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A cloud-based learning environment for developing student reflection abilities

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ABSTRACT

Students learn new knowledge effectively through relevant reflection. Reflection affects how students interact with learning materials. Studies have found that good reflection abilities allow students to attain better learning motivation, comprehension, and performance. Thus, it is important to help students develop and strengthen their reflection abilities as this can enable them to engage learning materials in a meaningful manner. Face-to-face dialectical conversations are often used by instructors to facilitate student reflection. However, such conventional reflection methods are usually only usable in classroom environments, and could not be adopted for distance learning or after class. Cloud computing could be used to solve this issue. Instructor guidance and prompting for initiating reflection could be seamlessly delivered to the students' digital devices via cloud services. Thus, instructors would be able to facilitate student reflective activities even when outside the classroom. To achieve this objective, this study proposed a cloud-based reflective learning environment to assist instructors and students in developing and strengthening reflection ability during and after actual class sessions. An additional experiment was conducted to evaluate the effectiveness of the proposed approach in an industrial course. Results show that the learning environment developed by this study is able to effectively facilitate student reflection abilities and enhance their learning motivation.

1. Introduction

Enhancing student reflection is important for the teaching and learning of new knowledge or skills because reflection affects how instructors and students interact with learning materials they encounter (McNamara, 2004). From instructors' perspective, student reflection often influence their best teaching (McNamara, O'Reilly, Best, & Ozuru, 2006). Reflection also influences how instructors plan teaching strategies for new classes in order to enhance student learning motivation and performance. From the students' perspectives, the lack of reflection abilities is a higher risk that new knowledge may be built upon faulty foundations (Boyd & Fales, 1983). Additionally, psychological investigations showed that good reflection abilities would improve learning because memory or mental storage capacity could be developed through association with pre-existing knowledge or experience (Schon, 1987). Studies also indicated that good reflection abilities would enhance student motivation, comprehension, and performance in learning new knowledge or skills (Boud, Keogh, & Walker, 1985; Kemmis, 1985; Paris & Ayres, 1994). Reflection abilities may also be a critical component in the acquisition, processing, and application of new information within other contexts (Chen, Kinshuk, Wei, & Liu, 2010; Chen, Wei, Wu, & Uden, 2008).

The reasons stated above suggest that it is important to develop and strengthen student reflection abilities to help them engage new learning materials in a meaningful manner. To induce student reflection in a classroom setting, instructors usually ask students certain questions to which the students reflect and provide feedback (Chi, de Leeuw, Chiu, & Lavancher, 1994; Davis, 2000). However, engaging students in face-to-face dialectical conversation in classroom settings is not possible for instructors during remote learning or after school sessions. Cloud computing and services could provide a solution. Prompts and activities helping to induce reflection could be seamlessly delivered to students' digital devices, allowing instructors to facilitate student reflective activities even when outside the classroom.

In order to assist instructors in developing student reflection abilities and to help students attain greater learning motivation and performance, a cloud-based reflective learning environment was proposed in this study. An experiment was also conducted in an industrial course in a Taiwanese university to investigate the effectiveness of the proposed approach.

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2. Literature review

2.1. Reflection

Since information explosion leads students always browse through on Internet, this phenomenon could affect their thinking and further influence their learning performance. Therefore, promoting students' reflection on their learning and behavior is currently a major educational goal in higher education. The concept of reflection was first proposed by John Dewey in 1933 (Dewey, 1933), which is defined as repeated thinking, searching, observation, and understanding toward problems, surrounding environments, or causal relationships. Reflection is described as a process of active, persistent and careful consideration that aims to construct individual knowledge and meaning by using personal experiences, perceptions, and beliefs (Carver & Scheier, 1998). The process would be initiated through personal experience, thinking, comprehension and awareness, so that people would be able to survey, explore, and evaluate issues, opinions, feelings, and behaviors they encounter (Ward & McCotter, 2004). Reflection is also regarded as a useful learning process that can help students express and evaluate their attitudes and feelings, expand their learning cognition, and increase the comprehension of their own thinking (Chirema, 2007; Ladewski, Krajcik, & Palincsar, 2007). Through individual inquiry and socially interact with others, reflection can lead students' thinking from surface to deep level (Moon, 2004; van den Boom, Paas, & van Merriënboer, 2007).

From a teaching perspective, Schon (1987) divided reflection into two major frameworks, which are reflection-on-action and reflection-in-action. Reflection which occurs after teaching or during the interval before planning and thinking would be reflection-on-action. On the other hand, reflection-in-action would be the adjustments of personal teaching methods and feedback responses that occur during the teaching process. From the learning perspective, reflection would provide opportunities to stimulate students to examine knowledge they have learned (Etkina et al., 2010; Jou & Shiau, 2012).

