Investigating the Effectiveness of Lecture Capture on Teaching and Learning

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BACKGROUND

Lecture capture (LC) is a relatively new teaching delivery technology used by many tertiary educational institutions and Universities in the developed countries including Australia in order to enhance the effectiveness of students' learning. A LC is the recording and online casting of full lecture delivered by the lecturer in a class room through the use of digital networking technologies. Like all other blended teaching and learning (technology mediated learning) approaches, this modern method has some benefits and drawbacks as well. It is therefore, important for the institutions/Universities to investigate the real effectiveness of LC on both teaching and learning before being implemented extensively.

PURPOSE

The main purpose of this paper is to investigate the effectiveness of LC on both students' learning outcomes and lecturers' teaching performance with its current state and technological support provided by the Institutions and also to inquire into the functional readiness of the University or the Institution in adopting this technology.

APPROACH

This study involves both qualitative and quantitative approaches to gather and analysis of data, and to provide necessary recommendations for further improvement. The qualitative part of this research encompasses an extensive literatures review to explore how these important issues have been addressed by the academic scholars and researchers. It is followed by gathering an in-depth understanding of the students and teachers about LC through the use of questionnaires. Depending on the gaps, two separate and independent sets of questionnaire have been developed and distributed to the students and teachers/lecturers, respectively. These two sets of questionnaires have been designed to collect information on both lecturers' and students experience and impressions. The quantitative component of this research involves a statistical analysis of the collected data. Based on the collected data and their analysis, some conclusions have been drawn.

RESULTS

Based on the survey results and analysis, this study has identified some major benefits and pitfalls of LCs not only on students' learning but also on lecturers' teaching. Although this technology in its current form is very much effective for the Arts and Business related courses, it is still emerging for engineering, Science and Medicinal courses which involve highly technical and/or mathematical expressions and hands on demonstrations.

CONCLUSIONS

Online LCs through the use of digital technology is still in its preliminary stage (infant age) and most of the cases are in trial phase. It has already become an effective tool in enhancing students' learning outcomes and lecturers' teaching performance. However, as it is preliminary or trial phase, both teachers and students of highly technical and engineering courses are facing some difficulties. Certainly it could be very powerful tool in enhancing teaching and learning if the identified difficulties are addressed well in near future.

KEYWORDS

Lecture capture, Technology mediated learning, Mind concentration level, and Students' learning outcomes

Introduction

The way of communication between teacher and student is changing rapidly because of increasingly digitally networked world. Therefore, many resources are now being freely shared online that can be advantageous for teachers and students to develop an understanding for an appropriate and legal use (McIntyre, 2011). Online technologies, which capture and share learning activities, turns teaching into more reflective, iterative, adaptive and collaborative design process to meet educational goals. One of the important and effective tools for online teaching and learning is the LC which is the recording and online casting of full lecture delivered by the lecturer in a class room through the use of digital networking technologies. The use of LCs, as supplemental learning materials, was initially a particular promise for supporting educationally disadvantaged students without examining the impact of this approach fundamentally (Anderson et.al, 2013). Many of the world class Universities have started using LC approach for both on campus and off campus students. It is indeed a good initiative to capture lectures for enhancing the teaching and learning effectiveness. Use of LC technology is becoming more popular amongst on-campus students as well as distance learners. Like all other blended teaching and learning systems, this modern method has some benefits and drawbacks as well. Most tertiary educational institutes and Universities have started to use LCs for all students in all courses before investigating its functional readiness.

In this research, a study is being conducted in investigating and analysing the overall impacts of LC on students' learning outcomes and lecturers' teaching performance. An initial survey is carried out on a small group of students and teachers with LC experience (those who gain direct benefits and/or difficulties from such approach) in order to investigate the functional readiness of this approach for the Engineering courses with highly mathematical and technical contents. This paper also discusses scope of important issues need to look into and some of the important benefits and drawbacks of the method for further improvement purpose.

