Enhancing student motivation using LectureTools
A cloud-based teaching and learning platform

Chiu, P. H. Patrio; Li, Robert K. Y.

Published in:
Knowledge Management and E-Learning

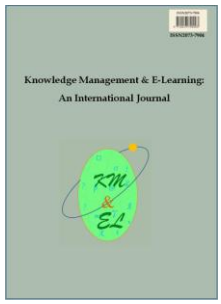
Published: 01/06/2015

Document Version:
Final Published version, also known as Publisher's PDF, Publisher's Final version or Version of Record

Published version (DOI):
10.34105/j.kmel.2015.07.016

Publication details:
Chiu, P. H. P., & Li, R. K. Y. (2015). Enhancing student motivation using LectureTools: A cloud-based teaching and learning platform. *Knowledge Management and E-Learning*, *7*(2), 250-264. https://doi.org/10.34105/j.kmel.2015.07.016

Knowledge Management & E-Learning



ISSN 2073-7904

Enhancing student motivation using LectureTools: A cloud-based teaching and learning platform

P. H. Patrio Chiu
Robert K. Y. Li
City University of Hong Kong, Hong Kong

Recommended citation:
Chiu, P. H. P., & Li, R. K. Y. (2015). Enhancing student motivation using LectureTools: A cloud-based teaching and learning platform. *Knowledge Management & E-Learning*, *7*(2), 250–264.

Knowledge Management & E-Learning, 7(2), 250–264

Enhancing student motivation using LectureTools: A cloud-based teaching and learning platform

P. H. Patrio Chiu*

Office of Education Development and Gateway Education
City University of Hong Kong, Hong Kong
E-mail: phchiu@cityu.edu.hk

Robert K. Y. Li

Department of Physics and Materials Science
City University of Hong Kong, Hong Kong
E-mail: aprkyl@cityu.edu.hk

*Corresponding author

Abstract: A cloud-based teaching and learning platform, LectureTools, was piloted at City University of Hong Kong in the 2012-13 academic year. LectureTools is an online platform that provides a suite of cloud-based teaching and learning applications. It combines the functions of interactive presentation, real-time student response system, student inquiry and online note-taking synchronised with the presentation slides, into one cloud-based platform. A comprehensive study investigated the effectiveness of the platform for enhancing student motivation among graduate (n=158) and undergraduate (n=96) students. Both groups of students reported enhanced motivation when using LectureTools. The scores on all six learning motivation scales of the Motivated Strategies for Learning Questionnaire, a psychometric instrument based on the cognitive view of motivation, increased when students engaged with the tool in class. Those who used the tool scored significantly higher on intrinsic goal orientation than those who did not use the tool. The students' quantitative feedback showed that they found the tool useful and that it improved their motivation. Qualitative feedback from the instructors indicated that the tool was useful for engaging passive students. They reported that the most useful function was the interactive online questions with real-time results, while the in-class student inquiry function was difficult to use in practice.

Keywords: Cloud application; Classroom feedback systems; e-Learning tools; Learning technology; Student motivation

Biographical notes: P. H. Patrio Chiu is a Senior Education Development Officer at the Office of Education Development and Gateway Education (EDGE), City University of Hong Kong. He received his Ph.D., M.Eng. and B.Eng. degrees in engineering from McGill University, Canada. He has taught Physics and Engineering at University and College levels before joining the Office of EDGE.

Robert K. Y. Li is Associate Dean (Academic Programmes, Teaching and Learning) of the College of Science and Engineering and Professor of the Department of Physics and Materials Science, City University of Hong Kong.

1. Introduction

A cloud application (or cloud app) is an application program that functions in the cloud and can be used by anyone with a Web browser and a communication device that can connect to the Internet. It is stored entirely on a remote server and is delivered over the Internet through a browser interface. Cloud-based applications such as Google Apps, YouTube and Facebook have become very popular in recent years (Miller, 2008). These applications provide users with a convenient way to access to useful information and functions for leisure, work and study through standard Web browsers or mobile devices. The education community recognises the importance of this latest technology, and new tools and pedagogies have been designed to fully utilise cloud-based applications in the teaching and learning environment (Alexander, 2006; Barone & Hagner, 2001; Mtega, Benard, & Dettu, 2013; Ouf, Nasr, & Helmy, 2010). Learning Management System (LMS) companies and textbook publishers such as Blackboard Inc., McGraw-Hill Education and Pearson Education have developed their own cloud-based teaching and learning environments for student learning and assessment. However, no major cloud-based teaching and learning tool, with an associated pedagogical model, has proven to be the dominant platform (Stevenson & Hedberg, 2011). Teachers tend to select user-friendly cloud-based applications based on pedagogical choices, pragmatism and external imperatives (Backhouse, 2013). However, they may not always consider how the technology affects the student learning experience. Thus, an interdisciplinary study of cloud-based teaching and learning tools to evaluate student motivation (psychometric parameter) and tool functionality (system components) and the correlation between them is of value to the community.

