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Research Paper

Engagement and learning approaches among medical students in an online surgical teaching programme: A cross-sectional study☆

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ABSTRACT

Background: The COVID-19 pandemic prompted the transition of all teaching and learning of final-year General Surgery students to an online platform. Despite the utility of online methods, challenges exist such as a sense of impersonal learning, and poor student engagement. Student engagement with course content is important for deep learning. An Online Student Engagement Scale (OSE) and a revised Biggs Two-Factor Study Process Questionnaire (R-SPQ-2F) were used to evaluate student engagement and learning approaches respectively.
Methods: A cross-sectional study was conducted in 2021 at a South African university. The OSE and R-SPQ-2F online survey tools were administered to all final-year students ($n = 325$) enrolled in the surgical online module. Quantitative data was collected, and the data was analysed statistically using R-Statistical computing software. Results are presented in the form of descriptive and inferential statistics. The reliability of the tools was evaluated by Cronbach's alpha.
Results: The survey response rate was 35.4 % (115/325). Students were engaged at a high level, and the median (IQR) scores of the OSE tool were 71.0 (63.0–78.0). Overall, students adopted a deep approach (DA) to learning, with median (IQR) scores of 34.0 (30.0–39.0) on the R-SPQ-2F tool. There was a moderate positive correlation between the total OSE score and DA (0.53, $p < 0.001$). Both the OSE and R-SPQ-2F tools showed an acceptable level of internal consistency of 0.893 and 0.806 respectively.
Conclusions: Student engagement was associated with deep learning approaches. The OSE and R-SPQ-2F tools were reliable tools to measure student engagement and learning approaches among medical students.

***Key message*:** In this study, the level of student engagement was high and was associated with deep learning approaches. The OSE and R-SPQ-2F tools were shown to be reliable tools for measuring student engagement and learning approaches among medical students in our setting.

Introduction

The COVID-19 pandemic acted as a catalyst to advance online instructional methods in medical education. Between 2020 and 2021, teaching and learning of final-year General Surgery students at a South African university moved to a fully online teaching platform [1]. Despite the utility of online methods, challenges exist such as a sense of impersonal learning with asynchronous methods, student isolation, and poor engagement [2,3].

Student engagement has a direct impact on student success, achievement, and satisfaction [4]. Student engagement is defined as "a complex meta-construct consisting of dimensions including students' academic experience of teaching, learning, and research through interacting with other students, faculty, and community at the cognitive (thinking), affective (feeling), and behavioural (doing) levels" [5].

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Factors including supportive instructors, multiple modes of interaction, use of interactive technology, students' participation in formal and informal learning communities, and attention to course design have been identified to impact engagement [3,6]. Student engagement is developed through interaction and three types of interaction are particularly relevant to supporting learning in online courses [3,7]. These include interaction with course content, such as accessibility, being able to manipulate, synthesize, and communicate course content; interaction with instructors (being able to communicate with and receive feedback from instructors); and interaction with peers, through the use of small group activities, and social networking sites such as WhatsApp groups to foster collaboration and community [3,7].

The three domains for student engagement i.e., cognitive (students' beliefs about themselves and about learning itself), emotional (motivation and feeling) and behavioural (habits, skills including reading, writing, and study skills have been researched before [8,9] and Dixson [10] has developed the Online Student Engagement Scale (OSE) to evaluate the related domains of skills, emotions, participation and performance of student engagement for online learning environments.

Social constructivist theory postulates that we learn better when acquiring knowledge through social interaction [10]. Students may perform tasks by themselves but are likely to perform better when they work collaboratively with others [10]. "This difference between what students can do independently and what they can do with the help of others refers to Vygotsky's zone of proximal development" [11]. Learning is viewed as being active, allowing students to construct their own knowledge, together with the use of collaborative and cooperative methods, and should be meaningful to them [12].

Positive learning experiences for students are influenced by several factors, including cognitive engagement, perceived course value, and the use of deep learning strategies [13]. Student engagement with course content is thought to be vital to foster deep learning [14]. The concept of deep learning was first introduced by Marton and Säljö [15]. Students who engage in deep learning have been shown to demonstrate higher-order thinking skills including synthesis and evaluation. Deep learners also demonstrate a commitment to understanding the content and do not merely engage in learning to obtain a passing score [13,14]. In contrast, surface learning is associated mainly with students who resort to memorisation and rote learning to earn a passing score [13,14]. While deep learners can transfer concepts learned to different situations [13]; surface learners fail to make such connections and are generally unable to apply the information in a new context. In medical education, students with a deep approach to learning may be more likely to be lifelong learners [16].

