Cloud Computing for Collaborative Knowledge Construction: A Case with Google Drive

Gary Ka-Wai Wong, The Hong Kong Institute of Education, Hong Kong, China

The Asian Conference on Education 2014
Official Conference Proceedings

Abstract
Usage of mobile technology in daily life has been developed to be a part of the cultures in many countries especially in a metropolitan city. Students nowadays bring their mobile devices to classroom and prefer to use their own devices whenever it is possible. With the advanced technology development and high connectivity to the Internet through wireless networks in school, it becomes common that students and teachers are bringing their own mobile devices (e.g. smartphones, tablet computers, and laptop computers) to classroom for personal, teaching, and learning purposes. However, it has been challenging for teachers to engage their students in classroom teaching when students bring their mobile devices to class as a distraction. How could we take the advantage of this mobile technology for our classroom teaching and learning, and enhance the student engagement in our classroom instructions? Since the choice of the technology tool heavily depends on the popularity and commonality of the tool, making a right choice of educational technology can have a high sustainability and penetration rate. In this presentation, we will present a case study in Hong Kong of how to make use of Google Drive application to engage students in the classroom activity. The pedagogical practices can be applied to K-12 and higher education. Through this study, we can observe that students are no longer locked in a classroom; instead their mind can be unlocked to accept further knowledge with advanced technology.

iafor
The International Academic Forum
www.iafor.org

Introduction

Usage of mobile technology in daily life has been developed to be a part of the cultures in many countries especially in a metropolitan city. Students nowadays bring their mobile devices to classroom and prefer to use their own devices whenever it is possible. With the advanced technology development and high connectivity to the Internet through wireless networks in school, it becomes common that students and teachers are bringing their own mobile devices (e.g. smartphones, tablet computers, and laptop computers) to classroom for personal, teaching, and learning purposes. However, it has been challenging for teachers to engage their students in classroom teaching when students bring their mobile devices to class as a distraction. How could we take the advantage of this mobile technology for our classroom teaching and learning, and enhance the student engagement in our classroom instructions? In addition, how could teachers provide a better learning activity to help students explore and discover new knowledge through their own effort? What learning activities could provide reflective experience to the students? Finally, what are the learning theories behind these practices in the classroom?

Among many current cloud-computing solutions on the Internet, Google Drive is one of the most common public cloud platforms to provide Software as a Service (SaaS). Although this software is not made to target on educational use, teachers can be creative in making use of this popular platform and turn into an educational technology easily. Google Drive supports both browser and native mobile operating systems (e.g. Apple iOS and Google Android). In my point of view, the choice of the technology tool heavily depends on the popularity and commonality of the tool. Making a right choice of educational technology can have a high sustainability and penetration rate. In my case, I intend to ask students to bring their mobile devices to use (or use the iPads provided by me) because the lecture hall is designed to have no computer. With their own mobile devices ready on hand, we can immediately engage students in my lecture. In this paper, I will discuss a recent case in my own classroom teaching of how to bring Google Drive and its application into my classroom. My lesson plan was designed based on the idea of Zone of Proximal Development (ZPD) by Lev Vygotsky, a Russian psychologist in working on sociocultural learning theory. Through the collaborative knowledge construction approach, I argue that students can be more engaging in my classroom discourse and create a learning community. With technology, I believe students are no longer locked in a classroom; instead their mind can be unlocked to accept further knowledge.

Cloud Computing as Educational Technology

As previously mentioned, Google Drive is a cloud computing platform which allows users to connect and access information through the cloud servers anywhere at any time as long as the Internet connection is provided. With wireless network connectivity, users can use their mobile devices to access their information stored on the Google Drive while on their move. Originally, Google Drive was previously called Google Doc, and it was developed so as to provide office suite applications such as word processing, spreadsheet, and presentation. A few years ago, Google has enhanced the features in this platform as a cloud storage to store these documents as well as other types of files. Thus, they have changed their name to Google Drive (Google, 2014).

