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A Pilot Study on Part-Time Occupational Therapy Students' Engagement and Academic Performance in Learning Neuroanatomy using Canvas LMS

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Abstract

Neuroanatomy is a challenging subject for part-time occupational therapy students. The use of Learning Management Systems (LMS) can provide flexible platforms that provide interactive e-resources to increase student engagement in neuroanatomy. This pilot study aimed to determine the students' engagement level on Canvas LMS and correlate with their academic performance. The Student Engagement Questionnaire was used to assess engagement levels, and final exam grades were analysed. Results showed that 63% of students demonstrated good engagement, with a noticeable improvement in academic performance. In conclusion, Canvas LMS effectively supports engagement and enhances academic outcomes in neuroanatomy for part-time occupational therapy students.

Keywords: Canvas LMS; neuroanatomy; occupational therapy; engagement

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1.0 Introduction

Neuroanatomy is fundamental in occupational therapy education. However, neuroanatomy is perceived as the most challenging subject for students, particularly those studying part-time (Crisostimo & Barbeau, 2022). The subject imposes a high cognitive load due to the broad information. This challenge is further compounded for part-time students, many of whom are adult learners balancing academic responsibilities with full-time jobs. Moreover, studying part-time limits students' access to practical sessions, which prevents them from having the opportunity for hands-on learning using anatomical models and exploring the relationships between structures. This

circumstance requires alternative online learning resources that are engaging and can provide understanding similar to classroom teaching.

Research showed that online learning resources such as modules and videos can enhance student engagement and academic performance (Kuzminykh et al., 2021). A study using interactive e-resources demonstrated a strong correlation in spanning the gap between neuroanatomy knowledge of the spinal pathway and its clinical application (Javaid et al., 2020). Similarly, the SotonBrainHub YouTube channel hosted by the University of Southampton saw increasing global demand for neuroanatomy videos (Hall & Border, 2020).

While e-resources have shown potential to enhance student engagement, the effectiveness of their use on online learning platforms such as Learning Management Systems (LMS) needs to be improved, particularly in occupational therapy students. Online platforms offer a range of functionalities, including hosting live lectures, patient-based case studies, quizzes, and even a repository for prerecorded lectures configured into short courses. The student's engagement can be tracked through platform log data (Alselaiti, 2023). Although some students effectively engage in the online learning environment, there is a possibility that other students still need to fully benefit from it due to individual differences in learning behaviours (Alselaiti, 2023).

Therefore, this pilot study aims to investigate part-time occupational therapy students' engagement levels and academic performance in learning neuroanatomy using the Canvas Learning Management System. Of special interest is

1. To determine the part-time occupational therapy students' engagement level in learning neuroanatomy using Canvas LSM.
2. To correlate the part-time occupational therapy students' engagement level and their academic performance in learning neuroanatomy using Canvas LSM.

2.0 Literature Review

2.1 Student Engagement

Student engagement is conceptualized across psychological, behavioural, and socioeconomic dimensions (Kassab et al., 2023). Engagement refers to a state that motivates students to participate in learning. Meanwhile, the student's behavioural perspective accounts for the effort and time students dedicate to completing educational activities.

A medical education study demonstrated that using interactive learning tools such as tablets, clickers, and applications to complement course content enhances student learning perceptions and engagement (Morris et al., 2016). This interactive learning experience encourages learning at the student's own pace. However, the findings suggest that whether this could consistently improve course outcomes remains uncertain.

Nevertheless, innovative approaches have been consistently demonstrated to enhance students' engagement in learning and academic outcomes (Diaz et al., 2021). Online anatomy videos can effectively reinforce student knowledge. Moreover, students' participation in LMS forums shows peer and educator engagement. Despite these findings, there remains a research gap in understanding how part-time occupational therapy students who face time constraints and limited access to traditional learning environments engage with LMS platforms.

