

Educational environment perception and cognitive load among physical therapy students during e-learning

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ABSTRACT

Background: Understanding students' perception of the educational environment and their cognitive load in this context is crucial for optimizing the effectiveness of e-learning platforms.

Objective: To compare educational environment perception and cognitive load in under-graduates Doctor of Physical Therapy (DPT) and post-graduate Master in Science of Physical Therapy (MSPT) students having online learning experiences.

Methodology: In this comparative cross-sectional study, data was collected through non-probability convenient sampling from n=274 under-graduates DPT (n=225) and post-graduates MSPT(n=49) students of either gender having one-semester experience of online learning, Dundee Ready Education Environment Measure (DREEM) for measuring educational environmental perception and Rating Scale of Mental Effort (RSME) for measurement of cognitive load. Online self-structured was developed questionnaire and shared through communication media platform and data analysis was made through SPSS version 28.

Results: There were n=225 under-graduates (DPT) and n=49 post-graduates (MSPT) students in which, there were n=208 females and n=66 males. The overall DREEM score showed that MSPT students are more significantly positive ($p < 0.001$, Cohen's $d = 1.01$) than DPT students regarding the perception of the educational environment with a large effect size. While there was no significant difference ($p = 0.114$) between MSP and DPT students regarding cognitive load.

Conclusion: Post-graduates (MSPT) students have better educational environmental perception than undergraduate (DPT) students but there was no significant difference in cognitive load in undergraduate (DPT) and post-graduates (MSPT) students.

Keywords: cognition; cognitive load; mental effort; physiotherapist; e-learning.

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INTRODUCTION

Online learning has grown significantly during the last ten years. About 90% of higher education institutions are thought to provide some kind of online education to meet the growing demand for it. Online education is no longer seen as anything novel [1]. The quality of the curriculum is reflected in the educational environment, which is essential for learning. Everything that takes on in academic institutions, departments, medical schools, and universities is referred to as the educational climate (EC). Learning objectives, teacher expertise, resources, tactics, assessments, timetabling, student help, facilities, classrooms, group size, and the atmosphere are some of the aspects that have an impact on the EC. Goals, satisfaction, instructor behavior, student behavior, and vice versa are all impacted. The EC acts as a change agent and a curriculum evaluation tool. Learning, goals, success, and wellness are all impacted by the learning environment [2].

At the undergraduate and graduate levels, the educational environment needs to be improved. Social lives, contributions, learning, and professional advancement are all negatively impacted by a situation that is not conducive to learning. Success and engagement are encouraged by a positive environment, which is shaped by cultural backgrounds, resources, staff, curriculum, and expectations [3].

Cognitive load in health sciences students refers to the mental effort required for processing and understanding information related to their field of study. Cognitive Load Theory (CLT) is a framework connected to task performance, controlling working memory during learning [4]. Sweller developed CLT to understand how problem-solving approaches affect learning including humans have limited cognitive capacity, part of it is required for problem-solving and learning, and different methods are used for learning and problem-solving. CLT is an approach that considers the limitations of the information processing system of the human mind [5]. Due to the complex concepts and effort in medical education, students have a very high cognitive load [6].

Physical Therapy is an emerging discipline in Pakistan in rehabilitation sciences. As with any other program, it is crucial to periodically evaluate the educational environment and cognitive load of the institute as perceived by its students. A number of studies have been done to evaluate the educational environment of medical and nursing colleges internationally and in Pakistan. No study that explores the educational environment and cognitive load of a physical therapy students has been found.

The purpose of this current study to compare educational environment perception and cognitive load among Doctor of Physical Therapy and Master

of Physical Therapy students having online learning experience.

METHODOLOGY

This comparative cross-sectional study was conducted on under-graduate students of Doctor of Physical Therapy (DPT) program and post-graduate students Master of Physical Therapy (MSPT). After approval from Research Ethical Committee of the Riphah College of Rehabilitation and Allied Health Sciences with Ref: RIPHAAH/RCRS/REC/Letter-00749. The duration of the study was six months after approval from ethical committee. The participants must have one semester experience of online learning from different universities and institutes of Physical Therapy in Rawalpindi and Islamabad while students not having online learning experience were excluded from this study.

The sample size was $n=377$, calculated through Rao software with 20,000 population size, 95% confidence interval and 5% margin of error. Data from $n=316$ students was collected, 42 students responded incomplete information, so data of remaining $n=274$ students was analyzed. The data was collected using convenient sampling through communication media platform in docx file and respondents answered on soft-form data.