2. Literature review

The use of e-learning tools to enhance in-class teaching and learning has been extensively examined. Hall, Collier, Thomas, and Hilgers (2005) stated that real-time in-class polling/questioning using a Personal Response System (PRS) can enhance student engagement. Simelane and Skhosana (2012) reported that the implementation of clicker technology in a mathematics course improved students' success rate. According to Liaw (2008) and Liaw, Huang, and Chen (2007), e-learning tools, with relevant multi-media instructions and well-designed interactive learning activities, have positive effects on learners' attitudes. Law, Lee, and Yu (2010) and Ruiz, Mintzer, and Leipzig (2006) observed a positive effect of e-learning tools on student learning across academic disciplines. With the advancement of cloud-based systems, it is possible to integrate a real-time PRS, online note-taking function and multi-media instructions into one online platform. Mazumder (2012) demonstrated that such tools were useful for enhancing student confidence and motivation. Samson (2010) stated that students were more engaged in class when using a cloud-based learning platform, LectureTools (www.lecturetools.com). Unlike traditional PRS, which generally only use multiple choice questions, LectureTools allows students to pose and answer questions in text format, and to take notes online, synchronised with the instructor's presentation slides and stored in the cloud server. These features significantly increase in-class teacher–student interaction. Zhu, Kaplan, Dershimer, and Bergom (2010) reported that students enrolled in a class with LectureTools had higher levels of attentiveness, engagement and learning than students who did not use the system.

To study the effect of a cloud-based teaching and learning platform on student motivation, a model of motivation is required. Student motivation can be conceptualised

by the general social-cognitive model of motivation stated by Pintrich and De Groot (1990). The model is based on three motivational components. First, the model includes an expectancy component that involves students' responses to the question, 'Can I do this task?' based on Paris and Oka's (1986) finding that more motivated students believed they were more capable. Second, the value component involves students' beliefs about the importance of the task, as Eccles (1983) found that motivated students were more likely to answer positively in this regard. Third, the affective component concerns students' test anxiety, based on Nicholls's (1976) finding that anxiey was related to students' perceptions of competence.

2.1. LectureTools - A cloud-based teaching and learning platform

A cloud-based teaching and learning platform, LectureTools, was selected as the key instructional tool for the study. LectureTools is an online platform that provides a suite of cloud-based teaching and learning applications. It combines the functions of interactive presentation (slideshow), real-time PRS, student inquiry (students can ask questions digitally during class) and online note-taking synchronised with the presentation slides, into one cloud-based platform. Teachers can use any computer with a Web browser to present the lecture materials, play online multi-media files (e.g., YouTube) and engage students with interactive online questions. Unlike traditional PRS where the interface is limited to selecting a few answers, LectureTools provides a more flexible Web-based interface that allows students to respond to a variety of questions, including multiple choice questions (Fig. 1), text-based free response questions (Fig. 2), image quizzes and order lists. As LectureTools is a cloud-based platform, students simultaneously provide their answers in class using a Web-enabled device, such as a notebook computer, tablet or even smartphone. The system is able to summarise the results and display them in class in real time. Because teachers receive instant feedback on student comprehension, they are able to adjust their teaching strategy based on students' in-class responses. Students are able to take notes and draw figures associated with individual presentation slide online (Fig. 3) using their own devices. All of the data and materials, such as teachers' presentation slides and students' personal notes and drawings, are saved on a cloud server. This cloud-based service enables students to access lecture materials and review their own notes using any device with an Internet connection at any time. The system also acts as a student repository for course content.

2.2. Motivated strategies for learning questionnaire

To gather the student motivation data, a standard instrument, the Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich & De Groot, 1990), was used to measure the psychometric parameters. The MSLQ has been used by education researchers around the world (Duncan & McKeachie, 2005; Stoffa, Kush, & Heo, 2011). The components of the instrument positively correlate with various aspects of motivation and learning strategies (Bassili, 2008), and it has robust reliability and reasonable predictive validity (Pintrich, Smith, Garcia, & Mckeachie, 1993). The learning motivation section (Appendix) of the instrument consists of six motivation scales with 31 items measuring the value components (intrinsic goal orientation, extrinsic goal orientation and task value), expectancy components (control beliefs and self-efficacy for learning and performance) and affective component (test anxiety). Students rate themselves on each item using a seven-point Likert scale ranging from 1 (not at all true of me) to 7 (very true of me).