Educational researchers have been interested in measuring students' approaches to learning [14] and the revised Biggs Two-Factor Study Process Questionnaire (R-SPQ-2F) is a 20-item scale, which measures the deep (DA) and students' Surface Approach (SA) to learning. The SA and DA both consist of two subscales each. The 'Strategy' subscales (deep strategy [DS], and surface strategy [SS]) describe the way a student goes about his/her study, while the 'Motive' subscales (deep motive [DM], surface motive [SM]) explore reasons for adopting a particular strategy [14]. It is a validated tool that has been tested in a variety of settings including in Pakistan, the United Arab Emirates, and Saudi Arabia [16–18].

To date, no such study of student approaches has been conducted in a medical context on the African continent. This study investigated student engagement and learning approaches in an online surgical teaching programme developed as part of remote emergency teaching and learning measures during COVID-19 at a South African university. We also explored any associations between student engagement and the use of deep and/or surface learning approaches on the course and investigated the reliability of the OSE and R-SPQ-2F tools in our setting.

Methods

The details of the online surgical module developed for final-year General Surgery students at the University of KwaZulu-Natal (UKZN) have been described previously [1]. Briefly, the 6-week online surgical module included a flipped-classroom approach with synchronous activities i.e. daily live tutorials delivered via the Zoom platform with a focus on case-based teaching aimed at developing the clinical reasoning skills of students [1]. Four to five students were assigned to a topic to encourage participation and discussions during the live Zoom sessions with the tutor and their peers and received immediate feedback on their contributions, they were marked according to a rubric (Additional file 1), and this contributed towards their continuous assessment mark in the block. Asynchronous activities comprised "videos on clinical examination and procedural skills, interactive video quizzes, PowerPoint presentations, and text resources uploaded onto the university's online learning management system (Moodle)", together with weekly multiple-choice question (MCQ) quizzes on course content. End-of-module assessment in the seventh week comprised a theory-based MCQ paper and a paper case of a clinical vignette in lieu of the clinical assessment [1].

Research questions and hypothesis

The research questions were:

- What is the level of student engagement in online learning?
- What are the learning approaches (deep and/or surface learning) of students?
- Is there an association between student engagement and deep and surface learning approaches?

Thus, the apriori hypothesis for our study was that students participating in the online surgical teaching and learning programme have varying levels of engagement with positive correlation between student engagement scores and a deep learning approach and negative correlation between student engagement scores and a surface learning approach.

Study design and participants

A cross-sectional study was conducted from March to November 2021 at UKZN in Durban South Africa. Approximately 40–55 sixth-year medical students completed the 6-week online surgical module. There were six such modules between February to November 2021, with a total of 325 students. In the fourth week of the module, students were invited to complete the OSE and R-SPQ-2F tools uploaded as a Microsoft (USA) form onto the Moodle learning management system (LMS).

Instruments and data collection

The OSE [10] and R-SPQ-2F [14] are established validated questionnaires. Both tools were reviewed by the study team to ensure content validity. The OSE scale [10] comprises 19 Likert-type items on a 5-point scale: 1 = not at all characteristic of me, 2 = not really characteristic of me, 3 = moderately characteristic of me, 4 = characteristic of me, and 5 = very characteristic of me [9,10]. It measures student engagement in the online learning space and consists of four categories: skills, emotions, participation, and performance (Additional file 2). The R-SPQ-2F [14] developed by Biggs and colleagues measures student approaches such as deep and surface learning and comprises 20 items scored on a 5-point Likert scale (1 = never or only rarely true of me [0–20 % of the time], 2 = sometimes true of me [21–40 % of the time], 3 = true of me about half the time [41–60 % of the time], 4 = frequently true of me [61–80 % of the time], 5 = Always or almost always true of me [81–100 % of the time] (Additional file 2). It has two main scale scores; DA and

SA and four subscales; DM, SM, DS, and SS [14]. We also collected information on student demographics of age and gender. Students were informed about the purpose of the study and email reminders were sent to them. The questionnaire was self-administered and completed online with only one response per student being collected. To ensure anonymity, no email addresses or identifiers were collected.