Background

A LC is the recording and casting online of complete lecture delivered by the teacher in a lecture theatre by using specific software and making that recording available electronically to students. The LCs' video or audio recordings are generally stored digitally by using digital networking technologies on Internet and can download or playing back online. Software synchronizes lecture slides for viewing along with the relevant sections of audio or video recordings of the teacher. These recordings, typically used as a supplement to lecture attendance are used by the majority of students (Davis et al., 2009), primarily in a 'targeted' manner to revisit difficult concepts, make additional notes, or for revision (Williams and Farndon, 2007). Although lecture recordings are known to be a valuable component of blended learning and the use of supplemental audio-only lecture recordings ('podcasts') correlates with statistically significant increases in grades, the quantitative impact of this approach on students' learning remains largely unexplored (Kay, 2012). McKinney et al, (2009) observed that students those who used these materials took more extensive notes. Kiewra, (1985) stated that this was likely to be a central issue given that note taking in lectures was known to increase academic performance. Some authors have speculated that the observed increase in academic performance reflects students' ability to pause recordings at difficult concepts, and/or listen to lectures several times, encouraging more note-taking than in lectures (Bassili and Joordens, 2008). Although few research studies were carried to investigate the effects of LCs on student's learning in a limited learning and teaching environment, so far its impact on engineering education are not investigated thoroughly in the literatures. Therefore, a broader investigation is essential that encompasses not only the impacts on learning, also the impacts on teaching. Particularly, impacts on teaching were neglected although effective teaching materials and delivering these materials through

lectures play vital roles in learning. Therefore, this study attempts to investigate not only the impacts on learning but also to investigate the impacts on teaching simultaneously.

Methodology

This research adopts both qualitative and quantitative approach to gather and analysis the collected data and provides some recommendations for further improvement. This is because qualitative methods produce information only on the particular cases studied, and any more general conclusions are only propositions while quantitative methods can then be used to seek empirical support for such research hypotheses. The qualitative part in this research encompasses an extensive literature review followed by gathering of an in-depth understanding of the students' and teachers' on LC through the use of questionnaires and collecting data on impacts based on their experiences. The literature review explores how these important issues have been addressed by the academic scholars and researchers. Based on the research gap two separate and independent sets of questionnaire are developed for students and teachers/lecturers. These two sets of questionnaires are prepared to gather both lecturers' and students' experience and impressions. The quantitative component of this research involves a statistical analysis of the collected data. Based on the collected data and their analysis, some conclusions have been drawn. As mentioned earlier two independent separate survey questionnaires have been developed and sent to the respective respondents (students and lecturers with LC experience) to collect their understandings, impressions and experiences on the LC. These collected data are analysed from two different perspectives – one from receivers' (students) perspective and another from deliverers' (lecturers) perspective to draw conclusions based on their combined experiences, impressions and preferences. The following two sections analyse the collected data.

Effectiveness of LC on students' learning outcomes

This part of the survey program were designed for and distributed to a group of On-campus engineering students who have experience with LC tools of blended learning and have been using this for at least two years. Due to the time constraints a small group of students (around 100) were invited to participate in this survey program. It is expected that this number of respondent is fair enough to represent the overall student population in South East Queensland, Australia. However, the result of this survey can vary based on the location and environment.

Effects on students' concentration in studies

This set of survey questionnaire starts with the collection and analysis of information on the students' mind concentration levels (MCL). All the participants have experience with large class environment (more than 150 students in the class). It asked students to provide their mind concentration level in different times in a day with the use of a 10 point scale where score 10 implies maximum concentration level and 1 means a very low concentration level (minimum). Figure 1 represents the average concentration level over clock times between 8 AM to 10 PM (data were collected for a two hours of time interval).

