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Online lecture capturing system: Expected and actual effects of implementation in a problem-based learning medical curriculum

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Abstract

Context: An online lecture capturing system (OLCS) was implemented in a medical school integrating problem-based learning curriculum. An academic investigation examining how medical students used OLCS and what were its educational effects were required.

Aims: This study examined medical students’ perceptions of OLCS, actual usage of OLCS, and the effects on learning.

Methods: An online questionnaire asking about the perceptions of OLCS was distributed to first and second year medical students. Individual student’s OLCS usage was analyzed descriptively. Cluster analysis was conducted based on the OLCS usage and students’ prior academic performance to reveal the academic effects of OLCS.

Results: Most students (82 out of 106) perceived OLCS as an effective educational tool. Their actual use of OLCS, however, was low and quite variable depending on their needs and preferences. Reviewing the captured lectures did not affect students’ performance on exams of knowledge.

Conclusions: This study calls for follow-up studies investigating personalized use of OLCS and student attributes in PBL.

Introduction

Medical students increasingly expect curricular materials to be delivered using technology, which makes learning more accessible and efficient. Students prefer podcasts as they allow control over the pace of material to be learned, provide flexibility in location of learning, and support a focus on what is to be learned (Fill & Ottewill 2006; Winterbottom 2007; Griffin et al. 2009; Chester et al. 2011; de Boer et al. 2011; Hill & Nelson 2011; Cooke et al. 2012). The literature is ripe with descriptions of students’ preferences for podcasts reviewed during evenings and weekends, on personal computers (not mobile devices) in preparation for exams (Brittain et al. 2006; Copley 2007; Heilesen 2010; Traphagan et al. 2010; Wang et al. 2010; Hill & Nelson 2011). Reviewing lectures, in the students’ view is more efficient than using their own notes or studying textbooks (Evans 2008) as it can aid students in understanding concepts (Toppin 2011). Podcasts allow students to learn in the way that is most pleasing to them (Cardall et al. 2008). Students seeking interaction with classmates are likely to attend face-to-face (f2f) lectures even when lecture capture is available (Pilarski et al. 2008).

Extant literature is mixed on the influence of podcast on student performance. Zhang et al. (2006) suggest that viewing segmented podcasts improved learning performance whereas watching non-segmented podcasts had no effect. The majority of authors found no effect on student performance from podcasts (Solomon et al. 2004; Inglis et al. 2011; Toppin 2011; Bacro et al. 2013; Hortos et al. 2013). To date, these studies have been conducted in traditional lecture-based curricula and rarely have focused on medical students matriculating in an integrated, problem-based learning (PBL) curriculum.

In our medical school, the program leading to the M.D. degree emphasizes self-directed, collaborative learning, and early clinical experiences. It integrates the basic sciences and clinical reasoning and places learning within an authentic patient context. There are no departmental or discipline-based courses. The two-year pre-clerkship curriculum consists of three components: Basic Science/PBL, Introduction to Patient Care, and Patient Care Experiences. The primary form of learning is through complex PBL cases. Students work in groups of eight with a faculty facilitator in 10-week blocks.
across the first and second year of medical school. For the first eight weeks of each block, students learn the basic sciences by working through complex patient cases in group sessions lasting up to 10 h per week. Lectures are kept to a minimum and are conceptual in nature. The challenging PBL cases require learners to work collaboratively to synthesize their ideas and not simply fit pieces together (Hoffman et al. 2006).

The ninth week of the block is dedicated to student assessment, and the tenth week is free of all academic activities. Students are assessed on three components: acquisition of knowledge, clinical reasoning, and contribution to PBL group learning. Reflective of the school’s curricular design, approximately 60% of the knowledge-based exam content comes from learning that occurs through the cases and students cannot attain a satisfactory score if they only study lectures. Attendance of f2f lectures was highly recommended but not compulsory. While lectures are not major parts of our curriculum, they are still essential for academic success. To support student learning, an online lecture capturing system (OLCS) was implemented for all f2f lectures. Introduction of OLCS allowed students to review lectures, which might affect their learning practice and, as a result, academic outcomes. Many of our students used the OLCS in their undergraduate programs and requested it for medical school lectures.