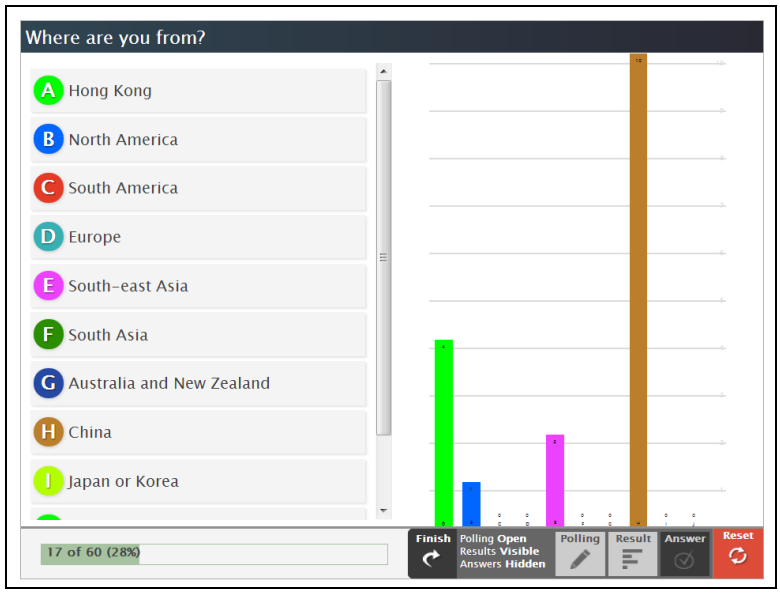


Fig. 1. Student response system showing real-time student responses

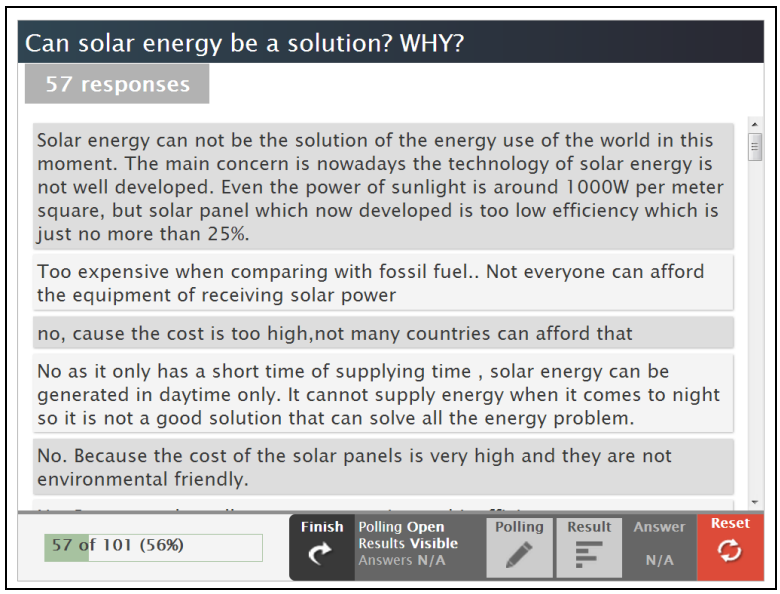


Fig. 2. Students are engaged with text-based free response questions

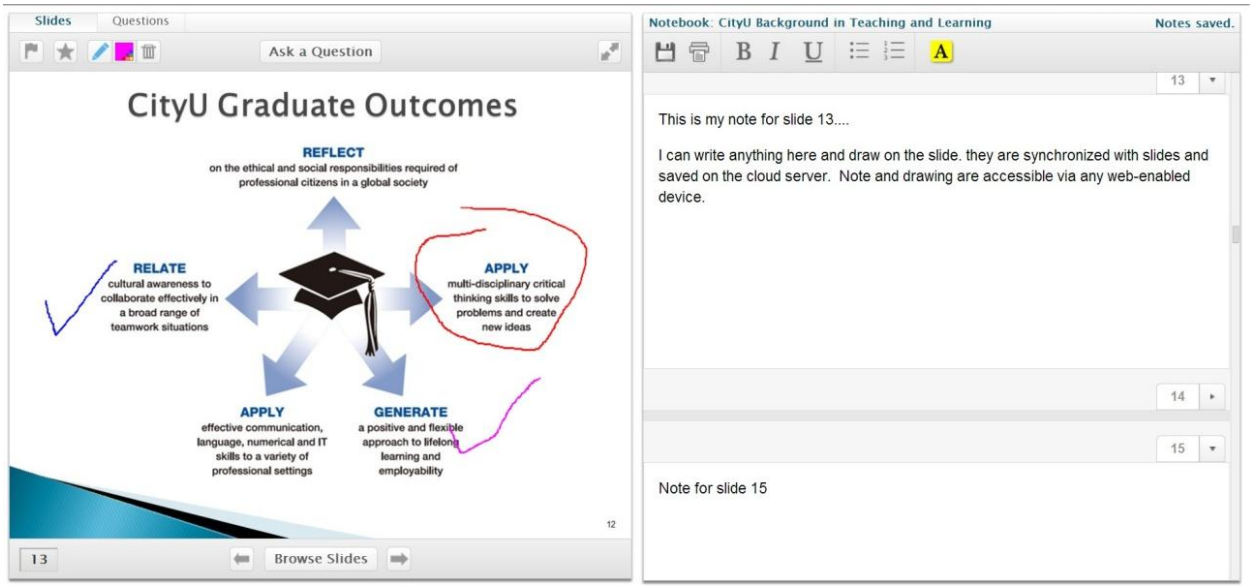


Fig. 3. Student view of the online note-taking and drawing feature

2.3. Research questions

The research questions for the study were as follows.

- Does the use of LectureTools, a cloud-based teaching and learning platform for interactive teaching and learning activities (TLAs) enhance student motivation in a higher education environment?
- How is the cloud-based teaching and learning platform used for interactive TLAs in a higher education setting?