Data analysis

Statistical data analysis was conducted in R Statistical computing software of the R Core Team, 2020, version 3.6.3 and results presented in the form of descriptive and inferential statistics. Descriptive statistics such as proportions and percentages were used to summarize categorical variables. Where applicable, continuous variables were summarized as the minimum, maximum, median, interquartile range, means, and standard deviation (SD). Total OSE scores were calculated as well as scores for the subscales: Skills, Emotional, Participation, and Performance [9,10]. Main DA and SA scale and subscale: DM, DS, SM, and SS scores were calculated by adding up item scores [14], see Table 1. Multidimensional numerical variables were presented as correlation plots and where applicable, statistical test results were annotated on panelled graphs. Likert plots were used for handling multidimensional visual presentation of the categorical data. Depending on the distribution of the numerical variables between two independent groups, mean or median differences were assessed using either a *t*-test or Wilcoxon respectively. The reliability of the OSE and R-SPQ-2F tools was evaluated by Cronbach's alpha. All the inferential statistical analysis tests were conducted at a 5 % level of significance.

Ethics

The study was approved by the Biomedical Research Ethics Committee (BREC) of UKZN (ref. no. BREC/00002686/2021). Participation was voluntary and all participants provided written informed consent.

Results

Demographic data

The survey response rate was 35.4 % (115/325). The median (IQR) age of final-year students was 24.0 (23.0–26.0) years, with women comprising 53.0 % (61/115) and men 45.2 % (52/115), two students identified as 'Other'.

Table 1
Summary of OSE and R-SPQ-2F questionnaires [9,17].

Online Student Engagement Scale (OSE)		
Scales	*Subscales*	*Items*
	Skills	1 + 3 + 4 + 5 + 6 + 7
	Emotional	2 + 8 + 9 + 10 + 11
	Participation	12 + 13 + 14 + 17 + 18 + 19
	Performance	15 + 16
Revised Biggs Two-Factor Study Process Questionnaire (R-SPQ-2F)		
Deep Approach (DA)		1 + 2 + 5 + 6 + 9 + 10 + 13 + 14 + 17 + 18
	Deep Motive (DM): intrinsic interest	1 + 5 + 9 + 13 + 17
	Deep Strategy (DS): maximize meaning	2 + 6 + 10 + 14 + 18
Surface Approach (SA)		3 + 4 + 7 + 8 + 11 + 12 + 15 + 16 + 19 + 20
	Surface Motive (SM): fear of failure	3 + 7 + 11 + 15 + 19
	Surface Strategy (SS): narrow target, rote learning	4 + 8 + 12 + 16 + 20

OSE

In general, students were engaged at a high level in the online surgical module, the median (IQR) score for the instrument was 71.0 (63.0–78.0), with minimum and maximum possible scores of 27.0 and 95.0 respectively (Table 2). There were no statistically significant differences in scores by gender. Fig. 1 shows the Likert plot of OSE scores by item, where items are arranged in descending order of the proportion of positive responses (i.e. 4 s or 5 s). Regarding students' scores in the Skills category, 81.4 % (92/113)[1] scored item 7 which refers to ("Listen/read carefully") as 4 or 5. Similarly, in the Emotional category, 88.7 % (102/115) identified with item 2 ("Put sufficient effort to ensure success"). Participants were less engaged in the Participation activities, 72.5 % (82/115) identified with item 14 ("Help my fellow students"). Item 18 ("Post in the discussion forum regularly") had the lowest median score (2, IQR:2–3) in this category and overall, with 59.4 % of students (66/111)[2] who did not identify with this item (scores of 1 and 2). Most students ~86.0 % identified with both items in the Performance category ("Aim to get a good grade/mark" and "Do well on the tests/quizzes"). The internal reliability of the OSE scale was high, as shown by the overall Cronbach's α value of 0.893 (Additional file 3).

R-SPQ-2F

Overall, students adopted a deep approach to learning as shown by the median (IQR) score for DA 34.0 (30.0–39.0), with minimum and maximum possible scores of 21.0 and 50.0 respectively (Table 3). Men scored higher on the deep motive subscale compared to women ($p = 0.049$). Fig. 2 summarizes the scores of individual items for the whole student cohort ($n = 115$) with most students ~55.0–75.0 % identifying with DA items (1, 2, 5, 10, 13, 18, and). The internal reliability of the R-

Table 2
OSE scores by subscales.