This study aimed to explore three questions: (1) What were the medical students’ expectations from and perceptions of OLCS? (2) How did medical students use the OLCS for their learning? (3) Is there an association between OLCS usage and academic performance of medical students matriculating in a PBL curriculum?

Methods

Context

A lecture recording application, Tegrity™, integrated with Blackboard Learning Management System, recorded instructor’s audio over synchronized PowerPoint slides during f2f lectures. The system generated bookmarks whenever a slide changed, which allowed students to search and skip through the presentation. Lecture capture was student operated, with a student volunteer starting and ending the recording. Students could access the recordings within 24-h after the f2f lecture. Their access patterns were traced through a log file with a timestamp. Students were able to review the recordings until the last day of each nine-week period. Based on Kay’s (2012) categories of video podcasts, our system could be classified as “lecture-based” as it recorded the entire lecture, “segmented” as it was broken into PowerPoint slides, “receptive viewing” as it was intended to receive information, and “conceptual” as it targeted conceptual understanding.

Participants

Students in pre-clerkship courses were participants of this study. The study was approved by the University Institutional Review Board (#1207739) and did not involve any monetary compensation. At the time of data collection, first year medical students (M1) were starting their 31st week of study; second year medical students (M2) were in their 71st week of study.

Instruments and procedures

Data collection consisted of two phases. Phase 1 included identifying students’ expectations from and perceptions of OLCS. The online survey included 12 multiple-choice questions with options to provide comments. Survey questions included (1) demographic information, (2) likes and dislikes of f2f lectures, (3) reasons for wanting to access online lectures, (4) any expected change in students’ preparation for f2f lectures, (5) use of time during f2f lectures, (6) study practices, (7) class attendance, and (8) expected academic performance with the introduction of online lectures. Since lecture attendance was not compulsory, we did not collect attendance records. Although the survey was primarily intended to obtain students’ feedback about their expectations from online lectures, questions about f2f lectures were intentional. By allowing students to express their opinion regarding the status quo, we hoped to understand the potential of online lectures for students’ learning. The link to the survey was distributed via mass e-mail to a total of 186 first and second year medical students. Participation was voluntary.

In phase 2, we collected data on students’ use of OLCS. The OLCS saved individual usage log data, which included students’ names, which were omitted from the analysis process, lecture title, access time/date/duration, and number of views. Students’ knowledge-based exam scores were retrieved by a system administrator and linked to the OLCS usage data with unique research identifying numbers. In this way, researchers were blinded to student performance data and OLCS usage data. The online lectures were typically 50–60 min long. To validate data, we excluded statistics of access to OLCS for less than 60 s (invalid access: 47 cases out of 940, 5%; mean: 16 s) and access to one lecture more than 10 times (system error: seven cases out of 940, 0.7%; mean: 50 times) from the analysis.

Data analyses approaches

Survey responses were analyzed descriptively. In order to examine differences between cohorts, Chi-square tests were conducted between first (M1) and second (M2) year students. When no difference was found, percentage of responses in total was calculated to demonstrate overall results.

Descriptive analysis on individual student’s use of OLCS was conducted. Cluster analysis was used to identify groups based on the OLCS usage and students’ prior academic performance (knowledge-based exam). Analysis of variance for the groups compared knowledge-based exam scores at the end of the block between before and after the OLCS use. All the analyses were done separately for M1 and M2 students.

Results

Of 186 students, 106 (57%) completed the survey with a response rate of 78% (n = 70) among M1 and 38% (n = 36) among M2 students. The sample was balanced in gender, both overall (53 female, 49 male, and 4 no disclosure) and per cohort (31 female and 35 male in M1 and 22 female and 14 male in M2). The average age of participants was 25, ranging from 21 to 35 (SD = 2.49).
Students’ perceptions of f2f lectures

Table 1 describes students’ preferences (like vs. dislike) for f2f lectures. Chi-square analyses revealed no statistical difference in their preferences between the matriculating years (M1 and M2). Descriptive analysis showed that students mostly liked (1) the opportunity to interact with other students (25%) and professors (21%) and (2) general atmosphere during lectures (23%). Students disliked the pace of lectures (46%) and presentation of materials, e.g., too much content within the allocated time period (23%).