3. Method

3.1. Participants

Two groups of students participated in this study. The first group comprised 158 graduate students enrolled in a Graduate Teaching Assistant induction course, SG8001 Teaching Students: First Steps (Mark, Thadani, Calonge, Pun, & Chiu, 2011), offered in semester A of the 2012-13 academic year. The course was divided into two sections: SG8001-S01 consisting of 61 students and SG8001-S02 consisting of 97 students. The course was taught by professional staff from the Office of Education Development and Gateway Education. The second group comprised 96 undergraduate students enrolled in a year 2 general education course, GE2306 Energy and Technology (http://www6.cityu.edu.hk/ge_info/courses/materials/html/GE2306.html), taught by a professor from the College of Science and Engineering in semester B of the 2012-13 academic year.

3.2. Procedure

The effect of LectureTools on student motivation was examined in the two settings (SG8001 and GE2306). Although the two courses involved different students and course levels, the instructors for both courses identified similar TLAs using LectureTools, as follows.

1. Use LectureTools as the key presentation method in class. Students can take notes synchronised with the slides and stored online.
2. Pose interactive questions in class so that students can answer via their own LectureTools account using their own devices. The results can be displayed in real time and the instructors can facilitate discussion based on the students' answers.
3. Advise students to pose questions to the course instructor at any time during the class so that any confusion over the course material can be clarified.

Presentation slides were prepared and uploaded to LectureTools for every class. Students accessed the materials in class via their own Web-enabled devices (i.e., laptop computer, tablet or smartphone). The instructors used LectureTools to present the course materials, while students logged in to their own LectureTools accounts to access the materials and take notes using the cloud-based platform. Their notes and drawings were synchronised with the presentation slides and saved on the cloud server. The instructors prepared interactive questions to engage students in class according to the instructors' pedagogical choices. Multiple-choice and text-based free response questions were the two main question types used in every class. Other question types, such as image quizzes and order lists, were used when appropriate. Students from both courses were encouraged to ask questions using the student inquiry function of LectureTools so that instuctors could address them during the class.

Because the SG8001 course consisted of two sections, students from section SG8001-S01 served as the subject group and were exposed to the use of LectureTools in class, while students from section SG8001-S02 served as the control group and did not use LectureTools. The same instructor conducted the teaching activities in both sections. The course content, intended learning outcomes and TLAs were identical and the same set of interactive questions was used in both sections. Presentation slides were presented to the subject group students using LectureTools and the interactive questions (multiple choice questions and text-based free response questions) were delivered through the same system. Students responded via their own Web-enabled devices and their answers were displayed in real time, followed by a discussion facilitated by the instructor. In the control group, presentation slides were presented using Powerpoint and the questions were delivered to the students verbally and projected onto the classroom screen. Students responded either by a show of hands or verbally. Both groups completed the MSLQ at the end of class.

For the GE2306 course, the instructor systematically used LectureTools as the main teaching tool to present material, including slides and video, and to interact with students in real time using the student response system with both multiple-choice and text-based free response questions. A direct student feedback questionnaire, including questions on motivation and usage, was delivered to the students online at the end of the semester to gather their quantitative feedback on the use of the cloud-based teaching and learning platform.

Qualitative feedback on the effectiveness of LectureTools was also obtained directly from the course instructors in written format after the completion of the courses.

3.3. Instruments

To investigate student motivation, both indirect (MSLQ in SG8001) and direct (student feedback on usage and motivation in GE2306) questionnaires were used. The findings were then compared with the instructors' feedback and previous research findings.

The motivational data for the SG8001 group were gathered using an online version of the MSLQ constructed using Google Apps. All SG8001 students were invited to complete the questionnaire via email at the end of the course. Completion of the online MSLQ was anonymous and no participation incentive was given to the students. The MSLQ was completed by 21 students in both the subject group (SG8001-S01) and the control group (SG8001-S02), with response rates of 34% and 22%, respectively.

Direct feedback was gathered from the GE2306 students using Google Apps. All of the students were invited to provide feedback, and 29 students completed the questionnaire, giving a response rate of 30%.

4. Results

4.1. Findings from the SG8001 students

The means, standard deviations and Cronbach's alphas of the scores of the two groups on the MSLQ motivation scale were calculated. The p-values of the paired t-tests for the six scales are presented in Table 1. All of the values were computed using the SPSS statistical package (IBM). The mean scores for the motivation scales ranged from 3.83 to 5.80 (standard deviation 1.01 to 1.77) for the subject group, compared with 3.54 to 5.55 (standard deviation between 1.01 to 1.70) for the control group. This result shows that the subject group attained higher mean scores than the control group for all of the motivation scales, with similar standard deviations. The subject group also had significantly higher mean scores for the Intrinsic Goal Orientation subscale of the MSLQ motivation scale (5.80 versus 5.35, p-value = 0.011).