An online questionnaire was developed using the DREEM and RSME questionnaires and was distributed to the students via email and WhatsApp. Dundee Ready Education Environment Measure (DREEM) questionnaire has 50-items, closed-ended inventory based on students' perceptions of five areas related to their educational environment. These are: learning, teaching, academic self-perception, atmosphere, and social self-perception. Items are scored on a 5-point Likert scale as follows: 4 = strongly agree, 3 = agree, 2 = unsure, 1 = disagree, and 0 = strongly disagree. The nine items in which 4, 8, 9, 17, 25, 35, 39, 48 and 50 were having reverse order and reverse coding respectively. Items with a mean score greater than 3 mainly represent strong areas, while items with a mean score of less than or equal to 2 are indicative of problem areas that require immediate review and remediation. Items with a mean score between 2 and 3 reflect areas that are neither strengths nor weaknesses but could possibly be enhanced. Item scores count towards an overall environment score as well as one of five subscales or domains (abbreviations and maximum subscale scores are in parenthesis): Students' Perceptions of Learning (SPL, 48), Students' Perceptions of Teaching (SPT, 44), Students' Academic Self-perception (SAP, 32), Students' Perception of Atmosphere (SPA, 48) and Students' Social Self-perception (SSP, 28). The total mean score has a maximum of 200 points, showing ideal educational environment interpreted as follows: 0–

50 points, very poor; 51–100 points, significant problems; 101–150 points, more positive than negative; and 151–200 points, excellent. The DREEM is a validated and reliable inventory used in many researches. The Cronbach α was 0.919 for the total mean score, 0.798 for students' perception of learning, 0.769 for students' perceptions of teachers, 0.693 for students' academic self-perceptions, 0.757 for students' perceptions of atmosphere, and 0.611 for students' social self-perceptions [7].

Rating Scale of Mental Effort (RSME) from 1 (Very very low mental effort) to 9 (Very very high mental effort) was used for measuring cognitive load. It had been shown that it was difficult to change a perceptually modified task, from "1 - very low and very low mental effort" to "9 - very high and very high mental effort", which had a high face validity and internal consistency [8].

The descriptive statistics was used for data presentation, in the form of frequency, percentages, means and standard deviation. To compare the under-graduate (DPT) and post-graduates (MSPT) students regarding educational environmental perception and cognitive load, the independent sample t-test was used. The level of significance was set at $p < 0.05$ and SPSS ver. 28 was used for data analysis.

RESULTS

There was $n=274$ participants of $n=225$ under-graduates (DPT) and $n=49$ post-graduates (MSPT)

students having online learning experience whereas $n=208$ were female and $n=66$ were male. So, there were $n=176$ female and $n=49$ male in under-graduate (DPT), and there was $n=32$ female and $n=17$ male in post-graduate (MSPT). The mean age of both under-graduate (DPT) and post-graduate (MSPT) was 22.60 ± 2.413 , while the mean age of under-graduate (DPT) was 22.10 ± 1.97 and post-graduate (MSPT) was 24.90 ± 2.88 .

The overall DREEM score showed that MSPT students are more significantly positive ($p < 0.001$, Cohen's $d=1.01$) than DPT students regarding the perception of educational environment with large effect size. The results of individual domains of DREEM also showed that MSPT students have a more positive ($p < 0.001$, Cohen's $d=0.69$) approach towards learning than DPT students. The score about teacher perception, the MSPT student as compared to DPT student ($p=0.005$, Cohen's $d=0.45$) showed that teacher is moving in right direction with moderate effect size. Regarding the academic perception MSPT student feeling more score on positive side ($p < 0.001$, Cohen's $d=0.65$) as compared to DPT. While comparing atmospheric perception, MSPT students perceived a more positive educational environment than DPT students that perceive lot of issue in the educational atmosphere ($p < 0.001$, Cohen's $d=0.83$). Regarding the score of social environments, MSPT students as compared to DPT, are more positive and perceived that it is not too bad ($p < 0.001$, Cohen's $d=0.64$). While there was no significant difference ($p=0.114$) between MSP and DPT student regarding cognitive load. (Table 1)

Table 1: DREEM Scores, its Domains, and Cognitive Load

Variable	Max Score	DPT		MSPT		p-Value	Mean Difference	Cohen's d
		Mean \pm SD	Percentage	Mean \pm SD	Percentage			
Overall DREEM	200	106.71 \pm 18.46	53.35	125.67 \pm 20.11	62.83	0.00***	18.95	1.01
Learning Perception	48	26.25 \pm 5.42	54.68	30.22 \pm 6.86	62.95	0.00***	3.96	0.69
Teacher Perception	44	24.81 \pm 4.68	56.38	26.93 \pm 4.43	61.20	0.005**	2.12	0.45
Academic Perception	32	17.34 \pm 5.28	54.18	20.81 \pm 5.35	65.03	0.00***	3.46	0.65
Atmosphere perception	48	24.29 \pm 5.42	50.60	28.81 \pm 5.22	60.02	0.00***	4.52	0.83
Social Perception	28	14.72 \pm 3.04	52.57	16.77 \pm 3.76	59.89	0.00***	2.05	0.64
Cognitive Load	9	5.73 \pm 1.62	63.66	5.33 \pm 1.61	59.22	0.114	0.24	0.25

Level of significance: $p < 0.001$ ***, $p < 0.01$ ** , $p < 0.05$ *.