From Figure 1 it is evident that students' MCL is very high early in the morning and it diminishes as the time passes and it is minimum at around 2 PM. Again their MCL start recovering after this time (students MCL curve can be varied for different room environment such as room temperature, humidity and day light condition – this can be a scope for future investigation). Therefore, students' MCL has significant impact on learning. Most of the University level lecture classes are held within a time band of 8 AM to 8 PM. In the class room environment it is not possible for students to be attentive equally all the times. In response to an open ended question, most of the students noted that their concentration during the lecture class is always not the same, it is contingent on the different times of the

day and sometime they can understand partially part of mathematics containing complex problems (Engineering courses).
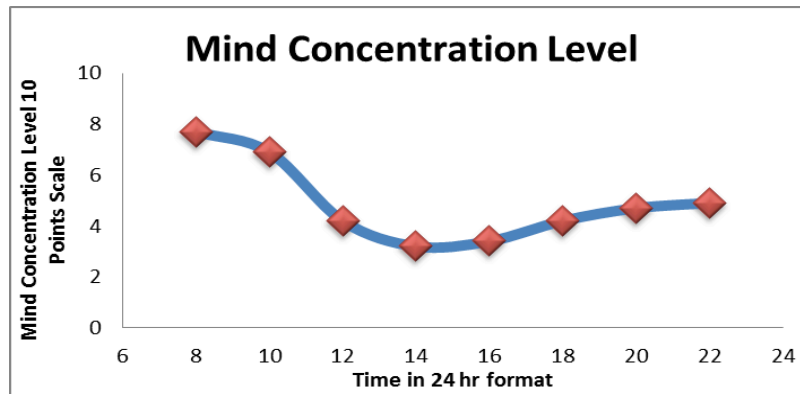

Figure 1: Student's mind concentration level over clock time

Moreover, for complete understanding they depend on additional consultations with the teacher and/ or study more texts. This problem becomes more serious in a large class environment (in a lecture theatre with more than 200 students). It becomes very difficult for many students to concentrate fully. In response to another question, most students (89% of the responded) believe that LC is an effective tool to overcome this situation. It may not be possible for the student to concentrate on physical lecture fully during class. However, through LC option students have opportunity to listen to captured lecture repeatedly during their study time or any suitable time and there is less chance for them to miss important lecture point/materials that significantly reduces their needs for additional consultancy with the lecturer after class, thereby reducing the needs for extra support from their lecturers.

Students' use of LC

In this study a group of students (sample size 100) were asked how frequently they access the LC. Figure 2 exhibits a pattern of students' use of LC throughout a semester consisted of 14 weeks. From Figure 2 it can be seen that during the first three weeks of the semester students' use of the LC is minimum and only less than 50% students use this facility. Students' access to LC during in weeks 5 and 6 prior to submission of assignments and mid semester exams are comparatively high. In weeks 12 to 14 the use of LC is maximum. This is because students need to view the recorded lecture to enrich their knowledge and experience that are necessary to prepare their final assignment and prepare them for the final examination. Therefore, the majority of the respondent believe that it is a very powerful tool to enhance their learning performance.
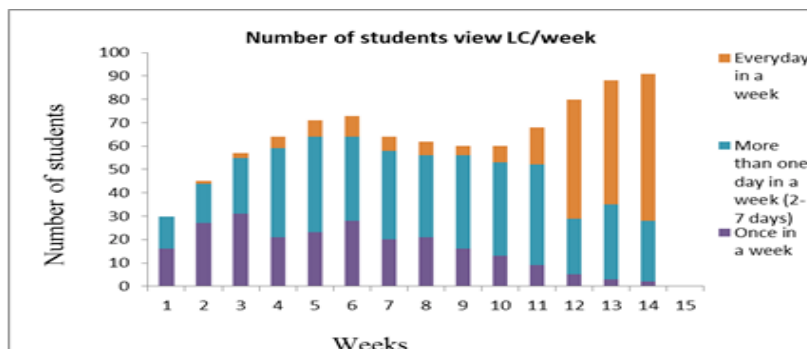