4.2. Findings from the GE2306 students

The GE2306 students' responses to the survey are shown in Fig. 4 to 7. Fig. 4 reveals that the students mainly used LectureTools to view lecture slides, respond to in-class multiple choice questions, complete in-class short answer questions and watch course-related videos. The findings indicate that LectureTools was used intensively as a medium for in-class interactive activities. More than half of the students agreed that the use of LectureTools increased their motivation in class (Fig. 5) and the majority of them found the tool useful for their studies (Fig. 6). All of the direct feedback from the students suggests that the use of LectureTools with interactive TLAs provided a positive effect on students' motivation. However, 20 students reported that they had encountered occasional technical issues with the tool (Fig. 7), suggesting the need for system or network improvement.

Table 1
Descriptive statistics for the SG8001 students on the motivated strategies for learning questionnaire (MSLQ)

	SG8001-S01 - Subject Group (n=21)			**SG8001-S02 - Control Group (n=21)**			
MSLQ Item	Mean	Std Dev	Cronbach's Alpha	Mean	Std Dev	Cronbach's Alpha	p-Value
Value Component							
Intrinsic Goal Orientation	5.80	1.10	0.54	5.35	1.18	0.62	0.011*
Extrinsic Goal Orientation	4.93	1.59	0.65	4.64	1.58	0.84	0.189
Task Value	5.66	1.15	0.91	5.47	1.01	0.739	0.150
Expectancy Component							
Control of Learning Beliefs	5.27	1.54	0.76	5.15	1.27	0.65	0.524
Self-Efficacy for Learning and Performance	5.70	1.01	0.89	5.55	1.06	0.90	0.183
Affective Component							
Test Anxiety	3.83	1.77	0.77	3.54	1.70	0.55	0.173

*Statistically significant

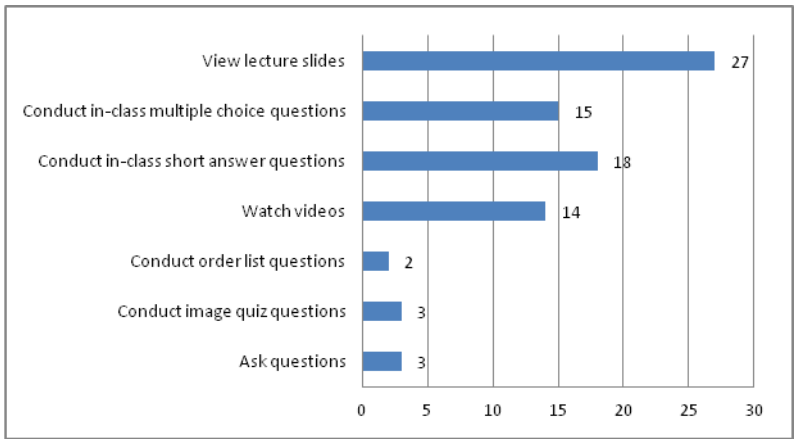


Fig. 4. Students' responses to the question 'Which LectureTools related activities have you used for your study? (You may select more than one activity.)'

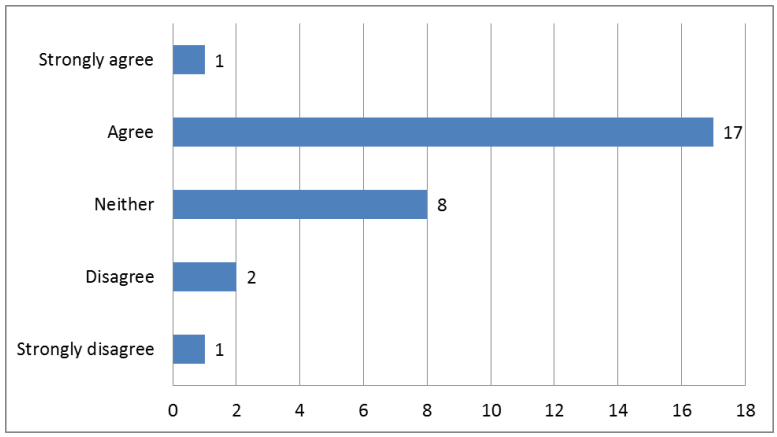


Fig. 5. Students' responses to the question 'Does the use of LectureTools increase your motivation in class?'

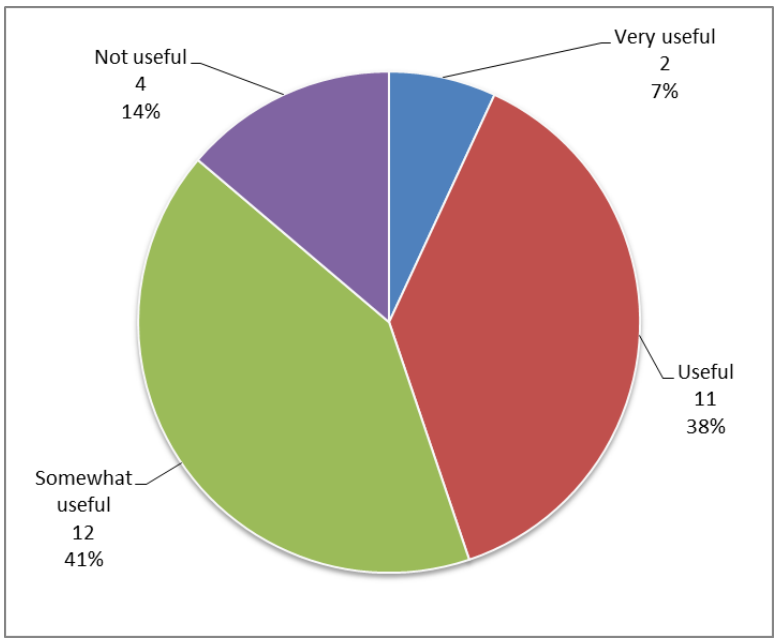


Fig. 6. Students' responses to the question 'Do you find LectureTools useful for your study?'

