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Exploring Student Enjoyment of Physiology Practical Utilising a Cloud-Based Platform

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ABSTRACT

The integration of cloud-based platforms, such as Lt by ADInstruments, Australia, enhances student engagement and satisfaction by providing interactive and adaptable learning environments, particularly for physiology practical sessions in medical education. This study evaluated students' enjoyment and satisfaction during these sessions on the Lt platform using the Learning Enjoyment Scale (LES). A cross-sectional study among preclinical medical students assessed perceptions related to teacher efficacy, participation, ease of topics, objective fulfilment, skill acquisition, and stress-free learning. The data were summarised using descriptive statistics, and Chi-square analysis identified significant relationships between enjoyment and related factors ($p < 0.05$). Of the 94 participants, 93.6% rated their learning experience as excellent. Additionally, 91.5% agreed that learning objectives were fulfilled, 92.5% were satisfied with skills acquired, and 88% found the course content easy to comprehend. Further, 88 students agreed or strongly agreed on teacher effectiveness in presenting practical sessions. Eighty-three students reported active participation, and most described the learning environment as low-stress. Statistical analysis revealed strong associations between enjoyment and factors such as teacher efficacy, active participation, and a stress-free learning environment ($p < 0.001$). These results indicate that cloud-based platforms enhance medical students' learning experiences by fostering engagement, enjoyment, and satisfaction with skills, objectives, and content comprehension. The key contributors include effective teaching, interactive learning, and reduced stress. Addressing remaining challenges, such as content simplification and comprehensive support, could further optimise outcomes and promote broader adoption of these platforms in medical education.

Keywords: *Cloud-based learning, Learning enjoyment scale, Medical education, Lab tutor, Student engagement*

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INTRODUCTION

Recent developments in educational technology have led to the increased implementation of cloud-based and virtual learning environments across medical education, including physiology, where virtual laboratories and cloud classrooms are now widely utilised to deliver practical content and simulations (1,2). Such platforms enable students to engage in on-site and virtual lab experiences, such as measuring electrocardiograms (ECGs), analysing heart sounds, and performing Electromyography (EMG) recordings. These simulations replicate traditional laboratory exercises, thus providing flexibility and accessibility, as students can easily access content anywhere on a computer, laptop or phone and participate in classes or access learning modules from any location with an internet connection. Traditional methods have struggled to maintain student engagement, whereas cloud-based platforms offer an alternative approach with interactive elements (3). Recent studies have shown that online simulations tailored to specific curriculum topics effectively deliver educational content and promote student engagement (4,5).

Student enjoyment is a key determinant of motivation, engagement, and academic success (6). Despite the widespread adoption of cloud-based platforms, their impact on students' enjoyment of practical sessions remains underexplored. In many institutions, conventional lecture-dominated, paper-based practical sessions still form the backbone of physiology teaching, although these are increasingly complemented by blended, student-centred approaches (7–9). By incorporating multimedia resources and immediate feedback mechanisms, cloud-based platforms provide students with opportunities to reinforce concepts in real time, correct mistakes, and deepen their understanding of challenging topics. Additionally, they create a risk-free environment for practising laboratory skills, thereby bridging the gap between theoretical knowledge and hands-on application.

The Learning Enjoyment Scale (LES), a validated tool based on Bloom's taxonomy that categorises educational goals, provides a structured framework to quantitatively assess students' learning enjoyment (10). It evaluates both cognitive aspects, such as knowledge acquisition and application and affective components, including direct questions regarding overall enjoyment of the teaching activity. By utilising the LES, educators can objectively evaluate the extent of students' enjoyment in their learning experiences, thereby providing valuable insights into the impact of innovative teaching methods on student satisfaction. The LES examines various factors that influence student enjoyment, including teacher effectiveness, topic complexity, student participation, fulfilment of learning objectives, perceived stress levels and skill development. A direct analysis of these factors determines their individual contributions to the overall LES score, thus providing a comprehensive understanding of the elements that shape students' enjoyment during the learning process. The LES was selected due to its validated use in assessing both cognitive and affective components of student engagement, which makes it a comprehensive tool for evaluating student enjoyment in educational settings.