Figure 2: Students' use of LC throughout the semester

Students' positive experience with LC

The majority of students (92% of the respondent) believe that LC is an effective tool while studying or preparing for the final examination. They feel no stress, no worry if they skip a lecture class due to any reason. If they don't understand any important concept during the lecture, they can still use the LC after class and listen to it again and again until their concepts turn out to be perfect. 98% of the responded students either strongly agreed or agreed that the LC is very helpful to catch up when they missed the direct lecture class (See Figure. 3a).
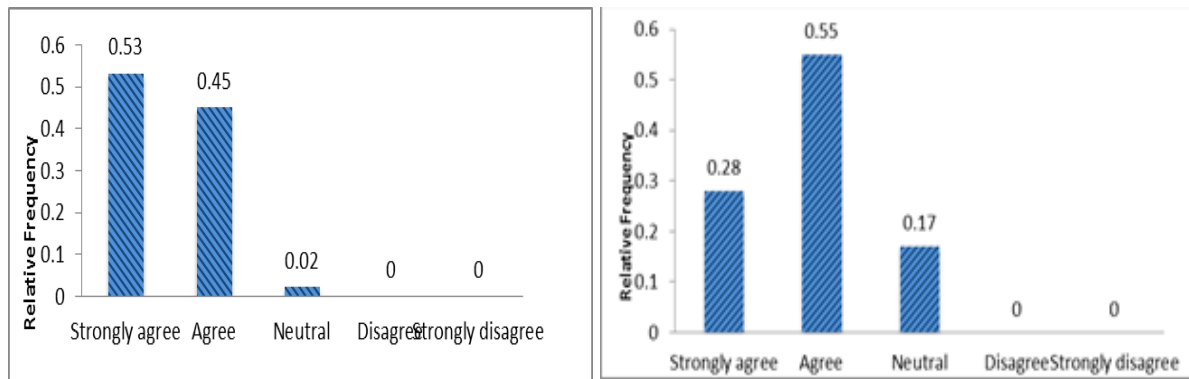

Figure 3: a) LC helps to catch up when students missed the class; b) LC helps to prepare for assignments and exams

As shown in Figure 3b, 83% agrees or strongly agrees that LC helps in preparation of assignment and final exam. Majority stated that it was really challenging for them in back days to prepare for the exams by just reading the lecture notes but since university have introduced this effective learning tool made their life easy. Now they can access to this tool anytime and can prepare well for their final examinations. Many others stated sometime it becomes really difficult to finalize an assignment without the help of LC because in weekly assignments students do not have enough time and wait for the teachers' availability for consultation. Therefore, this tool has a significant impact on students learning. From the survey results nearly 65% of students agreed that it decreases the consultancy times with the teacher. Almost 89% of the students believe that it reduces the problem with note taking in the class room situation and almost 53% students do not feel comfort in after class consultations with lecturers because of shyness or sometimes because of lecturer's negative attitudes.

Is LC helping students' to raise their grades?

In answers to this research question, the data from survey indicated that more than 80% students strongly agree or agree shown in Figure 4.
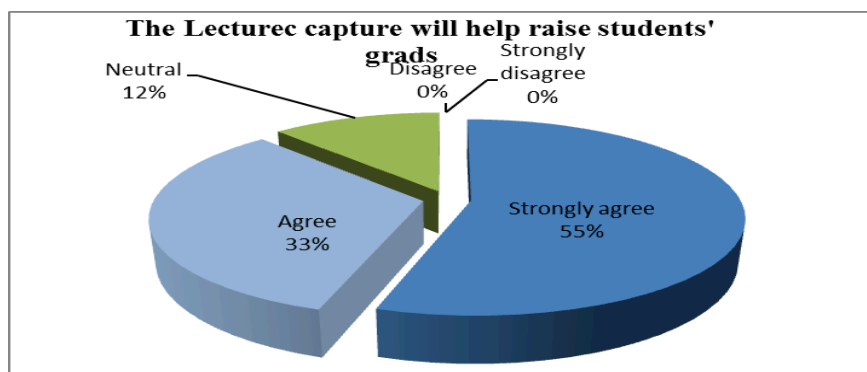