2.2 Academic Performance

Over the years, pedagogical research has demonstrated that digital technologies can enhance anatomy education across multiple disciplines, including medicine, dentistry, nursing, and allied health (Pringle & Rea, 2018). A study conducted by University College Cork found that using neuroanatomy e-resources among occupational therapy students significantly improved their quiz performance compared to those not provided with the resources (Javaid et al., 2020). LMS motivates students and improves academic outcomes (Odekeye et al., 2023).

The mode of content delivery also influences student performance. Although learning outcomes tend to be consistent across various delivery methods, the degree of student engagement, mainly through repeated viewing of educational videos, is critical for academic performance. Repeated content viewing leads to better results (Bains et al., 2022). Moreover, using LMS online discussion forums for specific anatomy courses has positively influenced physiotherapy students' performance. Frequent forum posts correlate with higher exam marks, suggesting forums enhance learning. (Green & Hughes, 2013). In addition, behaviours such as uploading assignments and completing quizzes play a role in students' academic achievement. Results from students' regular participation in assigned assignments and quizzes show their learning expectations and engagement (Ahmadi et al., 2023). While previous studies confirm that LMS usage contributes to improved academic performance in health science students, there is limited empirical evidence linking LMS engagement metrics to academic outcomes, specifically among part-time occupational therapy students.

3.0 Methodology

3.1 Course Content

The neuroanatomy course focusing on the central nervous system was constructed using the Canvas Learning Management System (LMS) using the free Canvas account. A unique code for the course was given to the students to permit access to web browsers, mobile

devices, and tablets. The course content was organized into subtopics that guided students through the learning process in a structured manner. Table 1. shows the Canvas LMS features activated for students' viewing.

	Features					
	Test-based material	Images & Animation	3D Models	Quizzes	Assignment	Discussion
Subtopics						
Nerve physiology	✓	✓	✓	✓	✓	✓
Cerebrum	✓	✓	✓	✓	✓	✓
Cerebellum	✓	✓	✓	✓	✓	✓
Meninges	✓	✓	✓	✓	✓	-
Ventricles	✓	✓	✓	✓	✓	-
Basal ganglia	✓	✓	✓	✓	✓	✓
Blood supply	✓	✓	-	✓	✓	✓
Spinal cord	✓	✓	-	✓	✓	✓

Announcements were used to keep students informed. The BigBlueButton, consisting of live virtual classes, was used during students' revision week to prepare for their final exam. Students were given access to Canvas LMS during the last two weeks of the semester. Students' attendance after each live virtual class and their cumulative hours spent on Canvas LMS are recorded automatically using the platform's built-in analytics tools.

3.2 Study size and population

This study used a cross-sectional survey design that targeted part-time occupational therapy students in academic year one, session two, 2023/2024. Purposive sampling was used to select the respondents, including all part-time occupational therapy students (n = 19) from University Teknologi MARA, Puncak Alam Campus, Malaysia. Both genders participated. Purposive sampling was considered appropriate because it ensured that only individuals with relevant exposure to the phenomenon under investigation were included, thereby strengthening the validity of the data collected (Campbell et al., 2020).

3.3 Instruments

The instrument contained two sections; section one consisted of demographic information such as age, gender, type of device used to access, hours spent on Canvas LMS, and final exam grade for anatomy subjects (session one 2023/2024 and session two 2023/2024). The second section assessed the students' engagement level using the Student Engagement Questionnaire (SEQ). The SEQ contains a 15-item score on a five-point Likert scale (1=strongly disagree, 2=disagree, 3=neutral, 4=agree, and 5=strongly agree). The survey assessed four areas of online learning: online engagement, online active learning, online academic relevance, and online collaboration. A score between 64-75 points represents good engagement, 39-63 points represents moderate engagement, and 16-38 points represents poor engagement. The SEQ (Vogt, 2016) had high reliability. The data was extracted from Google Forms.

3.4 Statistical Analysis

Data obtained from the instrument were analyzed using SPSS version 22. Frequencies and percentages were used for demographics and SEQ. A one-way ANOVA test analyzed student grade differences with hours spent on Canvas LMS. A linear regression test was used to correlate SEQ scores and final exam grades. The reliability of the SEQ scales was confirmed using Cronbach's alpha test.