One of the features Google promotes is the collaboration through the platform. In Google Drive, it allows creators to collaborate a working document with others without the synchronization issue. For example, suppose two students want to collaborate on a field trip proposal. If these students are asked to work on it separately, then they have two files existing in their own computers. When they finally want to put it together, they may realize there are duplicated ideas and it is difficult to consolidate these two separate files into one. But if they use Google Drive, they will be able to work on the same file at the same time, and they can see who is editing on which parts simultaneously. This will significantly reduce their time in collaborating on the same topic and document. More importantly, users can access to Google Drive through their smartphones or mobile devices as long as they run on Apple iOS or Google Android system.

Another way to collaborate is through the Google Form in the Drive. Google Form allows non-technology savvy to create online submission form instantly without knowing how to program with HTML codes or other languages. It provides a quick way to collect data from multiple users at the same time. When someone submits data using the pre-designed form, the data will be stored in a separate spreadsheet file as a database for further analysis. To help quickly offer instantly feedback to the form creator, Google Form also provides a "Summary of Responses" readily to present statistical figures or tables. As a teacher, I desire to gather data from my students in a classroom, and summarize their data into information so as to become knowledge. In this case, if a teacher carefully designs the lesson, Google Drive can become a powerful tool to transform data into knowledge in a collaborative approach. To take the advantage of mobile technology, I also introduce the usage of QR code into the lecture so as to embed the link of my designed form into a QR code. That way students can scan the QR code while on their site and access to the form without typing the web address to their mobile devices.

Google Drive and QR code technology are both useful and commonly known to the students. It is reasonable to assume students to be able to use the technological tool to assist their learning, rather than focusing on learning how to use the technology. Besides, teachers are able to create these tools quickly and easily anywhere they may be, and bring them to their classroom as long as the Internet connection is available. Although these tools are not originally designed for learning, teachers can easily turn them into powerful instruments for a better learning and engaging environment. In addition, it is more flexible and elastic when the technology is not particularly designed for a particular educational usage. Teachers can introduce their creativity and imagination into their teaching design and pedagogy.

The Underlying Learning Theory

Based on the learning activity designed in my lesson, there are mainly two theories behind the practice, namely the Zone of Proximal Development (ZPD) and Multiple Intelligence (M.I.). In this section, I will explain these two theories in details. The practices based on these theories will be discussed in the later section.

Zone of Proximal Development (ZPD)

In my previous work, I discussed the importance of ZPD in the learning process of children (Wong, 2014). Vygotsky believed that children quite often stay in their cognitive stage where they could solve problem independently, and he called the stage

as zone of actual development. In contrast, children sometimes could solve problems under circumstances with external supports, and Vygotsky called this stage as zone of proximal development. From this point of view, he proposed that children's learning happens when they put efforts while in the ZPD. Children cannot handle and perform tasks successfully in this zone, but they can succeed when they receive aids from peers and teachers. The following figure illustrates three different zones for children throughout their learning and cognitive process. Vygotsky proposed that children learn very little from performing tasks they can already do independently (Kozulin et. al, 2003; McDevitt & Ormrod, 2007). Instead, they develop primarily by attempting tasks they can accomplish only in collaboration with a more competent individual, which means the children attempt tasks within their zone of proximal development. In other words, when children are being challenged, this is when they can learn and acquire more knowledge.

In fact, we can design how to make sure of the understanding of children's ZPD and apply to educational practices to help children accomplish challenging tasks and activities with suitable assistance. One concept or technique is called scaffolding. Palinscar (1998) suggests that in the context of research about the negotiated nature of teaching and learning, ZPD with scaffolding is "probably one of the most used and least understood constructs to appear in contemporary educational literature" (p.370). Actually, the term scaffolding is used to "describe the guidance or structure provided by more competent individuals to help children perform tasks in their ZPD" (McDevitt & Ormrod, 2007, p.215). In fact, the scaffold is an external structure that provides support for the workers until the building is strong enough to support itself. After the building is stabilized, the scaffold becomes less necessary is removed at the end.

Crane (2014) has mentioned, "In a traditional teacher-centered classroom setting, where the role of students is reduced to objects receiving instruction from the teacher who dispenses knowledge to them, social interaction is limited to a one-way dependency. In the model developed by Vygotsky, roles of the teacher and student are interdependent and they both are subject to cognitive development. The role of a teacher is to serves as a guide or coach that provides assistance to a learner working on a challenging task within her or his ZPD. The teacher is needed to offer support, encouragement and design tasks to stimulate a learner's development." It is true that as teacher we are obligated to know how to build a scaffold for students to guide and stimulate them through a challenging but feasible task. Thus, they will learn or discover a new knowledge based on their previous understanding.