4.3. Feedback from the instructors

The instructors' feedback on the effectiveness of the system was reduced to a number of representative quotes, with each quote corresponding to one item. These items were then collated to form a qualitative statement about the use of LectureTools. Three statements were identified.

The cloud-based teaching and learning platform that enhanced student learning

- *Interactive questioning is the best part of the system because it allows passive students to engage in TLAs. Also the real-time display of results creates a good and active atmosphere; it encourages students to participate.*
- *To me, the ability for students to interactively ask questions is the major advantage of using LectureTools.*

Technical issues that hampered student learning

- *I experienced slow responses when students asked a question. It may be that a setting was not right and I did not see the question because of that.*
- *It is difficult for instructors to answer real-time inquiries from students in class, especially when there is no support from a teaching assistant. If students post questions and instructors fail to answer them, it will have a negative effect on student learning. The system should allow instructors to disable the function.*
- *Another concern is the lack of slide animation. To do any sort of animation, you have to have a series of slides. If loading times were not an issue, not having slide animation would be less of an issue.*

Network/server issues that hampered student learning

- *Sometime the server is slow and takes time to load the slides.*
- *My main issue with LectureTools is that the system tends to be very slow to load. Hosting it locally may improve this.*

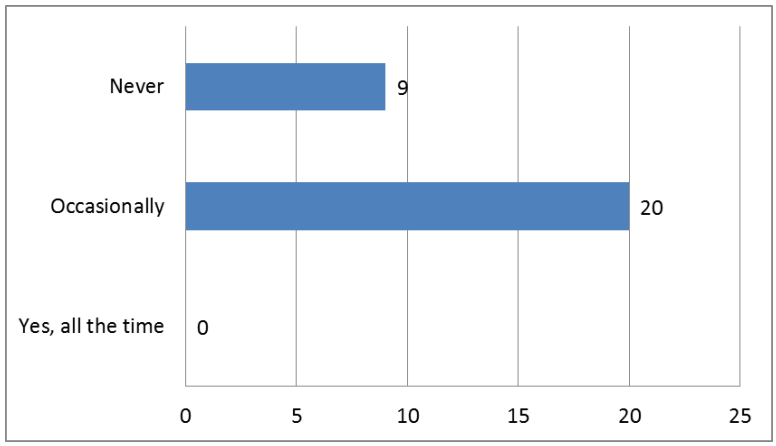


Fig. 7. Students' responses to the question 'Have you encountered any technical issue with LectureTools?'

5. Discussion

The goal of this study was to determine whether the use of a cloud-based teaching and learning platform with corresponding TLAs enhances student motivation. According to the MSLQ results from the SG8001 course, students exposed to the technology scored higher on all six subscales (intrinsic goal orientation, extrinsic goal orientation, task value, control beliefs, self-efficacy for learning and performance and test anxiety) of the three components of motivation (value, expectancy and affective). It is notable that the scores

for test anxiety were lower than the other subscale scores in both the subject and the control group. As test anxiety is negatively related to expectancies and academic performance, it is normal for students to score lower on test anxiety than on the other scales. This result is similar to that reported by Pintrich, Smith, Garcia, and McKeachie (1991) in their work on enhancing motivation. The significant improvement in intrinsic goal orientation (5.80 vs. 5.35) in this study suggests that students perceived themselves to be participating in the TLAs for an intrinsic reason such as challenge, curiosity or mastery. As the use of this technology was new to most (if not all) students, we would expect curiosity to contribute to the enhancement of their intrinsic goal orientation. The instructors adopted the technology with appropriate interactive questions that posed a sufficient challenge to all students, including the more passive students, thus boosting students' intrinsic challenge value. The enhancement of students' intrinsic goal orientation also indicates that students' participation in the TLAs was motivated from within, rather than by extrinsic factors such as grades, rewards or recognition by others. In fact, no incentives were given to students who actively participated in class. Feedback from the GE2306 students agreed with the MSLQ results. More than half of the class reported that the use of LectureTools increased their motivation (Fig. 5) and the majority found the system useful (Fig. 6). They actively used the platform to view lecture slides and respond to in-class questions (Fig. 4), suggesting an enhancement of learning and engagement in class. The findings are comparable to those reported by Zhu, Kaplan, Dershimer, and Bergom (2010), which showed that students had positive perceptions of using laptops with LectureTools in-class and that it increased attentivenss, engaged them better and thus helped them to learn more.