3.5 Ethics Consideration

As this is a pilot study, it was intended to gather initial insights and assess the feasibility of a larger research project. This study did not require ethical approval, as no sensitive personal data or interventions were involved.

4.0 Findings

4.1 Canvas LMS Course Content

The Central Nervous System (CNS) course content was designed and delivered using the Canvas LMS. The course was divided into modules covering key neuroanatomy topics, including nerve physiology, cerebrum, cerebellum, meninges, ventricles, basal ganglia, blood supply, and the spinal cord. Each module included text, images, 3D models, videos, and clinical anatomy for concise understanding. Fig. 1 shows the student's view of the CNS course, where they can access features such as announcements, syllabus, discussions, assignments, quizzes, people, grades, and BigBlueButton.

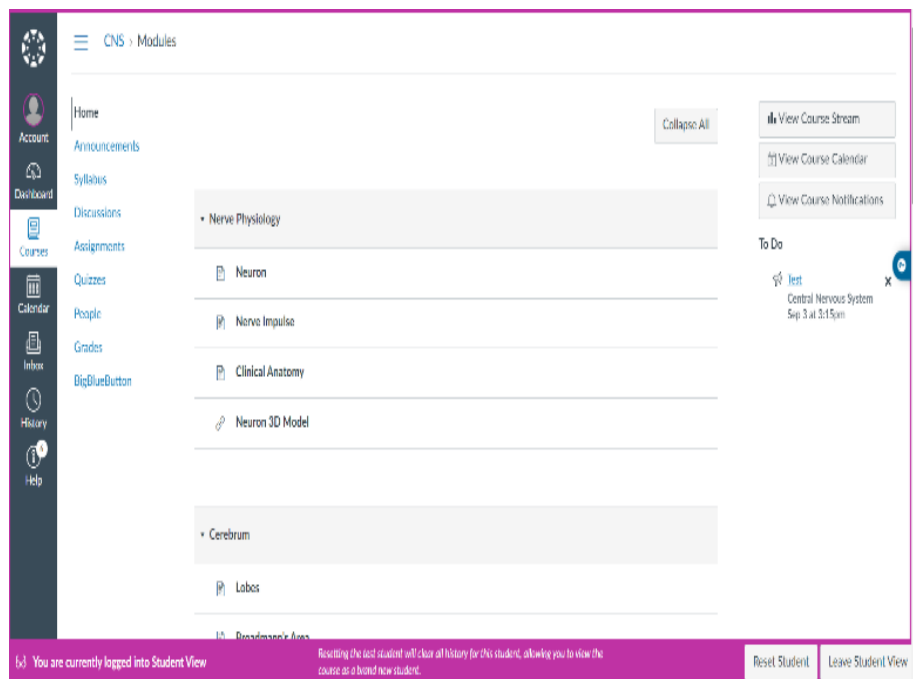


Fig 1. Students' view of the Central Nervous System (CNS) course content

4.2 Demographic Data

The demographic data of the part-time occupational therapy students from year one who participated in this study are summarized in Table 2. The study recruited 19 female students (68.4%) and six males (31.6%). The age distribution showed that 63.2% of students were between the ages of 30-35 years ($n=12$), followed by 26.3% aged 25-30 years ($n=5$), and 10.5% aged 20-25 years ($n=2$).

Most accessed Canvas using laptops (63.2%), followed by tablets and phones. Finally, the time spent on Canvas LMS varied, with almost half of the students ($n=9$) spending 3-6 hours on the platform, another seven spending 1-2 hours, and the remaining three spending 9-12 hours.

Table 2. Students' demographic variables

Variables	Frequency (n=19)	Percentage (%)
Gender		
Female	13	68.4
Male	6	31.6
Age		
20-25	2	10.5
25-30	5	26.3
30-35	12	63.2
Device used to access Canvas LMS		
Laptop	12	63.2
Mobile phone	3	15.8
Tablet	4	21.1
Hours spent on Canvas LMS		
1-2 hours	7	36.8
3-6 hours	9	47.4
9-12 hours	3	15.8

4.3 Student Engagement Level

The internal consistency of the Student Engagement Questionnaire (SEQ) was assessed using Cronbach's Alpha test in all four sections (Table 3). A high internal consistency for each SEQ scale demonstrated strong reliability across all sections. The SEQ is a validated instrument, and similar reliability has been reported in previous uses (Vogt, 2016). Therefore, the student engagement data that is collected is reliable.