Gender	Women ($n = 61$)	Men ($n = 52$)	*p*-value	Overall ($N = 113$)*
Skills				
Median (IQR)	24.0 (23.0–27.0)	23.0 (21.0–26.0)	0.115	24.0 (21.0–27.0)
n (Min-Max)	61 (17.0–30.0)	52 (11.0–30.0)		113 (11.0–30.0)
Emotional				
Median (IQR)	19.0 (17.0–22.0)	19.0 (17.8–22.3)	0.424	19.0 (17.0–22.0)
n (Min-Max)	61 (12.0–25.0)	52 (5.00–25.0)		113 (5.00–25.0)
Participation				
Mean ± SD	19.1 ± 5.27 (27.6)	19.8 ± 5.72 (28.9)	0.506	19.4 ± 5.47 (28.2)
Median (IQR)	19.0 (15.0–23.0)	20.0 (16.0–24.0)		19.0 (16.0–24.0)
n (Min-Max)	61 (8.00–30.0)	52 (7.00–30.0)		113 (7.00–30.0)
Performance				
Median (IQR)	9.00 (7.00–10.0)	9.00 (8.00–10.0)	0.903	9.00 (8.00–10.0)
n (Min-Max)	61 (0–10.0)	52 (0–10.0)		113 (0–10.0)
Total OSE score				
Median (IQR)	71.0 (64.0–78.0)	70.0 (63.0–78.8)	0.933	71.0 (63.0–78.0)
n (Min-Max)	61 (48.0–90.0)	52 (27.0–95.0)		113 (27.0–95.0)

* 2 students identifying as 'other' were not included in the analysis, % and *p*-values based on non-missing cases.

[1] Missing information for 2 students.
[2] Missing information for 4 students.

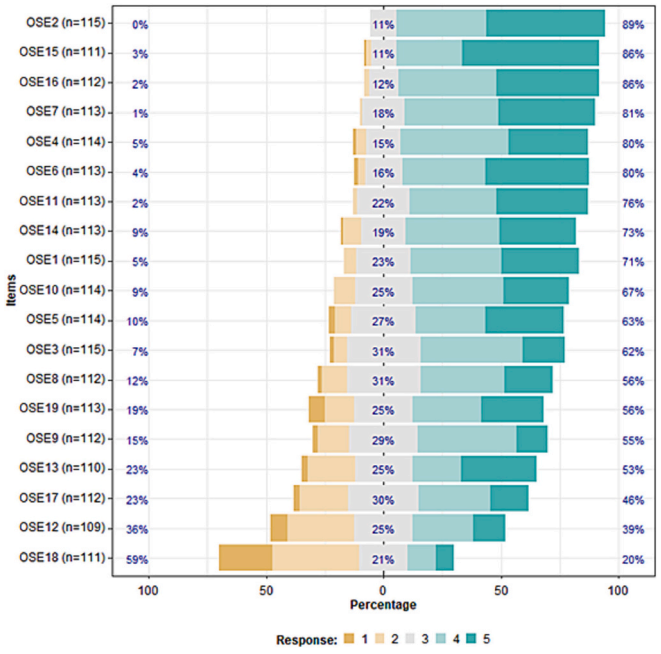

Fig. 1. Likert plot of OSE scores ($n = 115$).
OSE1 = Make sure to study on a regular basis.
OSE2 = Stay up to date with the readings.
OSE3 = Look over class notes between getting online to make sure I understand the material.
OSE4 = Am organized.
OSE5 = Take good notes on readings PowerPoints or video lectures.
OSE6 = Listen read carefully.
OSE7 = Put sufficient effort to ensure success.
OSE8 = Find ways to make the course material relevant to my life.
OSE9 = Apply course material to my life.
OSE10 = Find ways to make the course interesting to me.
OSE11 = Really desire to learn the material.
OSE12 = Have fun in online chats discussions or via email with the instructor or other students.
OSE13 = Participate actively in small group discussion forums including class WhatsApp groups etc.
OSE14 = Help my fellow students.
OSE15 = Engage in conversations online chat discussions email.
OSE16 = Post in the discussion forum regularly.
OSE17 = Get to know other students in the class.
OSE18 = Aim to get a good grade mark.
OSE19 = Do well on the tests/quizzes.
Response: 1. not at all characteristic of me; 2. not really characteristic of me; 3. moderately characteristic of me; 4. characteristic of me; 5. very characteristic of me.

SPQ-2F scale was high, as shown by the overall Cronbach's α value of 0.806 (Additional file 4).

Correlation between variables.

Fig. 3 shows the correlations between student engagement and their use of the deep and surface approach to learning as well as correlations between DA and SA. There was a moderate positive correlation between the total OSE score and DA (0.53, $p < 0.001$) and a weak negative correlation between the total OSE score and SA (−0.23, $p = 0.015$). Similarly, there was a weak negative correlation between DA and SA (−0.20, $p = 0.035$).

