

Relationship between medical students' perceived instructor role and their approaches to using online learning technologies in a cloud-based virtual classroom

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Abstract

Background

Students can take different approaches to using online learning technologies: deep and surface. It is important to understand the relationship between instructor role and student approaches to using online learning technologies in online learning settings supported by cloud computing techniques.

Methods

A cross-sectional quantitative research was conducted to investigate the characteristics of and relationships between medical students' perceptions of instructor role (instructor support, instructor student interaction, and instructor innovation) and students' approaches to using online learning technologies in cloud-based virtual classrooms (n = 192).

Results

The results showed high levels of medical students' perceived instructor support, instructor-student interaction and instructor innovation. Most students adopted the deep approaches to using online learning technologies. Instructor support and innovation were positively related to students' deep approaches to using online learning technologies. Instructor support was negatively related to students' surface approaches to using online learning technologies.

Conclusions

The relationship between instructor role (instructor support, instructor-student interaction and instructor innovation) and students' approaches to using online learning technologies highlight the importance of the instructor role in facilitating students' adoption of desirable approaches to learning from the application of technologies rather than course knowledge, and also provide a guideline for online instructors to use effective course design, assessment and facilitation strategies.

Introduction

Students' approaches to learning (SAL) are defined as 'a composite of a motive and an appropriate strategy' according to Biggs [1], and he categorized two main types of approaches to learning— surface and deep [2]. The key difference is that deep approaches involve the intention to understand and create meaning from what is being learned, whereas surface approaches involve an intention to reproduce. Deep approaches to learning can lead to motivation and develop ability of self-directed learning which is a key aspect of adult learning in present medical education. Medical students can combine reflective practice with checklist to reduce medical errors and solve complex medical problems. So, how to produce more

reflective, self-directed medical practitioners through promoting student's good learning habits has attracted the increased attention of health professions educators [3].

With the increasing use of the internet in higher education, online learning technology is widely used to implement learning, such as presentation, resource download and quizzes before cloud computing [4]. In online learning settings, student approaches to using online learning technologies, as additions to approaches to learning, have received increasing attention in higher education. According to the Student Approaches to Using Online Learning Technologies (SAOLT) Scale [4], deep approaches to using online learning technologies are 'likely to stimulate critical thinking and new research pathways, while students adopting this approach are trying to connect the ideas in the course to the real-world experiences' [4]. Surface approach to using online learning technologies are 'tend to restrict the use of online learning technologies to minimize work, to only fulfil minimum course requirements and to try to avoid developing a meaningful online presence' [4]. In blended learning settings, researches into student approaches to learning and to using online learning technologies has commonly identified the positive association between deep approaches and academic achievement, and negative relationship between surface approaches and academic achievement [4–7]. Meanwhile, effective approaches to online learning technologies could contribute to the students' learning outcomes [4, 8, 9]. Therefore, adopting both deep approaches to learning and to using online learning technologies, is imperative to be a reflective, self-directed medical practitioners. However, current knowledge about how to effectively help medical student to develop deep approaches to online learning technologies remains very limited.

The concept of student approaches to learning is context and task-dependent [10–12]. The role of instructors, one of the key elements of learning contextual factors, has been acknowledged as a significant factor influencing the learning approaches adopted by students [12]. Studies exploring instructor role in student learning suggest that instructor role is mainly assessed in terms of instructional support [13, 14], instructor scaffolding strategies such as instructor-student interaction [15, 16], and instructor innovation [17]. These studies indicate that instructor role in online learning environments facilitates students' understanding of the knowledge and encourages student engagement by utilizing various facilitation strategies and teaching tools supported by cloud technique [15, 16, 18]. In online learning environments, instructional support refers to the students' perceived instructional guidance from instructors, which includes providing relevant resources, timely feedback and explanation, and correcting students' misunderstandings [13, 16, 17]. Instructor-student interaction is one type of three types interactions: teacher-student interaction (e. g. immediate and targeted feedback), peer interaction and student-content interaction. Instructors' implementation of strategies to promote learner-instructor interaction has been identified as a driving force for promoting students' motivation [13, 15]. Instructor innovation involves the new course design, unusual class activities and teaching techniques employed by instructors in order to meet the challenges faced by today's education [19]. Although considerable number of studies have been conducted to explore the relationship between instructor role and student approaches to learning (SAL) in traditional and blending learning settings across a range of disciplines, such as science [20], nursing [21], and medicine [22], an integrated understanding of instructor role and student approaches to using online learning technologies (SAOLT) have received relatively less attention

amongst medical students in a cloud-based virtual classroom. The understanding of the relationship between instructor role and student approaches to using online learning technologies, would help instructors design and create an effective online learning environment and make effective use of the educational tools supported by cloud computing techniques.