Table 3. Cronbach's alpha test

SEQ scales	Reliability score
Online Engagement	0.927
Online Active Learning	0.869
Online Academic Relevance	0.917
Online Collaboration and Social Interaction	0.924

When asked whether Canvas LMS played a significant role in their education, 68.4% agreed and 10.5% strongly agreed (Table 4); one student disagreed. Regarding improved learning, 52.6% strongly agreed and 42.1% agreed, while one student strongly disagreed. Additionally, 63.2% agreed that Canvas LMS improved their interaction with the university, with 26.3% strongly agreeing and one strongly disagreeing. Moreover, 68.4% agreed they used Canvas to manage their studies, and 21.1% strongly agreed.

In terms of active learning, 47.4% agreed or strongly agreed that Canvas materials enhanced learning; one disagreed. A total of 52.6% agreed, and 36.8% strongly agreed that Canvas made lectures more meaningful. Regarding identifying work standards, 57.9% agreed and 31.6% strongly agreed. Around 47.4% agreed Canvas materials challenged them, 26.3% were neutral, and 10.5% disagreed.

A majority (63.2%) agreed Canvas made studies more relevant, with 31.6% strongly agreeing; one disagreed. On the other hand, 57.9% agreed and 26.3% strongly agreed that Canvas contributed to this, while 10.5% were neutral and one disagreed. Furthermore, 68.4% agreed Canvas helped apply learning to real-world contexts, with 21.1% strongly agreeing, one neutral, and one disagreeing.

Over half (63.2%) agreed they used Canvas for academic tasks with peers, 15.8% strongly agreed, and 15.8% were neutral. Similarly, 57.9% agreed they worked with peers outside class via Canvas, with 15.8% strongly agreeing. For staff participation in discussions, 57.9% agreed, 36.8% strongly agreed, and one strongly disagreed. Lastly, 57.9% agreed that online discussions with peers were helpful, and 21.1% strongly agreed.

Table 4. Student Engagement Questionnaire (SEQ)

Variables	Frequency	(%)
A. Online Engagement		
1. Canvas LMS is a major part of my university education.		
Strongly agree	2	10.5
Agree	13	68.4
Neutral	3	15.8
Disagree	1	5.3
2. I used Canvas LMS to improve how I learn at university.		
Strongly agree	10	52.6
Agree	8	42.1
Strongly disagree	1	5.3
3. Canvas LMS helped me to interact better with the university.		
Strongly agree	5	26.3
Agree	12	63.2
Neutral	1	5.3
Strongly disagree	1	5.3
4. I used Canvas LMS to manage my university study.		
Strongly agree	4	21.1
Agree	13	68.4
Neutral	1	5.3
Disagree	1	5.3
B. Online Active Learning		
5. I used Canvas LMS materials to improve my learning		
Strongly agree	9	47.4
Agree	9	47.4
Disagree	1	5.3
6. I used Canvas LMS materials to make lectures more meaningful.		
Strongly agree	7	36.8
Agree	10	52.6
Neutral	1	5.3
Disagree	1	5.3
7. I identified expected work standards using Canvas LMS.		
Strongly agree	6	31.6
Agree	11	57.9
Neutral	1	5.3
Disagree	1	5.3
8. I found that Canvas LMS materials challenged me to learn.		
Strongly agree	3	15.8
Agree	9	47.4