Discussion

This study aimed to investigate the level of student engagement in an online surgical module implemented as part of remote emergency teaching and learning measures during COVID-19. We also explored any associations between student engagement and deep and surface learning approaches and the reliability of the OSE and R-SPQ-2F tools in our setting. Level of student engagement was high with most students identifying with several items related to the OSE subscales of skills, emotion, and performance. These engagement scores imply that they were engaged and invested in their learning. However, responses relating to students' participation (items 12, 13, 17, 18 and 19) on the OSE scale had lower levels of agreement compared to the other three OSE subscales of skills, emotion, and performance. These responses suggest that their main reason for engaging in online activities was not motivated by a need for socialization. Regarding the learning styles of students, most adopted a deep approach to learning as shown by higher DA and subscales of DM and DS scores as obtained on the R-SPQ-2F tool. Correlation plots showed a moderate positive correlation between the total OSE score and DA that was statistically significant, indicating that student engagement had a significant effect on a deep approach to learning. This interpretation is also supported by a statistically significant albeit weak negative correlation between total OSE scores and a surface approach to learning. Both the OSE and R-SPQ-2F tools showed an acceptable level of internal consistency of 0.893 and 0.806 respectively.

In an American study [9] that explored student perceptions of engagement, transactional distance and outcomes in online courses, students who completed the OSE scale were engaged at a fairly high level, and scores across the skills, emotional, participation and performance subscales were comparable to findings from our study. The study also showed that women had higher levels of engagement than men [9].

Table 3
R-SPQ-2F learning style scores by subscales.

Gender	Women (n = 61)	Men (n = 52)	p-value	Overall ($N = 113$)*
Deep approach				
Mean ± SD	33.9 ± 5.71 (16.8)	35.3 ± 6.78 (19.2)	0.221	34.6 ± 6.24 (18.0)
Median (IQR)	34.0 (30.0–38.0)	34.5 (29.8–39.3)		34.0 (30.0–39.0)
n (Min-Max)	61 (21.0–50.0)	52 (22.0–50.0)		113 (21.0–50.0)
Surface approach				
Median (IQR)	23.0 (18.0–28.0)	21.5 (18.0–25.3)	0.585	23.0 (18.0–26.0)
n (Min-Max)	61 (13.0–39.0)	52 (10.0–43.0)		113 (10.0–43.0)
Deep motive				
Median (IQR)	18.0 (14.0–19.0)	18.5 (15.8–20.3)	**0.049**	18.0 (15.0–20.0)
n (Min-Max)	61 (10.0–25.0)	52 (12.0–25.0)		113 (10.0–25.0)
Deep strategy				
Mean ± SD	17.0 ± 3.01 (17.7)	17.2 ± 3.96 (23.1)	0.777	17.1 ± 3.46 (20.3)
Median (IQR)	17.0 (15.0–19.0)	16.5 (14.0–20.0)		17.0 (15.0–19.0)
n (Min-Max)	61 (10.0–25.0)	52 (8.00–25.0)		113 (8.00–25.0)
Surface motive				
Median (IQR)	9.00 (7.00–12.0)	9.00 (7.00–11.3)	0.915	9.00 (7.00–12.0)
n (Min-Max)	61 (5.00–19.0)	52 (5.00–21.0)		113 (5.00–21.0)
Surface strategy				
Median (IQR)	13.0 (11.0–16.0)	12.0 (10.0–15.3)	0.278	13.0 (10.0–16.0)
n (Min-Max)	61 (8.00–25.0)	52 (5.00–22.0)		113 (5.00–25.0)

* 2 students identifying as 'other' were not included in the analysis, % and *p*-values based on non-missing cases.