The instructors reported that the use of the technology enhanced student learning through the use of interactive questions. The system allows instructors to engage all students by probing them with online questions related to the course materials. All students can respond to the instructor without worrying about drawing attention to themselves, which may be seen as showing off by other students or cause embarrassment if the student gives an incorrect answer. Students also feel more comfortable about offering their views when they see the the real-time display of responses from their peers. The anonymous nature of the interactive question response feature gives particular comfort to shy students. All of the instructors agreed that the interactive question function was the best feature in LectureTools. Their responses agreed with Samson's (2010) finding that engagement in large lecture classes improved when using LectureTools.

Not all of the system's functions worked according to their original design purpose when it was implemented in the specific context of this study. The instructors reported that the real-time student inquiry function, which should enable students to ask questions in class, was difficult to use. As the instructors were delivering the lecture, it was almost impossible for them to continually check whether students had posted questions and reply to them. The questions could be addressed by the instructors after class, but the delayed feedback may already have hampered student learning. This finding is in contrast to Samson's (2010) statement that 'LectureTools also led to a dramatic increase in the number of students posing questions during class time'. In fact, GE2306 students reported that they rarely used this function compared with the other LectureTools features. The presence of an in-class teaching assistant to answer students' questions might increase the use of this function, but this resource was not available in this study.

As LectureTools was designed as a cloud-based teaching and learning platform and all data are saved on a cloud server, a good network connection is essential for the effective use of the system. In this study, however, the instructors reported some

connection problems when using the system in class. The system used a server located in the US, and thus the speed of accessing data may have been unstable due to geographic location and volume of Internet traffic. One instructor suggested that hosting the server on campus could improve the access speed.

6. Conclusion

The effectiveness of the cloud-based teaching and learning platform, LectureTools, was assessed by examining student motivation among graduate and undergraduate students. The results showed that the use of LectureTools enhanced students' scores on all six motivation scales of the MSLQ, namely intrinsic goal orientation, extrinsic goal orientation, task value, control beliefs, self-efficacy for learning and performance and test anxiety. Direct quantitative feedback from the students confirmed the positive effect of LectureTools on student motivation and learning. Qualitative feedback from the instructors indicated that they found the anonymous real-time interactive question feature with instant results display the most useful part of the system. This feature was very useful for engaging passive students as it allowed them to actively participate in class in a comfortable setting. However, a stable, high-speed network infrastructure for deploying the cloud-based teaching and learning platform is essential. Overall, the findings indicate that the use of LectureTools with interactive TLAs can enhance student motivation.

Acknowledgements

The authors wish to thank Dr. S. K. Crusher Wong (Office of the Chief Information Officer, City University of Hong Kong) and all SG8001 teaching staff (Office of Education Development and Gateway Education, City University of Hong Kong) for their support and comments in the work.

References

Alexander, B. (2006). Web 2.0: A new wave of innovation for teaching and learning? *EDUCAUSE Review, 41*(2), 32–44.

Backhouse, J. (2013). What makes lecturers in higher education use emerging technologies in their teaching? *Knowledge Management & E-Learning, 5*(3), 345–358.

Barone, C. A., & Hagner, P. R. (Eds.) (2001). *Technology-enhanced teaching and learning: Leading and supporting the transformation on your campus*. San Francisco, CA: Jossey-Bass.

Bassili, J. N. (2008). Motivation and cognitive strategies in the choice to attend lectures or watch them online. *Journal of Distance Education, 22*(3), 129–148.

Duncan, T. G., & McKeachie, W. J. (2005). The making of the motivated strategies for learning questionnaire. *Educational Psychologist, 40*(2), 117–128.

Eccles, J. S. (1983). Expectancies, values, and academic behaviors. In J. T. Spence (Ed.), *Achievement and achievement motives: Psychological and sociological approaches* (pp. 75–146). San Francisco: W.H. Freeman.

Hall, R. H., Collier, H. L., Thomas, M. L., & Hilgers, M. G. (2005). A student response system for increasing engagement, motivation, and learning in high enrollment lectures. In *Proceedings of the Eleventh Americas Conference on Information Systems* (pp. 621–626). Omaha, NE, USA.

Law, K. M., Lee, V., & Yu, Y. T. (2010). Learning motivation in e-learning facilitated computer programming courses. *Computers & Education, 55*(1), 218–228.

Liaw, S. S. (2008). Investigating students' perceived satisfaction, behavioral intention, and effectiveness of e-learning: A case study of the Blackboard system. *Computers & Education, 51*(2), 864–873.

Liaw, S. S., Huang, H. M., & Chen, G. D. (2007). Surveying instructor and learner attitudes toward e-learning. *Computers & Education, 49*(4), 1066–1080.

Mark, K. P., Thadani, D. R., Calonge, D. S., Pun, C. F., & Chiu, P. H. (2011). From neophyte to experienced facilitator: An interactive blended-learning course for graduate teaching assistants in Hong Kong. *Knowledge Management & E-Learning, 3*(2), 153–169.

Mazumder, Q. H. (2012). Improvement of confidence and motivation using online metacognition tool. *American Journal of Engineering Education, 3*(1), 53–66.