Neutral	5	26.3
Disagree	2	10.5
C. Online Academic Relevance		
9. Using Canvas LMS made my study seem more relevant.		
Strongly agree	6	31.6
Agree	12	63.2
Disagree	1	5.3
10. Using Canvas LMS made me feel part of the university.		
Strongly agree	5	26.3
Agree	11	57.9
Neutral	2	10.5
Disagree	1	5.3
11. Using Canvas LMS materials helped me put my study in real-world contexts.		
Strongly agree	4	21.1
Agree	13	68.4
Neutral	1	5.3
Strongly disagree	1	5.3
D. Online Collaboration and Social Interaction		
12. I used Canvas LMS to do academic work with other students.		
Strongly agree	3	15.8
Agree	12	63.2
Neutral	3	15.8
Strongly disagree	1	5.3
13. I used Canvas LMS to work with other students outside of class.		
Strongly agree	3	15.8
Agree	11	57.9
Neutral	4	21.1
Strongly disagree	1	5.3
14. Teaching staff (my lecturer) participated in online discussions.		
Strongly agree	7	36.8
Agree	11	57.9
Strongly disagree	1	5.3
15. I had helpful online discussions with other students.		
Strongly agree	4	21.1
Agree	11	57.9
Neutral	3	15.8
Strongly disagree	1	5.3

The SEQ score showed that 63.2% of the students demonstrated a good engagement level with Canvas LMS, 31.6% exhibited a moderate engagement level, and 5.3% had a poor engagement level (Table 5).

Table 5: Student engagement level		
SEQ Scores	Frequency	%
Good engagement	12	63.2
Moderate engagement	6	31.6
Poor engagement	1	5.3

4.4 Student current grades and duration spent on Canvas LMS

The current final exam anatomy grades, session two (2023/2024), which used Canvas LMS as a platform for students' revision, showed that students who spent 1-2 hours on Canvas LMS had varying academic outcomes (Table 6). A total of 42.9% achieved an 'A', 14.3% an 'A-', 28.6% a 'B+', and 14.3% a 'B-'. Among students who spent 3-6 hours on Canvas LMS, 33.3% achieved an 'A', 33.3% an 'A-', 11.1% a 'B+', and 11.1% a 'B' or 'B-'. For those who spent 9-12 hours on Canvas LMS, 66.7% received a 'B+', and 33.3% a 'B'. The relationship between current grades and duration spent on Canvas LMS was not statistically significant.

Table 6. The relationship between current grades and the duration spent on Canvas LMS

Current Grades Session 2 (2023/2024) n (%)	Duration spent on Canvas LSM (hours) n (%)			X ² statistic (df)	p-value	Previous Grades Session 1 (2023/2024) n (%)	X ² statistic (df)	p-value
	1-2 hours	3-6 hours	9-12 hours					
A	3 (42.9)	3 (33.3)	0 (0.0)	7.962 (8)	0.543	2 (10.5)	8.535 (10)	0.696
A-	1 (14.3)	3 (33.3)	0 (0.0)			4 (21.1)		
B+	2 (28.6)	1 (11.1)	2 (66.7)			4 (21.1)		
B	0 (0.0)	1 (11.1)	1 (33.3)			5 (26.3)		
B-	1 (14.3)	1 (11.1)	0 (0.0)			2 (10.5)		
C+	0 (0.0)	0 (0.0)	0 (0.0)			2 (10.5)		

*p-value was obtained using Pearson's Chi-square test

4.5 Students' engagement level and academic performance

The student engagement level measured by SEQ scores showed that among students with good engagement levels, 25.0% achieved an 'A', 16.7% an 'A-', 41.7% a 'B+', and 16.7% a 'B-' (Table 7). No students with good engagement received a 'B'; however, 16.7% received a 'B+'. For students with moderate engagement, 50.0% received an 'A', 16.7% an 'A-', and 33.3% received a 'B'. No students with moderate engagement received a 'B+' or 'B-'. Finally, among students with poor engagement, one student (100.0%) achieved an A-, while no students in this category received any other grades. However, the results were not statistically significant, although good engagement generally correlated with higher grades.