This study explores students' enjoyment of physiology practical sessions conducted on the Lt platform (ADInstruments, Australia), a cloud-based system that enhances practical learning in medical education through interactive, engaging online simulations. These simulations enable students to practice essential skills in a controlled, flexible environment, combining digital tools with hands-on applications to deepen their understanding of physiological concepts. The platform is designed to effectively meet the needs of diverse and expanding student cohorts. The study examines how features such as task complexity, instructor guidance and active engagement influence student satisfaction, thereby fostering a supportive and enjoyable learning environment that promotes better outcomes. This

study aims to examine the impact of cloud-based learning platforms on students' enjoyment of physiology practical sessions, as measured by the LES, and to identify key factors contributing to their satisfaction. The study shypothesises that students who engage with cloud-based platforms are likely to report high enjoyment scores on the LES.

METHODS

Study Design

This cross-sectional study was conducted to evaluate student enjoyment of physiology practical sessions delivered via the Lt Platform (ADInstruments, Australia), a cloud-based educational tool. The cross-sectional design was selected to capture a snapshot of student enjoyment at a specific time point, thus sminimising time constraints associated with longitudinal studies. This study utilised the LES to assess various dimensions of student enjoyment, including cognitive and affective aspects, and to explore factors contributing to satisfaction (such as task complexity, instructor guidance, and active engagement), the fulfilment of objectives, skill acquisition and the presence of a stress-free learning environment. The LES has been previously validated in educational settings, thus ensuring its reliability in assessing student enjoyment (9). For this study, the calculated Cronbach's alpha was 0.977, which indicated that the questionnaire had an excellent internal consistency.

Study Population

The study population comprised 94 third-year medical students who had completed at least one physiology practical session using the Lt Platform. A convenience sampling approach was employed, with all eligible students invited to participate via email and during lectures. Participation was voluntary and written informed consent was obtained from all participants prior to their participation in the study. Although an a priori power calculation was not conducted, the sample comprised almost the entire eligible cohort and is consistent with sample sizes utilised in comparable LES-based studies in physiology education.

Data Collection

Data were collected using the LES (10). The LES was utilised to assess both the cognitive and affective aspects of student enjoyment. The scale evaluated factors such as knowledge, comprehension, application, analysis, concentration and enjoyment. The second part of the scale assessed the influence of various factors on students' enjoyment. The survey was administered online immediately after students completed their physiology practical sessions on the Lt Platform. Participation was anonymous to encourage honest and unbiased responses.

Data Analysis

The LES consists of six items such as knowledge, comprehension, application, analysis, concentration and enjoyment. Students rated each item on a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). The total score across the 6 items ranged from a minimum of 6 to a maximum of 30. An excellent score was defined as above 80% (25 to

30), an acceptable score fell within the range of 60%–80% (18 to 24) and a low score was considered less than 60% (< 18). The collected data were analysed using SPSS version 29 (SPSS Inc., Chicago, IL, USA). Descriptive statistics, including means, standard deviations and percentages, were utilised to summarise participant responses. Inferential analysis using the Chi-square test was conducted to compare differences in student enjoyment across various factors and to examine relationships between LES scores and influencing factors. Based on conventional statistical standards in educational research, a *p*-value of < 0.05 was considered statistically significant in this study.

RESULTS

Table 1 summarises responses to statements assessing students' perceptions of the teaching activity conducted on the Lt Platform. The majority of participants agreed or strongly agreed with positive statements regarding the teaching activity. Specifically, 91.5% of students reported remembering most of the new information taught, and the same percentage indicated that they understood it. Further, 88.3% of the students felt confident in applying the learned information, and 91.5% felt confident in analysing and evaluating problems related to the taught information. Engagement and enjoyment were also rated highly, with 89.4% of students following the activity with interest and 92.6% reporting that they enjoyed the session. Notably, none of the participants was unsure about enjoying the activity, thereby highlighting its overall effectiveness in fostering a positive learning experience. However, a small proportion of participants (ranging from 5.3% to 7.4%) disagreed or strongly disagreed with these statements, thus suggesting areas for potential improvement.