Miller, M. (2008). *Cloud computing: Web-based applications that change the way you work and collaborate online*. Indianapolis, IN: Que Publishing.

Mtega, W. P., Benard, R., & Dettu, M. (2013). The prospects of Web 2.0 technologies in teaching and learning in higher learning institutes: The case study of the Sokoine University of Agriculture in Tanzania. *Knowledge Management & E-Learning, 5*(4), 404–418.

Nicholls, J. G. (1976). When a scale measures more than its name denotes: The case of the test anxiety scale for children. *Journal of Consulting and Clinical Psychology, 44*(6), 976–985. doi:10.1037/0022-006X.44.6.976

Ouf, S., Nasr, M., & Helmy, Y. (2010). An enhanced e-learning ecosystem based on an integration between cloud computing and Web2.0. In *Proceedings of the 2010 IEEE International Symposium on Signal Processing and Information Technology* (pp. 48–55). Luxor, Egypt. doi:10.1109/ISSPIT.2010.5711721

Paris, S. G., & Oka, E. (1986). Children's reading strategies, metacognition, and motivation. *Developmental Review, 6*(1), 25–56.

Pintrich, P. R., & De Groot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology, 82*(1), 33–40.

Pintrich, P. R., Smith, D., Garcia, T., & McKeachie, W. (1991). *A manual for the use of the motivated Strategies for learning questionnaire (MSLQ)*. Ann Arbor, Mich, USA: National Center for Research to Improve Postsecondary Teaching and Learning, University of Michigan.

Pintrich, P. R., Smith, D., Garcia, T., & Mckeachie, W. (1993). Reliability and predictive validity of the motivated strategies for learning questionnaire (MSLQ). *Educational and Psychological Measurement, 53*(3), 801–813.

Ruiz, J. G., Mintzer, M. J., & Leipzig, R. M. (2006). The impact of e-learning in medical education. *Academic Medicine, 81*(3), 207–212.

Samson, P. J. (2010). Deliberate engagement of laptops in large lecture classes to improve attentiveness and engagement. *Computers in Education, 1*(2).

Simelane, S., & Skhosana, P. M. (2012). Impact of clicker technology in a mathematics course. *Knowledge Management & E-Learning, 4*(3), 279–292.

Stevenson, M., & Hedberg, J. G. (2011). Head in the clouds: a review of current and future potential for cloud-enabled pedagogies. *Educational Media International, 48*(4), 321–333.

Stoffa, R., Kush, J. C., & Heo, M. (2011). Using the motivated strategies for learning

questionnaire and the strategy inventory for language learning in assessing motivation and learning strategies of generation 1.5 Korean immigrant students. *Education Research International, 2011*. doi:10.1155/2011/491276

Zhu, E., Kaplan, M., Dershimer, R. C., & Bergom, I. (2010). *Use of laptops in the classroom: Research and best practices* (CRLT Occasional Papers No. 30). Retrieved from http://www.crlt.umich.edu/sites/default/files/resource_files/CRLT_no30.pdf

Appendix: Motivated Strategies for Learning Questionnaire (MSLQ) - Motivation Items

1. In a class like this, I prefer course material that really challenges me so I can learn new things.
2. If I study in appropriate ways, then I will be able to learn the material in this course.
3. When I take a test I think about how poorly I am doing compared with other students.
4. I think I will be able to use what I learn in this course in other courses.
5. I believe I will receive an excellent grade in this class.
6. I'm certain I can understand the most difficult material presented in the readings for this course.
7. Getting a good grade in this class is the most satisfying thing for me right now.
8. When I take a test I think about items on other parts of the test I can't answer.
9. It is my own fault if I don't learn the material in this course.
10. It is important for me to learn the course material in this class.
11. The most important thing for me right now is improving my overall grade point average, so my main concern in this class is getting a good grade.
12. I'm confident I can learn the basic concepts taught in this course.
13. If I can, I want to get better grades in this class than most of the other students.
14. When I take tests I think of the consequences of failing.
15. I'm confident I can understand the most complex material presented by the instructor in this course.
16. In a class like this, I prefer course material that arouses my curiosity, even if it is difficult to learn.
17. I am very interested in the content area of this course.
18. If I try hard enough, then I will understand the course material.
19. I have an uneasy, upset feeling when I take an exam.
20. I'm confident I can do an excellent job on the assignments and tests in this course.
21. I expect to do well in this class.
22. The most satisfying thing for me in this course is trying to understand the content as thoroughly as possible.
23. I think the course material in this class is useful for me to learn.
24. When I have the opportunity in this class, I choose course assignments that I can learn from even if they don't guarantee a good grade.
25. If I don't understand the course material, it is because I didn't try hard enough.
26. I like the subject matter of this course.
27. Understanding the subject matter of this course is very important to me.
28. I feel my heart beating fast when I take an exam.
29. I'm certain I can master the skills being taught in this class.
30. I want to do well in this class because it is important to show my ability to my family, friends, employer, or others.
31. Considering the difficulty of this course, the teacher, and my skills, I think I will do well in this class.