As a consequence of the sudden outbreak of COVID19 in mainland China, the traditional face-to-face or blending teaching activities in higher education have been replaced by cloud-based virtual classrooms since 2020, leading to a shift from 'forced remote learning' to 'the new normal' online learning environments [23, 24]. Within such a changed learning context, how medical students perceive the instructor role and what is predominant learning approach to using online learning technologies amongst medical students? How do instructors influence medical students' choices of learning approaches to using online learning technologies? An integral understanding of how various learning environmental factors may possibly affect medical students' learning approaches to using online learning technologies is crucial to create a favorable remote learning environment. The present study aims to explore the characteristics of and relationship between medical students' perceived instructor role and approaches to using online learning technologies in a cloud-based virtual classroom in mainland China.

Methods

Ethical approval

The present study involving student participants were reviewed and approved by the University of Shandong Research Ethics Committee. All participants provided their signed consent to participate in this study.

Participants

The research is based on data collected two months after the onset of synchronous online learning. The online courses were delivered through a cloud-based virtual classroom (Rain Classroom or Tencent Classroom). A cohort of 213 medical students from Qilu Medical School of Shandong University, who entered a first-year medical course in 2017-2019, were invited to participate in the online questionnaire survey. Amongst 213 students, 152 (71.4%) were female and 61 (28.6%) were male. 20.7% of participants were freshmen, 22.5% were sophomores, 5.6 % were juniors and 51.2 % were seniors.

The online questionnaire used in this study had two parts and comprised of 26 items (See Table 5). The first part consisted of three measures used to assess participants' perceptions of instructor role in three dimensions: instructional support (six items of Lee et al.'s study [25], instructor-student interaction (five items of Ali et al.'s study [26]) and instructor innovation (four items adapted from College and University Classroom Environment Inventory (CUCEI)[27] and the study of Johnson et al. [28]). The second part included 11 items from SAOLT [4], which measures student approaches to using online learning technologies. Six and five items were used to represent deep and surface approaches to online learning technologies construct, respectively. An example item from the deep approach construct was "I find I use

the online learning technologies in this course to further my research into a topic.” An example for the surface approach construct was “I use online learning technologies in this course mainly to download files.” All items were slightly modified to indicate the online learning environment, and all items were scored on a 5-point Likert-type scale ranging from 1 “strongly disagree” to 5 “strongly agree”. In this study, the reliabilities for the instructor role, deep and surface approach scales were generally above 0.70 (See Table 1 for details).

Data analysis

The statistical analysis of quantitative responses was carried out by SPSS 23.0. Cronbach's α reliability coefficients were computed to determine the reliability of the sub-scales used in this study: instructional support, instructor-student interaction, instructor innovation, deep and surface approaches to using online learning technologies. Paired t-tests or repeated measure one-way ANOVA was used to compare if there was a significant difference within the mean scores of the students' perceptions of instructor role and learning approaches. Multivariate analysis of variance (MANOVA) was employed to identify if the students' perceptions of instructor role, deep and surface approaches to learning variables vary across gender, and grade. Correlations between instructor role and learning approach were analyzed by Pearson product moment correlations and multiple linear regression analysis with collinearity diagnostics.

Results

Descriptive statistics and reliability

We removed from the analyses students who had adopted both deep and surface learning approaches ($n = 21$), 192 out of 213 students were left to be analyzed. Among 192 medical students for analyses, 140 (72.9%) were female and 52 (27.1%) were male. 20.8% of participants were freshmen, 20.8% were sophomores, 6.3 % were juniors and 52.1 % were seniors. Table 1 shows the descriptive statistics of the variables and reliability data for all medical students in cloud-based virtual classroom. As is shown in Table 1, Cronbach's α coefficients for all sub-scales ranged from 0.71 (Surface approach to online learning technology) to 0.96 (Deep approach to online learning technology), indicating “good” internal consistency. The mean scores of three dimensions of instructor role were higher above 3.70, and that of instructor support scored the highest ($M = 3.91$, $SD = 0.64$). Among the 192 students, 146 (76.0%) adopted the deep and 46 (24%) adopted the surface as their predominant learning approach to use online learning technologies.

