields of study. Therefore, it would be beneficial to expand future research to include students from various academic disciplines, which would help provide a more comprehensive understanding of Google classroom's effectiveness across a wider range of university students. To ensure successful implementation, universities and colleges should offer training opportunities for students. This will help them discover the full range of Google classroom's features, ultimately leading to its broader adoption, and more effective use by the end-users which is cost-effective for them. Such efforts can enhance students' ability to fully benefit from the platform and support their learning in a meaningful way.[10]

The use of Google classroom is efficient in data management of the continuous assessment scores as it provides a flexibility for the instructions or the evaluators, however it has its efficacy in remote classroom management too. This indeed reduces the teacher efforts in can competence based education.[19,20]

Limitations

The limitation of the study is that data was only gathered from students. In order to gain a more holistic view of the factors influencing Google classrooms' adoption, future research should involve faculty members as well. Understanding their perspectives on the platform's usefulness, ease of use, and overall acceptance can provide valuable insights into how to improve its implementation and integration into the academic environment.

CONCLUSION

The findings of this study underscore the importance of Google classroom's ease of use and usefulness as key factors that drive its adoption among students. However, further research involving a broader sample of students and faculty members, along with the exploration of additional influencing factors, is necessary to fully understand the dynamics of Google classroom's acceptance and optimize its use in higher education. 95% of the students strongly agreed to blended learning with the facilitator is conducive for learning the developmental anatomy. A combination of classroom lecture and e-learning methodology had significant impact on knowledge of students. it is recommended the trainers use e-learning in conjunction with didactic teaching methods to elevated student engagement.

Recommendations

It is suggested that researchers' intent to explore and designing TAM to optimize the E focused and E intensive modules within the Google classroom and customize to the learner and the instructor.

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