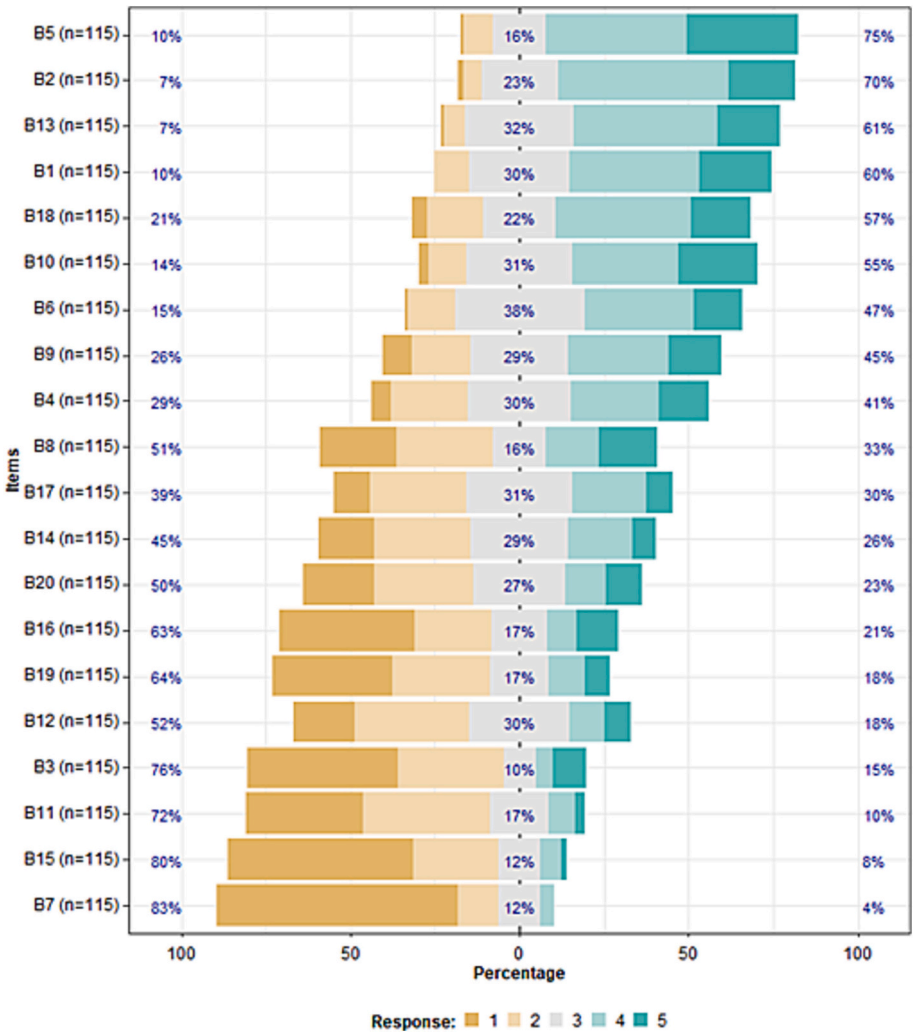

Fig. 2. Likert plot of R-SPQ-2F (n = 115).

B1 = I find that at times studying gives me a feeling of deep personal satisfaction.
B2 = I find that I have to do enough work on a topic so that I can form my own conclusions before I am satisfied.
B3 = My aim is to pass the course while doing as little work as possible.
B4 = I only study seriously what's given out in class or in the course outlines.
B5 = I feel that virtually any topic can be highly interesting once I get into it.
B6 = I find most new topics interesting and often spend extra time trying to obtain more information about them.
B7 = I do not find my course very interesting so I keep my work to the minimum.
B8 = I learn some things by rote, going over and over them until I know them by heart even if I do not understand them.
B9 = I find that studying academic topics can at times be as exciting as a good novel or movie.
B10 = I test myself on important topics until I understand them completely.
B11 = I find I can get by in most assessments by memorizing key sections rather than trying to understand them.
B12 = I generally restrict my study to what is specifically set (core topics/learning objectives) as I think it is unnecessary to do anything extra.
B13 = I work hard at my studies because I find the material interesting.
B14 = I spend a lot of my free time finding out more about interesting topics which have been discussed.
B15 = I find it is not helpful to study topics in depth. It confuses and wastes time, when all you need is an overview of the topics.
B16 = I believe that lecturers shouldn't expect students to spend significant amounts of time studying material everyone knows won't be examined.
B17 = I come to most tutorials/lectures with questions in mind that I want answering.
B18 = I make a point of looking at most of the suggested readings that go with the lectures.
B19 = I see no point in learning material which is not likely to be in the examination.
B20 = I find the best way to pass examinations is to try to remember answers to likely questions
Response: 1. this item is never or only rarely true of me (0–20 % of the time); 2. this item is sometimes true of me (21–40 % of the time); 3. this item is true of me about half the time (41–60 % of the time); 4. this item is frequently true of me (61–80 % of the time); this item is always or almost always true of me (81–100 % of the time).

This is contrasted with the findings of this study where no gender differences had been observed in overall OSE scores and could be explained by the small sample size in this study. Students in this study were also less likely to post in discussion forums which could be explained by the module structure with daily synchronous sessions where students interacted with faculty; this offered them an opportunity to ask questions and clarify concepts. Additionally, a qualitative study [6] explored possible reasons why students were less likely to post on online discussion forums. Findings indicated that students felt nervous and exposed when posting and were more comfortable to email tutors