Multiple Intelligence (M.I.)

Howard Earl Gardner was born on July 11th in 1943 and is an American developmental psychologist (Chung, 2014). He came up with the theory of M.I. which has a strong impact on how school can design their curriculum and instructions targeting on the needs of individuals. The theory of M.I. by Howard Gardner is also an interesting framework to help teachers understand the intelligence among individuals. Recognizing the uniqueness of individuals can bring advantages into a classroom teaching because new knowledge can be collaboratively constructed through social interactions with technology. Without the understanding of the importance of individuals, we may wrongly design a scaffold only targeting on individual needs, rather than on the learning community as a whole where everyone

can contribute to the knowledge discovery or formation. So the theory of M.I. is particularly importance in the design of my teaching practice.

Gruenkemeyer (2014) discussed that "M.I. is a social cognitivist theory based on the belief that every person possesses eight different types of intelligence. Gardner refers to M.I. as relatively independent mental faculties. No two people have the same intellectual profile; each person uses the combination of intelligences differently. The theory recognizes a broad swathe of human capacities, including ones from the arts and from the realm of human intercourse that have traditionally been considered nonintellectual and perhaps not even cognitive." No doubt, the theory suggests that the intellectual profile is formed by multiple types of intelligence. If we design a learning activity which can gather effort and thoughts from different individuals, then we can fill in the gaps of others.

Gruenkemeyer (2014) also mentioned that, "Gardner argues that technology can be used in order to enhance and implement the M.I. theory in education. Particularly, Gardner believes that online learning opportunities are very beneficial and applicable to the M.I. theory and improve learning. The online experience is an active experience for motivated learners and is changing the way people take in information. Because of the wide range of resources available with technology, Gardner argues education can be transformed for the better, but only if the technology is used appropriately. Digital devices, according to Gardner, provide an engaging experience and can appeal to the eight different intelligences." Thus, learning collaboratively with the resources on the Internet can easily construct knowledge according to the theory of Gardner.

The Technology in Practice

In this section, I will explain how I have implemented into a real classroom teaching based on the idea of ZPD and M.I. In this semester, I am teaching a general education course "Technology, Entertainment and Mathematics" formed by 15 students coming from math major and other. The course is about finding a relationship between mathematics and the latest technology development and entertainment encounters. Most of the students probably know that calculator is an invention of mathematicians, but they may not have thought that computer science is a field contributed mainly by pioneers who were mathematicians. Instead of me presenting the historical backgrounds of these mathematicians directly, I decided to distribute a list of these mathematicians through the Google Drive and Wikipedia. Students in the lecture hall were asked to access to the list through capturing the QR codes, and four of these mathematicians linked to their Wikipedia pages were assigned to each student to read in class. Then, they were asked to summarize their profiles into the following categories, namely Gender, Name, Origin, Date of Birth, Educational Achievements (both undergraduate and graduate studies), and Major Contributions in Computer Science. The summary was submitted to my customized Google Form, and then I was able to use the "Summary of Response" to present the collaborative results statistically. From the statistics, students could see clearly that the majority of the early pioneers of computer scientists are mathematicians with degrees in mathematics. At the end, questions were asked to follow up on their reflections about the results, and students were able to agree together from their personal research experience instantly during the class.

Besides Google Drive and QR codes, I made use of mobile technology and other equipment in the designed lecture with intervention. Students were asked to bring their own mobile devices to the lecture and complete the activity by using their personal devices. I provided my department's iPads to some of these students upon their request because their own devices might be too small or not fast enough. Also, the statistical results were constantly updated and shown on the projector screen so students can immediately see their contribution to the class. From my informal observation, students kept peeking on the interim statistic to see if their contribution made any difference. Meanwhile, I encouraged the students to discuss together about their own results when they were searching the information. During the lesson, no student reported that they had any difficulty to access to the Google Drive, use the QR code through their mobile devices, access to the WiFi network, and reviewing the information on the Internet.