Table 1: Student perceptions of learning and enjoyment during physiology practical sessions on a cloud-based platform

Students' perceptions	Agree/strongly agree		Unsure		Disagree/strongly disagree	
	n	%	n	%	n	%
I remember most of the new information taught in the teaching activity.	86	91.5	2	2.1	6	6.4
I understand most of the information given during this teaching activity.	86	91.5	2	2.1	6	6.4
I feel confident to apply the information I learned in this activity.	83	88.3	6	6.4	5	5.3
I feel confident to analyse and evaluate problems related to the information given during this teaching activity.	86	91.5	2	2.1	6	6.4
I followed most of the teaching activity with interest.	84	89.4	5	5.3	5	5.3
I enjoyed the teaching activity.	87	92.6	0	0	7	7.4

The overall LES scores for the teaching activity conducted on the Lt Platform are presented in Table 2. A majority of students (93.6%) rated the session as excellent, indicating high levels of enjoyment and satisfaction with the teaching activity. A smaller proportion (5.3%) rated the session as low, while only 1.1% rated it as acceptable. These results indicate that the vast majority of participants found the teaching activity enjoyable, with only a minimal percentage reporting lower levels of enjoyment.

Table 2: Distribution of learning enjoyment categories among students during physiology practical sessions

Learning enjoyment category	Frequency	Percentage
Excellent	88	93.6
Acceptable	1	1.1
Low	5	5.3
Total	94	100.0

Table 3 summarises the relationship between the LES categories and student perceptions of teacher effectiveness, participation ability and stress-free learning during the physiology practical sessions conducted on the Lt Platform. A significant association was found between LES scores and perceptions of teacher effectiveness ($p < 0.001$). Among students who rated their learning experience as 'Excellent', 97.6% and 97.8% strongly agreed and agreed, respectively, that the teacher was competent, while only 33.3% of those who rated their experience as acceptable or low held the same view. Similarly, a significant relationship was observed between LES scores and students' ability to participate in the activity ($p < 0.001$). Of those who rated their experience as excellent, 100% strongly agreed and 97.3% agreed that they were able to participate, compared to only 11 students from among all participants who disagreed or were unsure about their active participation in the learning activity. Stress-free learning also revealed a strong correlation with LES categories ($p < 0.001$). Of those who rated their experience as excellent, 100% strongly agreed and 95.5% agreed that they felt relaxed and not stressed during the activity, compared to only 9 students who were unsure or disagree.

Table 3: LES categories and student perceptions of teacher effectiveness, participation ability and stress-free learning

Learning experience	Response	Learning enjoyment scale			*p*-value
		Excellent n (%)	Acceptable or Low n (%)	Total n (%)	
The teacher is competent	Strongly agree	41 (97.6)	1 (2.4)	42 (100.0)	< 0.001
	Agree	45 (97.8)	1 (2.2)	46 (100.0)	
	Unsure or disagree	2 (33.3)	4 (66.7)	6 (100.0)	
I was able to participate	Strongly agree	45 (100.0)	0 (0.0)	45 (100.0)	< 0.001
	Agree	37 (97.3)	1 (0.7)	38 (100.0)	
	Unsure or disagree	6 (54.5)	5 (45.5)	11 (100.0)	
I was relaxed and not stressed	Strongly agree	44 (100.0)	0 (0.0)	44 (100.0)	< 0.001
	Agree	40 (97.5)	1 (2.5)	41 (100.0)	
	Unsure or disagree	4 (44.4)	5 (55.6)	9 (100.0)	

Table 4 presents the relationship between the LES categories and student perceptions of learning objective fulfilment, skill acquisition and content ease during the physiology practical sessions conducted on the Lt Platform. A significant association was observed between LES scores and the perception of learning objective fulfilment ($p < 0.001$). Among students who rated their experience as excellent, 97.5% strongly agreed and 100% agreed that the learning objectives were fulfilled, compared to a single student who rated their experience acceptable or low. Further, eight students were unsure or disagreed. Students' satisfaction with skill acquisition during the practical session also revealed a

strong correlation with LES scores ($p < 0.001$). Among those who rated their experience as excellent, an average of 98.9% of participants strongly agreed or agreed, while only 16.7% of students who rated it acceptable or low felt the same. Perceived content ease was also significantly correlated with LES categories ($p < 0.001$). Among those who rated their experience as excellent, 97.2% strongly agreed and 100% agreed that the topic contents were easy to understand. In comparison, 54.5% and 45.5% of those who rated their experience excellent and acceptable or low, respectively, were unsure or disagreed regarding the ease of understanding the contents.