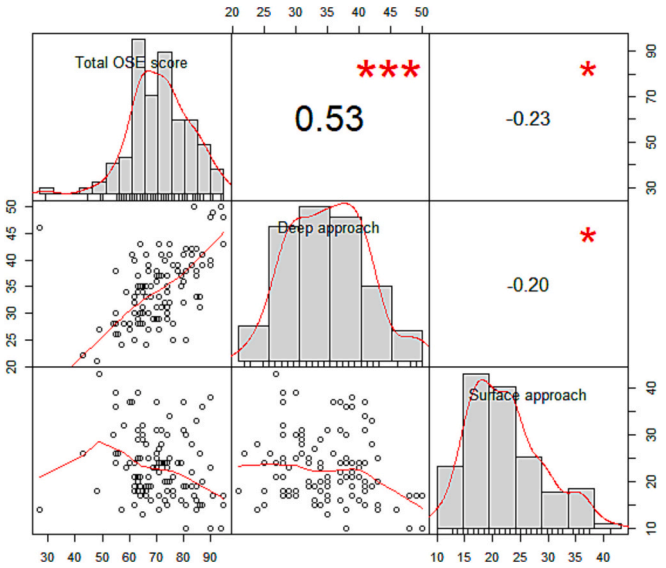

Fig. 3. Correlation plot.
OSE: Online Student Engagement Scale score.

directly when they had questions. Furthermore, the online surgical module at UKZN incorporated the three types of interaction that were shown to support learning in online courses [7]. Student interaction with course content was facilitated by uploading all material onto the Moodle LMS which was easily accessible and organized into a clear weekly structure. The content comprised recordings of live Zoom sessions, videos on examination techniques and procedural skills, with video quizzes to promote interactivity with asynchronous material [19] Additional weekly quizzes were posted to allow students to test themselves on content in preparation for end-of-module assessments which was followed by prompt formative feedback on correct answers [1].

Course designers were deliberate about maximizing interaction in live Zoom sessions and attendance at these sessions was a duly performed (DP) requirement for the module. Interaction with tutors thus occurred daily in live Zoom sessions that focussed on active learning methods such as case-based teaching that prioritised students' development and assessing of clinical reasoning skills [1]. Some instructors used the "chat and polling functions" on Zoom in the live sessions. Interaction with peers was fostered through small group activities as other instructors used the breakout rooms to enable small-group work and discussion [1]. However, few students ~20 %–53 % identified with the socialization and participatory activities (items 12, 13 17, 18, and 19) on the OSE scale. This may be due to challenges experienced by students during the COVID-19 pandemic (e.g. dealing with personal and family illness, adapting to online teaching, time pressures, and students' reports of generally being in 'survival mode') [20]. However, it is encouraging to note that despite the circumstances, most students ~73 % helped other students in the class (item 14 on the OSE scale) and tried to get to know their peers (56 % of students identified with item 19 on the OSE scale).

Reports on medical students in similar studies found that the students generally adopted a deep approach to learning [16–18]. Students in the preclinical years had higher surface approach learning scores compared to students in the clinical years and this may be due to a carry-over of learning styles from secondary school that is externally driven and relies on memorization of facts [16]. The course content also changed notably from mainly lecture-based teaching to problem-based learning activities, critical thinking, and deep approaches to learning as students progressed through their studies [16]. Male students also had a higher mean score for superficial learning approaches compared to females [16]. Findings from our study also showed that students adopted a deep approach to learning, however in contrast to the Mirghani et al. study [16], males in our study scored higher on deep motive strategies compared to females. This may be explained by the small sample size in our study and unmeasured differences related to ethnicity, year of study, and diverse prior schooling experiences of students that differed between our study and others. The R-SPQ-2F tool was found to be both valid and reliable in diverse settings [17,18] and we also found the tool to have high internal consistency in our setting. Furthermore, on evaluation of the association between student engagement and deep learning approaches, we found a statistically significant moderate positive correlation between the total OSE score and deep approach to learning among our student cohort. This finding is supported by another South African study [20] as well as an American study [13], albeit both conducted in non-medical educational contexts. Floyd et al. [13] in their study of relationships among perceived course value, student engagement, and deep and surface learning strategies among undergraduate information technology students in the United States showed a positive, statistically significant correlation between perceived course value and deep learning strategies and between student engagement and deep learning. The intersection of perceived course value, student cognitive engagement, and deep learning strategies is essential to a positive learning experience [13].

Although perceived course value was not measured in the current study, one can infer that students completing their undergraduate medical degree place a high value on the course due to its utility, presence of meaningful, 'real-world' activities, and influence on their future careers [13]. Cognitive engagement and perceived course value indicate motives for learning and influence students' approaches to learning [13]. Deep and surface learning approaches are motivated by different factors and it is expected that they would move in a related manner i.e. students who use deep learning approaches would likely not use surface approaches, and vice versa [13]. Thus, student engagement with course content is important for deep learning and active, engaged students generally display greater characteristics as lifelong learners [13,20].