Figure 4: LC will help raising student's grade

About 88% students believe that LC can help to raise their final grades. Students could see many more benefits but the main reason for watching LC was linked to gaining a full understanding of the course material which in turn gives students the possibility of increasing their grades. Another benefit regarding the availability of the LC is that for some students they feel uncomfortable from taking notes during direct class lecture and can concentrate more while watching LC. Most of the students in this survey agreed that having access to the LC as another tool to help them learn the course content more clear, not as a replacement for, or an excuse to skip, the direct lecture. For some student, the LC may have been the difference between passing and failing the course. They found difficult to concentrate in direct classes and stopped attending most of the direct lecture classes.

Negative impacts of LC on students' learning

The initial survey report also reveals that students those who miss direct lecture class (face to face lecture) experience extreme difficulties with most of the engineering courses that involve extensive mathematics or drawing elements which by nature needs the use of whiteboards and technical explanations or hands on experiments (almost 82% student agree with this point). This is because the currently used LC software such as Echo 360, Cisco, Panopto etc can only capture the outcomes of connected computer and do not have option for video recording of the whiteboard whereas most of the engineering courses involve mathematical expressions or drawings, and hands on experiments. Therefore, the lecturers need to use traditional whiteboards to explain the mathematical expression or drawings. So, it becomes problematic for the students those who miss the class and try to follow LC where whiteboard activities remained unseen. This problem becomes more aggravated when teaching involved show and tell type contents and/or physical/laboratory experimentations. Another negative impact of LCs explored from this survey on students learning is that it can lead some students to become lazy/unorganised (laziness). 35% of the respondents believe that it is not good idea to attend class where LCs can be an alternate to the class room. Because students are aware of the LC and they better prefer engaging in more paid work and other activities instead of attending in the class or studying on time. Some students leave their studies for final examination time with the hope that they will be able to cover the study by listening to the captured lectures. It may be possible only for literature based (descriptive type such as Arts, Business related courses) courses but it is not a great idea for engineering or technical courses or even creative science courses as they need to gain clear conceptions through proper guidance from the lectures and hands on experience. This type of student's attitude may lead to a disastrous students' result.

Impact of LC on students' grades

This research has also conducted a survey to verify the impacts of LC (LC) on students' learning outcomes through the analysis of students' grades before and after the implementation of LC.
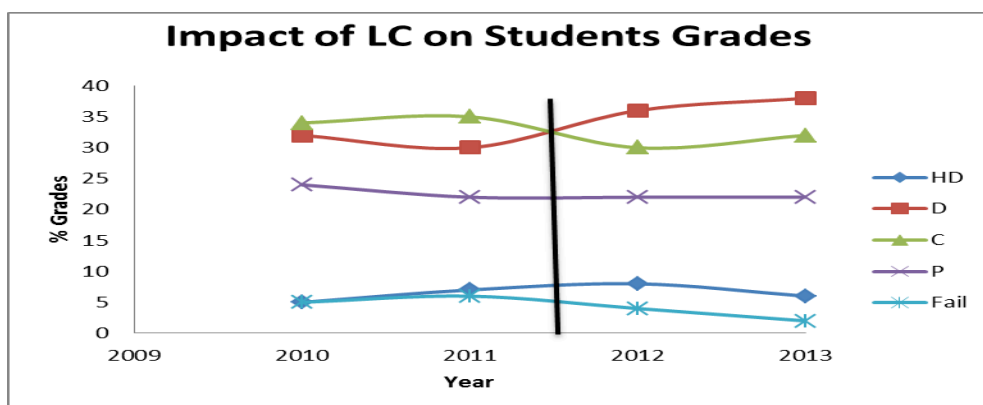