Students’ perceptions of online lectures

Table 2 describes the primary reasons students desired OLCS: (1) complement f2f lectures (30%), (2) regulate their own study time (27%) and accommodate with flexible schedule (27%). Only a few students (7%) thought that OLCS could substitute for f2f lectures. There was no statistical difference between the matriculating years (M1 and M2) in their responses. Reviewing online lectures allowed students to control lecture pace, reduce note-taking (six responses), and facilitated their understanding of difficult concepts (10 responses). This allowed them to accommodate for dislikes of f2f lectures such as the fast pace of material presentation.

Because students had the option to attend f2f lectures or review the online lecture or both, asking which online lectures students preferred to review and for what reason was meaningful. Table 3 illustrates student self-reported criteria. Descriptive analysis identified difficulty of lecture material (21%) or pace of f2f lectures (21%), preparation for exam (20%), and missing f2f lectures (20%) were good reasons for reviewing online lectures while preparation for other f2f lectures (6%) was not.

Table 4 describes student perception of how online lectures might change their learning strategies: preparation for f2f lectures, time use during f2f lectures, change in study practices, and change in class attendance. Overall students did not expect changes: no changes in preparation for classes (69%), no changes in time use during f2f lectures (45%), and no changes in class attendance (56%). However, many of them (75%) anticipated a change in study practice.

Students’ perceptions of learning outcomes are described in Table 5. A Chi-square test was performed to examine the difference of student perceptions between matriculating years which was significant, $\chi^2 (1, n=98)=9.79, p=0.002$. First year students were more likely to expect positive effects of online lectures than were second year students. Overall, students from both cohorts expected positive effects from online lectures (84%), with no one expecting negative effects.

OLCS usage

Of 190 students from both cohorts, 94 (M1: 51, M2: 43) accessed OLCS to review an online lecture at least once (see Figure 1). For the nine-week period including the exam week (week 9), students accessed OLCS 12 times (SD = 16.00) on average.
average and reviewed eight video lectures (SD = 10.11) for a total of 8.3 h (SD = 11.87). Figure 2 illustrates the pattern of OLCS viewing across the 9-week period.

Relationship between OLCS usage and academic performance

In order to explore whether there was any association between video lecture usage (i.e., review times, duration, and timing of reviewing) and prior academic performance (i.e., knowledge-based exam scores from the previous PBL block), we employed cluster analysis (Ward linkage procedure with squared Euclidean distances). Groups were categorized in each class according to four variables: (1) prior academic performance, (2) number of times accessed, (3) review duration, and (4) review timing. Students who did not review the video lectures were excluded from the analysis and identified as “No review” group.

A three-cluster solution for first year medical students (M1): Cluster 1 (n = 38), Cluster 2 (n = 10), and No review (n = 38) as well as second year students (M2): Cluster 3 (n = 30), Cluster 4 (n = 13) and No review (n = 58) were extracted. Table 6 shows the profiles of these clusters. In both M1 and M2 classes, only the number of times accessed (M1: t(46) = 8.91, p < 0.001; M2: t(41) = 12.59, p < 0.001) and the duration of

Table 4. Foreseeable differences in students’ learning activities with the introduction of online lectures.

<table>
<thead>
<tr>
<th>Area</th>
<th>First year students (n = 70)</th>
<th>Second year students (n = 36)</th>
<th>Total (n = 106)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
<td>Don’t know</td>
</tr>
<tr>
<td>Preparation for classes</td>
<td>7</td>
<td>49</td>
<td>14</td>
</tr>
<tr>
<td>Time use in f2f lectures</td>
<td>21</td>
<td>34</td>
<td>15</td>
</tr>
<tr>
<td>Study practice</td>
<td>55</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Class attendance</td>
<td>18</td>
<td>44</td>
<td>8</td>
</tr>
</tbody>
</table>

Table 5. Students’ perceptions of the effect of online lectures on their learning outcomes.