To prompt and guide student knowledge construction, researchers recommended instructors to use different types of questions (Chen et al., 2008; Lee & Chen, 2009). King (1994) used three types of questions to help students construct individual knowledge, which are questions on memory, comprehension, and connection. Students would gradually enhance their cognition and comprehension as they progress from lower-level (memory) questions based on factual knowledge to higher-level (connection) questions based on reflective practices. The literature review also indicated that higher-level questions would facilitate reflection and could result in better understanding and higher learning performances (Redfield & Rousseau, 1981; Roscoe & Chi, 2008).

2.2. Cloud computing

During the last two years, cloud computing has become an increasingly popular phenomenon in every field. Cloud computing currently includes a series of hardware and software service provided via the Internet (Venters & Whitley, 2012). Since applications and user data would be stored remotely on cloud servers, users can seamlessly access cloud services and applications by using any digital device with an internet connection. In other words, cloud computing can enable users to access, process, share, and store information via the Internet from any location or device (Lin, Fu, Zhu, & Dasmalchi, 2009). In traditional IT systems, user productivity may be restricted since personal information was exclusive to specific applications, services or devices (Sang & Sung, 2013). However, these obstacles would be overcome by cloud computing since it can provide services to users seamlessly. Therefore, cloud services would make users more efficient, help facilitate collaboration with their peers, and give users seamless access to their information anytime and anywhere from any digital device (Marston, Li, Bandyopadhyay, Zhang, & Ghalsasi, 2011).

Cloud computing would be highly practical in education for both instructors and students. The technology allows instructors and students to access powerful services and massive computing resources wherever and whenever they needed, including various useful applications, services, and tools which are provided freely and openly to instructors and students (Jou & Wang, 2013). Since one of the feature of cloud computing is enable software as a service (SaaS), rather than as a standalone program. Therefore, the interconnectivity feature of cloud computing would allow instructors to administer entire learning processes easily and conveniently, allowing students to learn effectively (Paul, Chen, & Gloria, 2010). Additionally, cloud computing offers a potential way to enable instructors and students to conduct formal lessons even without a standard indoor classroom since the cloud services allow them to share their data with anyone, anywhere, and at anytime (Astrid, Paul, Carol, & Jordana, 2012).

2.3. Influence of web-based learning instrument on learning

Generally, the online learning environment is suitable to offer opportunities for reflection. It is useful for students to construct individual knowledge if appropriate learning services can be applied to assist them in concentrating on learning and guiding their engagement in reflection (Lamy & Goodfellow, 1999; Yang, 2010). To date, several web-based applications or services have been proposed to support various classroom activities including reflection activities (Huang, Lin, & Cheng, 2009; Jou, Chuang, & Wu, 2010; Lin, Tan, Kinshuk, & Huang, 2010). However, most of these services are novel or stand-alone programs. This means that users (instructors and students) have to spend additional time and efforts to familiarize themselves with these new tools. Users may be required to install additional programs on their own devices or register as a new user, which would negatively affect the motivation for using these services to support specific educational contexts (Lin, Lin, & Huang, 2011).

However, the age of cloud computing saw other web applications such as SkyDrive, Evernote, DropBox, and Google Apps being developed. Different from traditional web pages and applications, such cloud computing applications offer SaaS to users who can use various digital devices to apply these services openly and freely. Users today are inundated with a myriad of web applications that provide friendly user interfaces and powerful functions in the cloud. Therefore, many instructors and students were already using these cloud applications in their daily lives (Lin & Jou, 2012). These observations compelled several researches to suggest that these modern web applications could be a new way of engaging participants in meaningful teaching and learning activities (Alexander, 2006; Hughes, 2009; Schneckenberg, Ehlers, & Adelsberger, 2011; Thompson, 2007; Wang, Woo, Quek, Yang, & Liu, 2012). Most of both instructors and students would be more motivated in using these applications in an educational context since they already have the necessary technical skills (Dohn, 2009). Therefore, they would only need to learn how to apply these applications in supporting educational activities for their classes (Pretlow & Jayroe, 2010). Previous studies also found that participants who take part in a web-enhanced class outperformed those who underwent traditional lectures (Crook & Harrison, 2008; Hamann & Wilson, 2003). Effective use of web applications can also blur the boundaries between formal and informal learning (Bennett, Bishop, Dalgarno, Waycott, & Kennedy, 2012).