Figure 5: Impact of LC on Course Outcomes

For the purpose of this initial preliminary research it only considered and analyzed three courses in engineering discipline which started lecture capturing in 2012. Therefore, this research analyzed students' grades in years 2010 and 2011 (before LC implementation) and grades in years 2012 and 2013 (after LC implementation). Figure 5 exhibits grade distributions over the four selected years. The curves in Figure 5 reveals that the there is a very minor improvement (changes) in student grades in Engineering courses since implementation of LC although some researchers such as Morris (2010) indicated that in general courses (mostly literature based), students grades increased significantly due to the implementation of LCs.

One of the possible reasons could be the infant stage of LC approach where the system itself is facing some technical difficulties in capturing highly technical elements used in most Engineering courses. Another possibility could be the students' overconfidence of the technology use or students' unfamiliarity with the system.

Impact of LC on Teaching

The other important role player in a teaching and learning is the lecturer who is responsible for passing the correct message (information) to the students through lectures, demonstrations and consultations. Like students, lecturers' activity and performance can also be affected by the LC technology. This section investigates the impact of LCs on teaching. This investigation encompasses the understanding and experience of lecturer in LC. To conduct this study, this research interviewed a number of lecturers with at least 2 semester experience with LC facilities. All the interviewees were asked a set of pre-set open ended questions regarding the effectiveness of Lecturer on their teaching performance.

General impressions of LC

The first question was asked to them to express their overall impressions about LC. The majority of the responded agreed that like all other blended learning approaches it had substantial impacts in the development of their teaching. In spite of some initial difficulties (as seen in any new approach), it is very helpful in developing their teaching capability. One of the respondents stated that a LC could be a very effective tool for a lecturer to improve his/her teaching performance. Similar to the students the lectures have also opportunity to listen to their own captured lecture. By doing so, the lecturers can identify the strength and weakness of their lecture. This opportunity can help teachers to identify the strength and weakness of their lecture. With the knowledge acquired from this approach, teacher can easily take action to avoid repeating the similar mistakes or can put some extra hard work to minimize the issues recognized for the further improvement. This way one gets opportunity to strengthen his/her lecturing skills.

Reduces the needs of additional consultancy

The majority of the lecturers agreed that one of the benefits of LC was significant reduction of student consultations. In traditional non-lecture captured situation, it is very common that most students need special consultations with the lecturer as, sometimes it becomes hard for them to concentrate in the class, or they miss the lecture class because of valid reasons. Situation becomes even worse for some students those who are shy or introvert by nature. Whereas a course with LCs option, students can listen to the records together with the slides repeatedly whenever they face difficulties in understanding the lecture materials. Therefore, this helps students to reduce meeting time with the lecturer. As a result the lecturer gets more times to concentrate on other issues such as research and administration.

Difficulties in using LC

While lecturers were asked to comment on some of the drawbacks of LCs, 90% of the lecturers pointed out that the LC with its current format is not sufficient enough for the Engineering courses that include high contents of technical, experimental, and mathematical materials. LC software (e.g. Echo360) only captures modules that can be attained by

computer such as lecture slides, audio recording and visualiser recording. The current system is unable to record video of the lecture room presentations, for example direct video of the activities on white board or presenters' performance including direct contact with students, lecturers' body language. These are essential for effective delivery of lectures on engineering courses. Lecturing such courses, the lectures need to explain the course materials through the use of high level of mathematics, sketches and drawings etc. For this purpose the lecturer needs to use the white/black boards. While doing so it is important for the lecturer to maintain a strong interaction with the students through the use of effective eye contact and body language to keep the student attentive and to develop the students' interest in the subject matter. Although lectures can use the advanced visualisers connected to the computer, but for such courses with significant amount of mathematical works or drawings, it becomes really inconvenient for the lecturer to explain the materials which he can do it comfortably using white board and/or with physical appearance. A lecture can be more effective with the physical expressions and body language of the lecturer.