Table 7. The relationship between students' engagement level and their academic performance

SEQ Scores	Current grades [n (%)]					X ² statistic (df)	p-value
	A	A-	B+	B	B-		
						12.667 (8)	0.088
Good Engagement	3 (25.0)	2 (16.7)	5 (41.7)	0 (0.0)	2 (16.7)		
Moderate Engagement	3 (50.0)	1 (16.7)	0 (0.0)	2 (33.3)	0 (0.0)		
Poor Engagement	0 (0.0)	1 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)		

*p-value was obtained using Pearson's Chi-square test

5.0 Discussion

The sociodemographic data showed that the majority of the participants in this study were females aged between 30 and 35 years old. Older students prefer self-paced learning with Canvas LMS for convenience. (Ahmadi et al., 2023). Most of these students accessed the platform using a laptop. Larger screens may improve engagement with visual content. Moreover, the use of mobile devices reflects growing technology reliance. (Bains et al., 2022).

This study demonstrated that Canvas LMS promoted active learning and enhanced the engagement of part-time occupational therapy students. Many students strongly agreed or agreed that Canvas LMS materials improved their learning. This was similar to studies demonstrating the effectiveness of interactive content in enhancing neuroanatomy learning (Javaid et al., 2020). Moreover, most students agreed that Canvas LMS made lectures more meaningful, indicating that the platform was able to supplement traditional lecture content in a way that enhanced student understanding.

Nearly 90% agreed Canvas LMS clarified academic standards. A previous study showed that clear and structured learning materials encourage better academic performance and student confidence (Odekeye et al., 2023). Most students agreed Canvas LMS made studying more relevant. A study using technology-enhanced learning tools improved anatomy course outcomes among physical therapy students and can help overcome barriers associated with self-directed problem-based learning (Bains et al., 2022).

This study showed that 63.2% of students agreed that they used Canvas LMS to do their academic work with other students, while 57.9% agreed that the usage is for working with other students outside of class. This supports previous findings that LMS fosters peer collaboration and enhances learning. (Kassab et al., 2023).

The SEQ scores showed that 63.2% of students engaged well with Canvas LMS. This is consistent with a study that incorporated multimedia resources, structured tasks, and peer collaboration to enhance students' involvement in e-learning environments (Ahmadi et al., 2023). Although a smaller portion of students exhibited moderate or poor engagement levels, likely due to limited digital literacy or external commitments (Park & Choi, 2009), the Canvas LMS remains an effective tool for supporting active learning among part-time occupational therapy students.

The findings of this study can also be interpreted through Fredricks et al.'s (2004) multidimensional model of engagement, where student interaction with Canvas LMS demonstrated strong behavioral (time spent and quiz completion) and cognitive engagement.

Final exam grades improved from session one to two, with more students achieving grade 'A'. This suggests Canvas LMS improves neuroanatomy comprehension and retention. Studies also found that integrating LMS into blended learning and using the LMS tools positively impacts students' academic achievement by supporting active and independent learning (Almoslamani, 2018; Soffer & Cohen, 2019).

Students engaging for 1–6 hours generally performed better, with over 40% scoring an 'A'. Study shows that persistent interaction with LMS tools such as videos, quizzes, and discussions enhances students' understanding, leading to better academic performance (Bains et al., 2022). Good engagement led to strong results; 25% earned an 'A'. Moderate engagement showed similar trends. The use of LMS platforms has the potential to effectively bridge the engagement gap, particularly in subjects requiring substantial cognitive effort like neuroanatomy (Almoslamani, 2018).

6.0 Conclusion & Recommendations

The use of Canvas LMS improved academic outcomes for part-time occupational therapy students in neuroanatomy, particularly those with good engagement with the platform. However, the changes were not significant. This pilot study has limitations, including a small purposive sample and limited generalizability. A larger follow-up study is recommended to further examine how individual factors such as learning styles, digital literacy, or time availability influence engagement and academic outcomes.

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Paper Contribution to Related Field of Study

This study contributes to the field of health sciences education by highlighting the effectiveness of Canvas LMS in enhancing engagement and academic performance among part-time occupational therapy students studying neuroanatomy. It provides empirical evidence supporting the use of structured e-learning platforms to deliver complex anatomical content, particularly for part-time learners with limited access to traditional classroom settings. The findings offer practical implications for educators designing online anatomy curricula across allied health programs.

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