<table>
<thead>
<tr>
<th>Variable</th>
<th>First year students</th>
<th>Second year students</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive effect</td>
<td>59</td>
<td>23</td>
<td>82 (84)</td>
</tr>
<tr>
<td>Negative effect</td>
<td>0</td>
<td>0</td>
<td>0 (0)</td>
</tr>
<tr>
<td>No difference</td>
<td>5</td>
<td>11</td>
<td>16 (16)</td>
</tr>
<tr>
<td>Total</td>
<td>64</td>
<td>34</td>
<td>98 (100)</td>
</tr>
</tbody>
</table>

Table 6. Means and standard deviation of four variables by clusters of first and second year students.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Most Review Group</th>
<th>Least Review Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>First year students</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prior academic performance</td>
<td>76.5 (6.95)</td>
<td>76.2 (7.48)</td>
</tr>
<tr>
<td>Duration</td>
<td>31.7 (16.14)</td>
<td>2.7 (2.94)</td>
</tr>
<tr>
<td>Times</td>
<td>43.0 (25.12)</td>
<td>5.2 (4.90)</td>
</tr>
<tr>
<td>Timing (week)</td>
<td>6.3 (1.06)</td>
<td>6.1 (2.16)</td>
</tr>
<tr>
<td>n</td>
<td>38</td>
<td>10</td>
</tr>
<tr>
<td>Second year students</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prior academic performance</td>
<td>79.2 (6.98)</td>
<td>77.1 (7.93)</td>
</tr>
<tr>
<td>Duration</td>
<td>20.5 (6.89)</td>
<td>2.5 (2.45)</td>
</tr>
<tr>
<td>Times</td>
<td>26.54 (8.46)</td>
<td>4.1 (3.34)</td>
</tr>
<tr>
<td>Timing (week)</td>
<td>7.59 (0.71)</td>
<td>6.57 (2.14)</td>
</tr>
<tr>
<td>n</td>
<td>58</td>
<td>13</td>
</tr>
</tbody>
</table>

The values of duration represent mean hours reviewed by students.

Numbers in parantheses represent percentage of total responses. Eight students (6:M1, 2:M2) were excluded from the analysis because they responded “I don’t know”.

Figure 1. The number of lectures viewed by students (X-axis represents individual student).

Figure 2. The number of views by weekly (X-axis represents weeks of the block).
reviewing video lectures (M1: \( \bar{x} = 46.0 \), \( p < 0.001 \); M2: \( \bar{x} = 12.71 \), \( p < 0.001 \)) were significant discriminators of the clusters. No statistically significant difference on prior academic performance or timing of review was found between clusters. Clusters 2 and 4 were named “Most Review Group” for higher rate of review times and duration. Clusters 1 and 3 were named “Least Review Group” for lower rate of review times and duration.

Table 7 describes average scores of raw and standardized knowledge-based exam scores of blocks 4 (for M1) and 8 (for M2). No statistically significant differences were found on academic performance in current blocks (blocks 4 and 8) between clusters. We also did not find any changes of academic performance from previous to current blocks between clusters (Z-score change).

### Academic performance

The values of Z-score change represent the change of z-score between the previous and current blocks.

<table>
<thead>
<tr>
<th>Academic performance</th>
<th>No review</th>
<th>Most review Group</th>
<th>Least review Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>First year students</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Raw score (block 4)</td>
<td>73.8 (7.77)</td>
<td>71.6 (8.05)</td>
<td>76.3 (7.67)</td>
</tr>
<tr>
<td>Z-score (block 4)</td>
<td>-0.07 (0.99)</td>
<td>-0.35 (1.03)</td>
<td>0.25 (0.98)</td>
</tr>
<tr>
<td>Z-score change</td>
<td>0.07 (0.81)</td>
<td>-0.18 (0.57)</td>
<td>0.08 (0.73)</td>
</tr>
<tr>
<td>n</td>
<td>38</td>
<td>10</td>
<td>37</td>
</tr>
<tr>
<td>Second year students</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Raw score (block 8)</td>
<td>82.2 (8.43)</td>
<td>80.8 (8.24)</td>
<td>83.1 (7.65)</td>
</tr>
<tr>
<td>Z-score (block 8)</td>
<td>-0.01 (0.92)</td>
<td>-0.21 (1.18)</td>
<td>0.12 (1.09)</td>
</tr>
<tr>
<td>Z-score change</td>
<td>-0.04 (0.57)</td>
<td>0.05 (0.73)</td>
<td>-0.02 (0.71)</td>
</tr>
<tr>
<td>n</td>
<td>58</td>
<td>13</td>
<td>29</td>
</tr>
</tbody>
</table>