Majority of the interviewed lecturers stated that they experienced significant impacts of LC option on class attendance. Due to the learners accessibility to the entire LC, many students become self-assured that they can acquire all required knowledge from LC. This type of student psychology might discourage them to attend the actual lecture class. Some of the responded have already started experiencing a lower class attendance. Due to the less number of student attendance, the lecturers are becoming psychologically depressant and the lecturers may lose their interest in performing better. This may lead to poor teaching performance in future. Almost all the respondents agree that most of the lecturer do not have sufficient and appropriate training in use of such a sophisticated technology. As a result, the lecturers are often facing difficulties in using the technology and spending a significant amount of time in solving instant problems.

Challenges and Recommendations

Online LCs through the use of digital technology is only in its preliminary stage (infant age) and most of the cases are in trial phase. At its preliminary or trial phase both teachers and students are facing some difficulties as discussed above. No doubt it could be very powerful tools in teaching and learning if these major difficulties are carefully addressed in future. However, it is an open debate how these major difficulties can be addressed with the available resources. That is a significant challenge for the Universities and the tertiary institutes. This section provides some of the potential points in solving those problems.

Improvement of LC environment: One of the major shortcomings of the currently used LC is that it only can capture the Audio-Visio parts that reflect the computer outcomes only. It cannot capture the lecturers' physical appearance as well as their body languages, eye contacts and their classroom activities including mathematical/technical activities which needs to perform on the class room boards. It is a challenge for the lecturer/teacher to handle these shortcomings and use it efficiently. An extensive training for the lecturer/teacher is required in using technology such as proper use of visualisers, tablets, video editing etc. Before being implemented fully, there is a great need for improvement of the technology itself that would not only be capable of capturing the computer outcomes but also be capable of capturing the whole classroom environment.

Motivation: By nature, for most people it is hard to adopt a new system when they are very much familiar and comfortable with an existing system. Therefore, both lecturers and students must be motivated for getting desired outcomes and this can be carried out through organizing frequent training, workshop, symposiums and both lecturer and students are encouraged to participate in such programs.

Teachers to be innovative: Teachers have to rethink the nature of the profession, seeing teachers as reflective practitioners, action researchers and collaborative innovators–a learning profession in a learning system. Teaching is not just an art or a science; it is, or it should be, more like a design science – experimental, innovative, collaborative, iterative and creative (Cobb et al., 2003).

Teacher's ability to adapt to this technology: In adopting LC approach, teachers should see technology as the means by which teaching professionals could discover how to use technology in order to achieve the objectives of the approach. This means the teacher should have sufficient knowledge and experience of the technology and should have capability to use them properly while capturing his/her lectures. There are few research projects that have focused on this issue. Black and Wiliam, (1998) researched on assessment for learning where they showed how teachers were able to share their knowledge within and across schools.

Conclusion and future scopes

LC is a relatively new blended learning technology adopted by many world-class Universities and tertiary educational Institutes. The technology is still emerging and in its infant stage. Like all other blended learning technology, it has some benefits and pitfalls as well. Many academic researchers believe that tertiary educational institutes and Universities have started to use LCs for both On-campus and On-line courses before testing its functional readiness. In other words its effectiveness on both learning and teaching were not investigated in details. In this research study, the authors carried out an investigation to analyse how effective is LC from both learners and teachers perspectives. This investigation involved surveying of students' and lecturers' opinions of and experience in LC. Based on the survey results and findings, it identified some major impacts of LC on students' learning and lecturers' teaching that could be useful in meeting challenges for the Universities and other tertiary Institutions to make it more reliable, effective and user friendly in future. Because of the time constraint this investigation was carried out with limited number of students and teachers and respondents were mostly from engineering discipline. That may result in some conservativeness and biasness. In future a more extensive research will be conducted by investigating among larger and diverse student cohorts to examine the validity of the findings of this research.

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