Table 4: Categories of the LES and student perception regarding the fulfilment of learning objectives, skill acquisition and content ease

Learning outcome	Response	Learning enjoyment scale			*p*-value
		Excellent n (%)	Acceptable or low n (%)	Total n (%)	
The learning objectives were fulfilled	Strongly agree	40 (97.5)	1 (2.5)	41 (100.0)	< 0.001
	Agree	45 (100.0)	0 (0.0)	45 (100.0)	
	Unsure or disagree	3 (37.5)	5 (62.5)	8 (100.0)	
I am satisfied with the skills I gained during the practical part of this activity	Strongly agree	47 (100.0)	0 (0.0)	47 (100.0)	< 0.001
	Agree	39 (97.5)	1 (2.5)	40 (100.0)	
	Unsure or disagree	2 (28.5)	5 (71.4)	7 (100.0)	
The topic contents are easy	Strongly agree	35 (97.2)	1 (2.8)	36 (100.0)	< 0.001
	Agree	47 (100.0)	0 (0.0)	47 (100.0)	
	Unsure or disagree	6 (54.5)	5 (45.5)	11 (100.0)	

DISCUSSION

In the current study, teachers' efficacy, students' engagement and learning environment free from stress during EMG and grip-force practical sessions were assessed among medical students using the LES. Almost all participants perceived the teacher as highly competent, and this perception was strongly associated with higher LES scores ($p < 0.001$). Rather than focusing solely on statistical significance, this pattern suggests that instructor behaviour and instructional design are key drivers of student enjoyment in physiology practicals. Only six of the respondents were uncertain or disagreed with a similar statement. This high level of approval could most likely be attributed to the teacher's strategies being efficient and enjoyable for the students. The *p*-value also supports the hypothesis that students who enjoyed their practical classes more were most likely to perceive their teacher as competent. The same argument is reported in the literature, thereby emphasising that the teacher's competency is a tool for improving students' satisfaction levels and learning outcomes (11, 12). This is in contrast to educators who endorse factors other than teacher competence, such as student involvement, syllabi, educational technology and learning atmosphere, as major factors contributing to students' satisfaction and learning accomplishment in practical medical education (13–15).

Further, the perceived level of participation was also significant, with 83 students agreeing or strongly agreeing with their level of participation in the practical sessions. In the subject of physiology, it is essential to include procedures such as EMG and grip-force measurements

to complement theory with practical application. The level of statistical significance suggests that students who reported higher enjoyment also felt more capable of participation in practical sessions, thus supporting the fact that practical sessions can improve learning experiences, particularly in relation to other factors such as the use of virtual reality and students' active involvement in the session (16,17). Moreover, it is worth noting that most students (85 of 94) reported not feeling stressed during the practical. Therefore, reducing stress in the classroom should be emphasised, particularly in medical training, where stress may interfere with learning and skill accomplishment (18). This significant association denotes that students who truly enjoy the learning process are likely to experience a low-stress practical environment, which will not only improve their satisfaction rate but also their practical performance (19,20). Another argument is that students might enjoy practical sessions for social interaction rather than meaningful participation (21). Enjoyment could arise from the atmosphere rather than effective interaction with the material, thus suggesting that the relationship between enjoyment and participation is not as strong as it appears (22,23). Nonetheless, a few studies claim that a low-stress environment may not be the most effective solution in many cases, as moderate levels of stress can improve students' activity and apparently enhance results in practical sessions (24). Although support is necessary, moderate competition or pressure may help improve important problem-solving skills needed for medical practice.

Regarding learning objectives, the majority of students (n = 8) agreed they were fulfilled, with only a small proportion (n = 8) expressing uncertainty or disagreement. This finding aligns with the results of Katsioudi et al. (25), who observed the positive impacts of technology-based interventions, such as personal response systems, on student learning and satisfaction in biomedical and medical sciences courses. It was revealed that these tools improve students' perceptions of engagement and achievement of learning objectives, findings similar to those of the cloud-based practical sessions in the present study.