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### Academic performance

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### Discussion

In our study, medical students’ expectations and perceptions of OLCS were positive and consistent with literature (e.g., Pilarski et al. 2008). However, the study demonstrated that patterns of actual OLCS usage among students varied significantly, with only a small number of students actively reviewing video lectures. It could have been explained by the nature of a PBL-oriented medical curriculum, which has been rarely explored in previous research. We investigated the association between OLCS usage and academic performance but did not find statistically significant relationship.

### Students’ perceptions of online lectures

Medical students perceived that online lectures could improve learning from f2f lectures by helping to overcome the fast pace and a busy mode of presentation. F2f lectures typically deliver 73 slides in 50 min. These densely packed lectures can overwhelm students. Having a back-up to review a lecture or to control lecture pace in accordance with their understanding helps students information/knowledge acquisition from lectures (Griffin et al. 2009; Chester et al. 2011). Better control over the volume and pace of incoming information may help relieve stress and anxiety in a classroom (Pilarski et al. 2008). By satisfying students’ needs as a back-up, the OLCS were perceived as a “complement” rather than a “substitute” for f2f lectures.

With the introduction of OLCS, students anticipated a difference in their study practice because they could revisit lectures and get better understanding of difficult or missed material. Many also reported they liked to review video lectures to prepare for exams. These findings were consistent with previous studies examining students’ learning styles with video lectures (e.g., Chester et al. 2011). However, students in the current study did not expect major changes in preparation for f2f lectures or in classroom activities. It implied that students (even faculty) did not intend to use the OLCS to prepare for (or facilitate) classroom activities in a more proactive way. The current research study occurred at the end of the academic year. One would postulate that students had refined their study habits across the academic year and were, therefore, less likely to anticipate changes in their study strategies.

The timing of the study could explain differences in first and second year students. Second year students were introduced to the online lectures at the end of the pre-clerkship year while first year students had a whole year ahead of them. It is likely that while second year students were at the departing point with the PBL curriculum and had limited chance to change their approach to studying in it, first year students might have expected an opportunity to fine-tune their study strategies as they grew accustomed to the PBL curriculum and took advantage of using the OLCS in their studies.

### Usage of OLCS

The OLCS was perceived as a good student-centered tool allowing students to control the pace of learning and review parts of f2f lectures multiple times, which, in turn, might have affected students’ study strategies. However, the level of actual usage was quite low compared with students’ high expectations from the system. The analysis of OLCS usage revealed high variations in the patterns of access to video lectures among students. Twenty-two students (11%) reviewed video lectures more than 30 times over 22 h on an average, while 96 students (50%) never reviewed any online lectures.

This finding could be explained by students’ individual differences and preferences. Considering the high review traffic at one week before exam, students seemed to review lectures to prepare for exams. This finding was supported by students’ survey responses and the pattern is consistent with Heilesen’s (2010) findings. If students liked (or needed) to listen to instructor’s explanations for in-depth understanding, they might review more lectures while others who preferred to study other learning materials might not allocate study time to review the lectures. Because study strategies were likely stable.
by the end of the year, it would be difficult for them to find additional time to review lectures if students maintained their previous study patterns.

The problem-based medical curriculum also might have affected students' review patterns as it emphasized problem solving and case-based reasoning skills in addition to biomedical knowledge (Hoffman et al. 2006). In addition, only 40% of the knowledge-based exam would come from lecture material, so students might perceive that the impact of review on knowledge-based exam scores might be limited. The culture and requirements of problem-based medical curriculum might have led students not to rely heavily on review of lectures but instead to see lecture review as supplementary to their overall approach to exam preparation.