Inferential analysis

The potential difference between mean scores of the subscales of instructor role was examined by a repeated measure one-way ANOVA. Huynh-Feldt correction test was used to compare the differences of mean scores for each sub-scale because the assumption of sphericity variance was violated. There was significant difference between mean scores of three dimensions of instructor role ($F_{(1.724, 329.21)} = 7.45$, $p = .001$) Post-hoc Bonferroni test (See Table 2-1) indicated that of three dimensions of instructors' role, the

mean scores of instructors' support ($M = 3.91$, $SD = 0.64$) and instructor-student interaction ($M = 3.88$, $SD = 0.6$) were significantly higher than that of instructors' innovation ($M = 3.75$, $SD = 0.76$). Results of Paired t-tests (See Table 2-2) showed there was significant difference between the mean scores of deep approaches ($M = 3.51$, $SD = 0.97$) and surface approaches ($M = 2.7$, $SD = 0.71$), $t_{(191)} = 8.24$, $p < 0.001$). Among the 192 students, 146 (76%) adopted the deep and 46 (24%) adopted the surface as their predominant learning approach to use online learning technology.

MANOVA was employed to determine whether there were statistical differences in students' perceptions of three dimensions of instructor role, deep and surface approaches to use online learning technologies among those with different demographic characteristics — gender and grade. There was no significant main effect of gender and grade on instructor support.

Relationships between students' perceived instructor role and their learning approaches to using online learning technologies

Table 3 presents the results of the correlation analysis. Six significant relationships ($p < .001$) were noted with r values between -0.15 and 0.62 indicating negative and positive relationships, respectively. No collinearity was detected between instructor support and instructor-student interaction or instructor innovation. The instructor support, instructor-student interaction and instructor innovation had significant positive or negative correlations to deep or surface learning approaches to use online learning technology, respectively (See Table 3). Tables 4 is results of regression analysis. With regard to instructor role on approaches to use online learning technologies, both instructor support and innovation had a significant positive effect on deep approach to use online learning technologies, and instructor support also had a significant negative effect on surface approach to use online learning technologies. Whereas instructor-student interaction had no effect on approach to using online learning technologies.

Discussion

This study examined the relationships between instructor role and medical students' approaches to using online learning technologies in cloud-based online learning settings. The results revealed some characteristics of students' perceptions of both instructor role and their approaches to using online learning technologies, and indicated that instructor support, instructor-student interaction and instructor innovation were significantly positively related to medical students' deep approaches to using online learning technologies, and both instructor support and instructor innovation were significant predictors to medical students' deep approaches to using online learning technologies. Instructor support was negatively associated with medical students' surface approaches to using online learning technologies, and was the predictor variable on medical students' surface approaches to using online learning technologies.

The characteristics of medical students' perceptions of instructor role and their approaches to using online learning technologies

The results revealed that medical students appreciated the instructor role in a cloud-based virtual classroom in mainland China. They endorsed a certain amount of support and interactivity provided by their instructors, and instructors had a certain amount of innovations in a cloud-based virtual classroom. Meanwhile, most medical students agreed that they had adopted more deep approaches rather than surface approaches to learning in a cloud-based virtual classroom. Previous research indicated that providing effective instructional support and interactivity, such as effective course design, timely feedback and immediate communication to students in order to ensure that students have acquired the proper knowledge and felt more supported in the course, were particularly critical for the instructors in online learning environments [15, 17]. Therefore, in a cloud-based virtual classroom, medical students could perceive a satisfactory learning process supported by instructors who have made full use of various learning and immediate communications tools supported by cloud-based technology, such as Tencent Docs, bullet subtitles for sending queries and recording video of class in Rain Classroom, or WeChat which were found effective to improve students' learning by enhancing their behavioral and cognitive engagement in e-learning environment [18]. However, the results also indicated that students perceived higher level of instructor support and instructor-student interaction than that of instructor innovation during the learning experience in a cloud-based virtual classroom. So, it is still a challenge for instructors and administrators that how to improve the instructors' technology application ability in cloud-based learning settings.