DREEM: Dundee Ready Education Environment Measure. DPT: Doctor of Physical Therapy. MSPT: Master of Physical Therapy. SD: Standard Deviation

DISCUSSION

The primary objective of this study was to compare educational environment and cognitive load between post-graduates (MSPT) and under-graduates (DPT) students during e-learning. The results of current study showed that there was significant difference in educational environment perception and its domains and there was no significant difference in cognitive load among post-graduates (MSPT) and under-graduates (DPT) students.

In this current study educational environment perception or overall DREEM was higher in post-graduates (MSPT) than under-graduates (DPT) students. Compared to post-graduates (MSPT) students, under-graduates (DPT) students might view the online learning environment differently. The view of students may be affected by lack of experience and expertise in field of physical therapy [9]. Their earlier online learning experiences and technological comfort could also be important. In contrast post-graduates (MSPT) students often have a greater level of professional experience as

well as a deeper comprehension of the subject topic. Because of their prior online learning experiences and exposure to cutting-edge technologies, they can have higher expectations for the online learning environment [10, 11].

The results of current study showed that there was significant difference in student learning perception. The post-graduates (MSPT) students showed more positive learning perception compared to under-graduates (DPT) students. Higher total score in learning perception reported by post-graduates (MSPT) may have been due to the imminence of professional development as well as their adaptations to the learning environment and their knowledge of the core curriculum content [7].

In terms of perception of teacher was higher in post-graduates (MSPT) than under-graduates (DPT) students which may be due to teachers have good knowledge of the subject, are well prepared, have excellent communication skills and are kind enough to provide feedback [12].

The current study showed that the student academic perception was more positive in post-graduates (MSPT) because it calls attention toward the level of confidence of the students toward their academic progress. Many studies report that the career preferences have a strong influence on students' academic performance, motivation, and well-being [13].

In current study, there was significant difference in atmosphere perception in post-graduates (MSPT) and under-graduates (DPT) students. This difference might be due to students' motivation for learning, non-random sample selection and assessment methods used could have affected the relationship of students' academic performance and their perception of the educational environment. In addition, students' habit of study has also significant impact on their academic achievement [14].

In this current study results were more positive in post-graduates (MSPT) than under-graduates (DPT) students, which may be due to updated curriculum which may ensure the more active involvement of students in the teaching-learning process, as well as creating supportive climate, and a strong social network of support [13].

The results of this study were suggestive to that there was no significant difference in cognitive load among post-graduates (MSPT) and under-graduates (DPT) students. The possible reason could be that both groups post-graduates (MSPT) and under-graduates (DPT) students used their cognitive capacity to solve problems as cognitive load depends on prior knowledge, cognitive ability, motivation, and emotion, as well as the task environment, such as task difficulty and deadline

pressure [15]. But studies suggested that under-graduate students could experience more cognitive strain as they get used to online study. They must develop new abilities in self-control, web navigation and time management. It may be difficult for individuals to successfully integrate and apply knowledge when they switch from in-person practical training to online theoretical study [9, 10, 16]. Conversely post-graduate (MSPT) students may already have established cognitive load management techniques from their earlier training or practical experience. They could be more adept at adjusting to the online learning environment, but the depth and complexity of post-graduates' coursework can still be very taxing on their cognitive abilities [16, 17].

CONCLUSION

It was concluded that post-graduates (MSPT) students have better educational environmental perception than under-graduate (DPT) students but there was no significant difference of cognitive load in under-graduate (DPT) and post-graduates (MSPT) students.

DECLARATIONS & STATEMENTS

Author's Contribution

ZM: substantial contributions to the conception and design of the study.

ZM and ZA: acquisition of data for the study.

AU and AA: interpretation of data for the study.

JA: analysis of the data for the study.

ZM: drafted the work.

AW: revised it critically for important intellectual content.

ZM, ZA, AU, AA, JA and AW: final approval of the version to be published and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All authors contributed to the article and approved the submitted version.

Ethical Statement

The study was conducted after getting approval from the Research & Ethics Committee of Riphah College of Rehabilitation Sciences (RIPHAH/RCRS/REC/Letter-00749).

Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

The data presented in this study are available on request from the corresponding author.

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Conflicts of Interest

The authors declare no conflict of interest.

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