The COVID-19 pandemic disrupted medical education systems globally and accelerated the use of online technologies [21]. Major institutional changes and teaching strategies were used to combine online and in-person teaching [21] with varying concerns relating to the extent to which students engaged in online sessions. Most studies reviewed in a recent scoping review on student engagement were from high-income country settings with different methods used for measuring student engagement in both face-to-face and e-learning/blended learning settings [5]. Factors that were identified as drivers of medical students' engagement were positive student relationships with peers and faculty, a sense of agency, empowerment, and self-competence of the students, and "perceived relevance through meaningful learning activities" [5]. Regarding outcomes of student engagement, cognitive engagement was shown to be a positive predictor of knowledge-based achievement and academic performance [5]. The authors concluded that student engagement is an important, yet under-researched construct in the medical education context [5].

The findings of this study are important as they add insight to the limited number of published studies from low- and middle-income country settings that examined student engagement and learning styles among medical students. It reinforces the value of both engagement and learning approaches in addressing the quality of student learning and academic performance for designers and medical teachers [20]. Additionally, student engagement is a robust predictor of academic achievement, improved student retention, and positive mental health outcomes among students including lower rates of depression and greater life satisfaction [5].

Limitations of this study are that it is a single-centre study, and employed a convenience sampling technique of final-year students from a single clinical discipline with a relatively small sample size, thus limiting the generalisability of findings. We are unable to comment on causal associations between student engagement and learning strategies

since the study used self-reported data and was cross-sectional in nature. Regarding student engagement with peers, we did not explore other forms of informal peer collaboration that may exist such as the use of WhatsApp and Facebook groups, nor did we create dedicated groups on social media to monitor peer-to-peer interaction in the block. Due to the anonymous nature of data collection in our study, it was not possible to compare student engagement and learning approaches of participants with end-of-module assessment scores and academic performance. We would have liked to evaluate engagement behaviours on the Moodle LMS such as the number of times students in the current study accessed module content, interactions, and the number of clicks on content items, quizzes, and assignments, etc. thereby triangulating evidence of student engagement by combining multiple methods to get a better idea of student engagement in our context [5]. However, this was not possible due to the anonymous nature of data collection in our study. We did not collect data from students in the pre-clinical years since the learning approach in the preclinical years was outside the scope of the current investigation, thus we are unable to comment on the evolution of learning styles as students progressed through their training.

Conclusion

This study aimed to investigate student engagement and learning approaches in an online surgical module developed as part of remote emergency teaching methods during COVID-19. The level of student engagement was high and student engagement on this course was associated with deep learning approaches. Furthermore, the OSE and R-SPQ-2F tools were shown to be reliable tools for measuring student engagement and learning approaches among medical students in our setting. Findings from this study have helped us to refine the online teaching and learning programme in General Surgery at our institution. For the past three years we have used a blended model of instruction comprising large group teaching daily via Zoom, thus maintaining standardization of teaching. Students have returned to the clinical platform where they interact with patients, attend surgical intakes, and observe and/or perform certain procedures under supervision. Students have access to all video resources including weekly quizzes on the Moodle LMS and interaction in the live Zoom sessions is facilitated by assigning a small group of students to a particular topic to encourage discussion between tutors and peers during these sessions.

Longitudinal studies are needed to follow up on student engagement following context-specific changes to the curriculum in medical schools and the adoption of blended teaching and learning methods in the post-COVID-19 era. Qualitative studies may provide valuable insights into student engagement experiences, the interplay of other factors such as motivation, and self-regulated learning behaviours on student engagement and learning approaches, and the effects of student engagement on other outcomes such as student retention, satisfaction, and career preparedness [5].

Abbreviations

OSE	Online Student Engagement Scale
R-SPQ-2F	Revised Biggs Two-Factor Study Process Questionnaire
IQR	Interquartile Range
DA	Deep approach
CI	Confidence Interval
SA	Surface approach
DS	Deep strategy
SS	Surface strategy
DM	Deep motive
SM	Surface motive
UKZN	University of KwaZulu-Natal
MCQ	Multiple-choice question
LMS	Learning management system
SD	Standard deviation
BREC	Biomedical Research Ethics Committee
Min-Max	Minimum-maximum

Consent for publication

Not applicable.

Ethics approval and consent to participate

This study was approved by the Biomedical Research Ethics Committee of UKZN (ref. no. BREC/00002686/2021). All participants provided written informed consent.

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CRediT authorship contribution statement

Sumayyah Ebrahim: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Conceptualization. **Jacqueline Marina Van Wyk:** Writing – review & editing, Supervision, Methodology.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.sopen.2024.10.010.

Data availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

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