Results of the SOALT questionnaire showed that medical students adopted more deep rather than surface approaches to using online learning technologies in a cloud-based virtual classroom. This result is consistent with the results of previous research with medical students in blended learning environments [29]. The possible explanation could be due to the medical curricula reform made in China in response to the Ministry of Education's requirements to cultivate more reflective and self-directed medical practitioners, that was accordant with the global trend towards encouraging deeper learning in medical education [30]. The main aim of medical curricula reform is to create a student-centered learning environment in which various teaching methods, unlike didactic pedagogies, are adopted to foster deep learning and understanding [31-33]. According to constructivist learning theory [33, 34], instructors may promote students' deep approaches to learning by "ways of thinking about teaching and learning that emphasize student responsibility and activity in learning rather than content or what the teachers are doing" (Cannon and Newble, pp. 16–17) [34]. Given that students may develop their approaches to using online learning technologies as shown by their level of responses and activity, it could be possible for instructors to make students more engaged in learning and better encourage them to adopt deeper approaches to using online learning technologies, such as inquiry-based activities designed by instructor via cloud-based education apps [35].

This study showed no significant difference in students' perceptions of instructor role and approaches to among those with different demographic characteristics such as gender and grade. The previous studies about the demographic characteristics are mixed and elusive [36-38]. As the age range of the students involved in this study were significantly narrower (18-21 years), which could be unlikely to influence the students' approaches to learning. In addition, students' approaches to use online learning technologies

are dependent on learning environment and experience [4, 39]. Therefore, further studies about the effects of student demographics on online learning process are expected in the future.

The relationship between instructor role and students' deep approaches to using online learning technologies

This study revealed a significant positive relationship between instructor role including instructor support, instructor-student interaction and instructor innovation and students' deep approaches in a cloud-based virtual classroom. The results from the regression statistics showed significant positive contribution of instructor support and innovation to the students' adoption of deep approaches, and significant negative contribution of instructor support to the students' adoption of surface approaches. The instructor innovation ($\beta = 0.37$) contributed more than instructor support ($\beta = 0.33$) as a significant coefficient in the regression with deep approaches to using online learning technologies as the dependent variable.

The positive effect of instructional support and innovation on students' adoption of deep approaches to use online learning technologies among medical students, to our knowledge, is the first time to be reported. This results is similar with the findings of previous research into deep approaches to learning in blended learning environments [40]. To attain a deeper learning in a cloud-based virtual classroom, it was more critical for instructors to offer proper guides on how to adopt deep approaches to using online learning technologies during learning process [4, 7, 15, 29]. because both deep approaches to learning and to using online learning technologies are positively related to students' acceptance of online learning activities, recognition of online contributions, and their higher academic marks in blended learning settings [7, 29]. So, the instructional guidance includes not only about the content knowledge but also the integration of content knowledge and online learning technologies, for example, how to effectively access collaboration and use learning analytics to warn instructors about certain issues via cloud-based education apps. It is perhaps not surprising that the most positive correlations between instructor innovation and deep approaches to using online learning technologies, as instructors who keep pace with these new educational technologies could consider innovative and effective course design based on student needs, use various kinds of assessments including traditional assessment, rubrics and learning analytics to assess students' learning, and perform activities with personal characteristics supported by a well integration of content knowledge and cloud computing learning technologies [15, 41].

The negative effect of instructional support on medical students' adoption of surface approaches to use online learning technologies further supported the importance of instructional support to reduce student adoption of surface approaches. Compared with deep approaches, surface approaches to learning and to using online learning technologies are positively related to perceptions of unreasonable online course design and learning workload, and poor academic performance in blended learning settings [4, 42]. Therefore, instructors could create a high-quality online learning environment by providing proper instructional guidance such as critical discourse and reflection to boost deep approaches and reduce surface approaches to using online learning technologies.