**Academic benefits of OLCS**

This study did not demonstrate improvements on knowledge-based exams after reviewing captured lectures. The result is consistent with findings from other studies that examined the academic impact of video lectures compared with face-to-face lectures (Bertsch et al. 2007; Bennett & Glover 2008; O’Brien et al. 2011). We can gain insight into this finding from the learning strategy perspective. Reviewing video lectures multiple times at students’ preferred pace allows students to understand difficult concepts and catch up with some information they missed in class. However, re-reviewing lectures might not be as effective if it focused only on revisiting lectures, just as rereading is a less effective study strategy than other more active study activities such as the self-testing strategies of elaborative interrogation and self-explanation (Dunlosky et al. 2013). Although students could search, skip, and repeat segmented video lectures, they might not have received optimal benefits from re-reviewing lectures, a passive mode of study.

One may posit that students need more time to get familiar with the new technology and to adjust their learning practice to get academic benefits from OLCS. In order to gain a longitudinal insight into the academic impact of reviewing captured lectures, authors traced the first year students for their first two blocks in the following academic year. For the first two blocks of their second year of medical school, student patterns of OLCS usage were consistent with patterns in the previous year. Simple regression analyses revealed no statistically significant relationship between the OLCS usage and knowledge-based exam scores from each following block. The academic results of this study had been confirmed for three consecutive blocks.

The study was limited in assessing performance based on the knowledge-based exam. Sixty percent of questions on the knowledge-based exam came from PBL cases rather than face-to-face lectures. Thus, one needs to be cautious to generalize the findings. Direct and aligned measures of academic achievement related to OLCS are required to ensure better validity of measures.

It is worth noting that one student diagnosed with ADHD expressed that using the OLCS helped him/her concentrate his/her attention on certain lecture parts, which would have been impossible without the system. This opens new avenues for research on OLCS and explains why such systems can be adopted differently by students in accordance with their individual preferences and needs. As such, it would be suggested to consider students’ individual characteristics and match OLCS’s functionalities accordingly.

Based on the current results, a better research question to explore would be “How is OLCS integrated into medical curriculum?” To demonstrate better educational impacts, OLCS can be utilized to facilitate students’ meaningful engagement with PBL-oriented medical curriculum in ways such as identifying learning objectives, designing authentic learning environments, and archiving video lectures as a learning resource. In designing learning activities including a lecture, it is important to make students clearly perceive and accept learning objectives (Gagné 1985). Short video lectures explaining core objectives of curriculum or learning activities can orient students more effectively as “cognitive anchors” and make class time more efficient (Mayer 1979; Narula et al. 2012). Text-based PBL cases can be enhanced by utilizing multimedia scenarios that boost case reality and students’ motivation and curiosity, which results in better clinical reasoning skills and student satisfaction (Maldonado 2011; Omori et al. 2013). Archived video lectures can be good learning resources for students as a lecture library by allowing students to easily access information and manage personalized learning resources by allowing them to search, bookmark, and annotate (Jarvis & Dickie 2009).

**Limitations**

There were several methodological limitations in this study. First, the OLCS usage was measured by online access through Blackboard. However, views from downloaded files on personal devices or access through public links were excluded from the analysis because of their anonymity. Second, the results were subject to the context of a medical school that uses PBL for its pre-clerkship curriculum. Generalization of the results should be done cautiously, and follow up, longitudinal studies in a different learning contexts are suggested. Third, interpretation of the survey responses from second year students needs to be done with caution due to the low response rate (38%). Fourth, the survey questions were developed by the authors specifically for this study and had not been validated previously.

**Conclusion**

Online lecture capturing is still relatively new to medical education. Its effects on medical students’ learning practices, motivation, and academic performance are not yet fully explored. The current study contributes much to medical education that is adopting online video lecture capturing technologies and investigating their educational impacts. As the analyses in this study indicated, medical students perceived OLCS positively while their actual use of it was quite variable. The result implies medical students’ personalized use of OLCS for their learning practice. Although the current study does not provide enough evidence for any significant
educational impact on learning, it suggests OLCS can provide students with flexibility of study strategies and control over fast lecture pace.

A fundamental question remains as to whether the introduction of the online lecture capturing system affects medical students’ actual learning activities, especially in PBL-oriented medical curriculum. To answer the question, follow-up studies investigating personalized use of OLCS and individual student attributes are required.

Notes on contributors

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Declaration of interest: The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the article.

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