Students also reported high levels of satisfaction with skills acquisition, with the vast majority agreeing that they had effectively learned practical skills during the session. Only a few students expressed uncertainty or dissatisfaction. This satisfaction emphasises the importance of interactive, hands-on elements in fostering skill acquisition, engagement and self-confidence in medical education. Cloud-hosted platforms such as Lt possibly enhance students' perceived preparedness by integrating theoretical knowledge with interactive, practice-oriented learning experiences (26,27).

Regarding the ease of content comprehension, the majority of students agreed that the course content was straightforward and easy to understand. A smaller group of students (n = 11) were either unsure or disagreed. The relatively lower agreement on content ease compared to other parameters suggests that while the platform facilitates comprehension, there may still be areas that require additional support or simplification. This finding reflects challenges associated with cloud-based labs, such as integrating hardware and software and other operational complexities, which may pose selective barriers to comprehension for some students. The top-down, student-centred design of Lt is effective in simplifying complex subjects and improving learning outcomes in physiology, which likely contributed to the high agreement on content ease in this study (28,29).

The overall positive responses demonstrate that the cloud-based sessions delivered through Lt provide an engaging and enjoyable educational experience for most students. The results are consistent with the existing literature, which emphasises the role of virtual labs in enhancing student engagement and satisfaction, particularly in medical education (30).

These findings further validate the utility of cloud-based platforms in bridging theoretical knowledge and practical skills, thereby fostering an effective learning environment that meets students' needs in healthcare education. However, factors such as learning style, cultural background, prior experience with cloud-based platforms and digital proficiency were not considered in this study and should be explored in future research.

This study has a few limitations. The sample size was limited to a single institution, which may restrict the generalisability of the findings to other educational settings and contexts. Additionally, the study relied on self-reported measures, which are subject to response bias and may not fully capture students' actual engagement or learning outcomes. The cross-sectional design further limits the ability to assess long-term impacts of cloud-based platforms on knowledge retention and skill development. Furthermore, this study focused on a specific physiology practical session; thus, the findings may not be directly transferable to other disciplines or types of practical activities. In addition, a lack of assessment for other potentially influential factors, such as students' prior experience with digital learning tools or the variability in teaching styles among instructors, also represents a limitation. Future research could explore the longitudinal effects of cloud-based platforms on learning outcomes, include larger and more diverse student populations and consider other influencing factors (such as those mentioned above) to provide a more comprehensive understanding of their impact. Finally, the analysis relied on *p*-values without accompanying confidence intervals or effect size estimates, which limits the precision and interpretability of the reported association; this should be addressed in future research.

CONCLUSION

This study demonstrates that increased teaching interaction and a low-stress learning environment contribute significantly to students' enjoyment and success in medical practical classes. The positive associations observed, along with statistically significant p-values, highlight that enhancing these factors can improve the quality of practical teaching sessions, ultimately increasing students' enjoyment and interest in the subject. Additionally, the findings emphasise the effectiveness of cloud-based platforms such as Lt in enhancing student satisfaction, engagement and skill acquisition during physiology practical sessions. High levels of agreement on learning objectives, skill satisfaction and content comprehension validate Lt as a valuable tool for integrating practical and theoretical learning in medical education. The findings of this study indicate that hands-on and interactive learning can strengthen students understanding by connecting theoretical knowledge with practical experience. The high level of enjoyment reported by students also suggests that an engaging learning environment may enhance their confidence, participation, and motivation. At the same time, addressing areas where some students experience difficulty in understanding the content may further improve the effectiveness of the learning platform. Overall, the results highlight the value of combining well-planned teaching approaches with appropriate educational technologies to create a more engaging, supportive, and effective learning experience for medical students. Future research should explore how factors such as cultural learning styles and digital literacy influence students' experiences with cloud-based learning. Moreover, longitudinal studies should be conducted to examine the long-term impact of cloud-based learning on students' knowledge retention and clinical skill development in medical education.

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ETHICAL APPROVAL

The study was approved by the Institutional Research Ethics Committee under the reference number HEC-10-2023/24-F-M. All participants provided informed consent and their responses were anonymised to ensure confidentiality. The study adhered to the principles outlined in the Declaration of Helsinki.

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