This study revealed the positive relationship between instructor-student interaction and the students' adoption of approaches to using online learning technologies, and there was no significant contribution of instructor-student interaction toward the students' adoption of deep or surface approaches to using online learning technologies in a cloud-based virtual classroom. Previous studies about the effect of instructor-students interaction on students' learning approaches did not show univocal results, and most researchers suggested student preferences for interactive teaching methods are significantly positively related to deep approaches [43, 44]. However, Booth and James's study revealed the increased interactivity between teacher and students in the traditional classroom did not enhance students' deep approaches to learning [45]. These inconsistencies could be due to many complicated contributing factors to students' adopted learning approaches, such as student personality, emotional stability and preference for teaching method, which were changing among tasks and individuals [44-46]. It is worth noting that previous studies mainly focused on approaches to learning rather than approaches to using online learning technologies, so this study extends our knowledge about the effect of interactivity on learning approaches. As for the no effect of instructor-student interaction on students' adoption of approaches to using online learning technologies, the possible reasons are as follows. First, our results echoed the previous research which suggests the changes in learning context, such as increased interactivity, may not make any substantial difference to students learning approaches including approaches to using online learning technologies. By comparison, students learning approaches could be affected greatly by their cultural values, personal situations and other individual characteristics [46]. Second, the instructor-student interaction might be focused only on stages of learning task, but not how to achieve desired learning goals by using the online technologies [4]. Therefore, based on the results of this study in a cloud-based virtual classroom, instructors may consider various learning interactivity involving online learning technologies (e. g. availability or learning analytics via cloud-based education apps) to improve instructor-student interactions.

Limitations and directions for future research

The present study offered some insight into the characteristics of and relationships between instructor role and students approaches to using online learning technologies in a cloud-based virtual classroom in mainland China.

Some limitations should be noted as indications for future work. First, we did not identify the effect of instructor-student interaction on students' approaches to using online learning technologies, which may be attributed to the students' individual characteristics, such as personality, emotional stability and cultural values. Whether these students' individual characteristics would be moderators of the relationships is also worth to note in future studies. Second, three dimensions of the instructor role in this study was examined (instructor support, instructor-student interaction and instructor innovation). It is also essential to determine how students' approaches to use online learning technologies may change when instructors perform more different roles, such as boosting peer interaction. Last but not least, further study may consider a longitudinal research design to determine the consistent causation between these variables.

Conclusion And Implications For Practice

To gain an integrated understanding of medical students' perceived instructor role and student approaches to using online learning technologies in online learning settings supported by cloud techniques, this study investigated the characteristics of and relationships between medical students' perceptions of instructor support, instructor student interaction, and instructor innovation and their approaches to using online learning technologies in a cloud-based virtual classroom. The results showed medical students appreciated instructor support, instructor student interaction, and instructor innovation during the learning process, most student adopted the deep as their predominant learning approach to using online learning technologies, instructor support and innovation had significant positive effects on adoption of students' deep approaches to using online learning technologies. Furthermore, instructor support had significant negative effects on adoption of students' surface approaches to using online learning technologies. According to studies of Ellis et. al. [4, 7], students' approaches to using online learning technologies also have a profound influence on their learning outcomes. Therefore, this study illustrated more micro issues about teaching and learning strategies in cloud-based online learning settings, which was seldom examined in the literature. So, the findings of this study have the following contributions and implications for educational practice. First, the relationship between instructor role (instructor support, instructor-student interaction and instructor innovation) and students' approaches to using online learning technologies highlight the importance of the instructor role in facilitating students' adoption of desirable approaches to learning from the application of technologies rather than course knowledge. The results, therefore, contribute to the theoretical development framework for student approaches to learning in online learning settings supported by cloud technique. Second, this study could provide a guideline for online instructors to use effective course design, assessment and facilitation strategies [15].

Declarations

Ethics approval and consent to participate: This study, with use of the student survey, was identified as exempt from supervision by the Ethics Committee of Shandong University. Students were informed about the study and signed consent forms. All procedures involving human participants were performed in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Consent for publication: Not applicable.

Availability of data and materials: The dataset used during the study is available from the corresponding author on reasonable request.

Competing interests: No conflicts of interest, financial or otherwise, are declared by the authors.

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Authors' contributions: RW, JH and CL designed the study. RW, JH, CL and LW were involved in recruiting and collecting data for the study. RW and JH were involved in analyzing and interpreting study data. RW and JH wrote and revise the paper. All authors give their final approval for this version to be published.

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Tables

Table 1 to 5 are available in the Supplemental Files section.

Supplementary Files

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