Critical Reflection

The lesson made use of the idea of providing the cloud-computing platform as the scaffold to assist the students to use their learned skills and knowledge about mathematicians and conclude that computer science is a theoretical and practical field contributed by the early mathematicians. Instead of having a student or the teacher to summarize and analyze the profiles on behalf of the whole intelligences, the task was distributed to each one and used their intelligence to summarize, analyze, and present to the community. To quote it again, "Gardner believes that online learning opportunities are very beneficial and applicable to the M.I. theory and improve learning" (Gruenkemeyer, 2014). One idea implied by the M.I. theory is distributive and collaborative knowledge construction. Instead of believing that someone has all necessary intelligence, the idea suggests everyone can contribute to the knowledge base somehow. Although some students could not complete reading all the profiles of mathematicians during the class, the anonymity shown on the screen could help relieve the stress of students in completing every single task.

Furthermore, the cloud computing technology allows students to access to information even when they leave the classroom. After the class, I left statistical results on the Google Drive so students could access to it after class. Although I did not keep track of who completed all the submissions or accessed it again after class, the option is available for further design of the course. In fact, I could have invited the students to continue to submission after the lecture, and generate a completed figure. Since the objective of helping students recognize the contributions of mathematicians in computer science was achieved, I decided to keep the information as it was. Nonetheless, the students were actively engaged and they participated in the learning activity without seeking for extra credit. The motivation came from their intrinsic desire to contribute to the community rather than the extrinsic bonus. I think that is a good indicator that the built scaffold is successful to assist students walk through the ZPD and become independent learners in this regard. Instead of the teacher serving as the assistant, the technology can serve as a major role in helping students complete an assigned task to build new knowledge as the outcome.

In my opinion, I believe that this activity is not suitable for students to complete individually outside of the classroom because the immediate discussion was necessary to reinforce the idea. Although it was possible to extend the distributed construction to

outside of classroom, I wanted to make sure students can instantly read the statistic and discuss with me who also serves as a major assistant role in the ZPD.

Conclusions

In the conclusion, Google Drive is mainly used in my intervention to illustrate the idea of ZPD and M.I. in the cloud environment. Originally, this cloud technology along with QR code is not originally designed particularly for education. Yet, it possesses every element that can be turned into an educational technology elastically. Certainly, some other cloud applications have been designed with pre-defined purposes, but the flexibility for customization is limited and it ends up with so many different apps for different purposes. If there was a unified platform where teachers can easily build new applications on it while commonly adopted by students using across platforms, it would be more useful and flexible. At the end, I think educational psychology is the foundation of the usage of educational technology for learning and teaching, and the underlying theories guide the designer and educators in technology-aided learning. Through this experience, we can see that simple tool can be already the simplest way for success in helping students to learn effectively.

References

Chung, J. (2014). *Howard Gardner: Multiple Intelligences*. Retrieved from: https://cgscholar.com/community/cg_community/profiles/jhoon-chung/publications/29097.

Crane, M. (2014). Lev Vygotsky: Theory of sociocultural development. Retrieved from: https://cgscholar.com/community/cg_community/profiles/malgorzata-crane/publications/30267

Kozulin, A., Gindis, B., Ageyev, V. S., & Miller, S. M. (Ed.). (2003). *Vygotsky's educational theory in cultural context*. Cambridge University Press.

McDevitt, T. M., & Ormrod, J. E. (2007). *Child development and education* (3rd ed.). Supper Saddle River, NJ: Pearson Education.

Google (2014). Retrieved from: https://support.google.com/drive/answer/2424384?hl=en

Gruenkemeyer, K. (2014). *Dr. Howard Gardner: The theory of multiple intelligences*. Retrieved from: https://cgscholar.com/community/cg_community/profiles/kaysie-gruenkemeyer/publications/28946.

Palinscar, A. S. (1998). Keeping the metaphor of scaffolding fresh – A response to C. Addison Stone's "The metaphor of scaffolding: Its utility for the field of learning disabilities". *Journal of Learning Disabilities*, 31, 370-373.

Wong, G. (2014). *Cognitive development through learning technologies: Vygotsky and his insights to our future*. Retrieved from: https://cgscholar.com/community/cg_community/profiles/ka-wai-gary-wong/publications/29563.