MODELLING TEACHER PRACTICES TO APPLY LEARNING ANALYTICS AS A METACOGNITIVE TOOL IN LEARNING TO ENHANCE STUDENT SUCCESS

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Abstract

In the contemporary context, adoption of educational technologies has become inevitable. In virtual learning environments, teachers are not only exploring new ways of teaching, e.g. blended or online, but also incorporating various tools and strategies in order to facilitate the learning/teaching process. Learning analytics has received a lot of attention as it offers a support to teachers in monitoring students' performance and making decisions regarding pedagogical approaches and techniques that would enhance learning and fulfil students' realtime needs. In this research, a case study of university online or blended learning courses investigates the usage of learning analytics as a metacognitive tool to analyse how teaching and learning as well as learning design may be improved in order to enhance student success.

Keywords: Blended Learning, Case Study, Learning Analytics, Metacognition, Moodle, Online learning, Virtual Learning Environment.

Introduction

The significance of online and blended learning has recently increased dramatically. However, teaching and learning in virtual learning environments is much different than in traditional face-to-face educational settings, and often it might be even more challenging on both students and teachers (Bennet & Lockyer, 2004; Oliver, 2001).Thus, teachers are obliged to explore the possibilities and features of virtual learning environments in order to create a coherent and comprehensive learning experience for students. Despite the fact that learning analytics (LA, henceforth) is quite a new phenomenon, its application has become a rather common practice within educational institutions that are trying to improve study experiences, raise overall quality of studies, increase students' motivation and learning success, and, finally, reduce drop-out rates. Besides, the application of

learning analytics can provide a comprehensive understanding of how teaching and learning processes work (Czerkawski, 2015). Taking into consideration the fact that many universities are moving towards online and blended learning, the main goal of this research is to examine the usage of LA as a metacognitive tool to analyse how teaching and learning, as well as learning design may be enhanced.

Learning Analytics for Enhancing Teaching and Learning

To begin with, it is important to briefly explain the concept of learning analytics. One of the early attempts to explain the concept was made by researcher Siemens (2010), who claimed that LA is basically usage of data which is produced by learners in order to attain information that can be used to enhance the learning experience for the learners. Researchers Long and Siemens (2011) state: "learning analytics is the measurement, collection, analysis, and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs". In other words, LA can be described as a method used for evaluation and analysis of learner-produced data, attained from a virtual learning environment, in order to facilitate and to enhance learning and teaching processes.

Also, there is another way to explain the phenomenon of LA. For instance, the concept of LA can be understood in terms of its objectives. Researchers Diaz and Brown (2012) suggest that LA is all about collection, analysis, and interpretation of data that is either produced by or associated with learners and the learning environments where the learning process takes place. Here, the emphasis is laid on LA as a tool for observation and monitoring of learners' activities and progress, which enables teachers to predict learning outcomes (Diaz & Brown, 2012). LA provides teachers with the possibility to examine learners and detect any subjects that the learner is or will be struggling with, then teachers can take certain steps to address these issues (Leitner, Khalil, & Ebner, 2017; Gasevic, Dawson, & Siemens, 2015; Greller & Drachsler, 2012; Fritz, 2011; Dietz-Uhler & Hurn, 2013). Indeed, application of LA may be rather beneficial when trying to improve learning and teaching (Diaz & Brown, 2012). LA can assist teachers in adjusting didactic content or approach, providing feedback, and selecting proper communicative strategies with the learners, especially with those who are at higher risk of dropout (Martin & Whitmer, 2015; Kim et al., 2016). Consequently, it can be stated that LA can be a rather useful tool for monitoring a learner's progress and finding solutions to educational problems such as high drop-out rates, poor students' performance, and learning design.

LA helps to understand learning and teaching processes in virtual learning environments (Czerkawski, 2015), which may be rather different from learning in face-to-face classrooms. Besides, application of LA may increase a teacher's awareness of a number of

educational practices and support the development of various strategies that would help to enhance those learning and teaching processes (Siemens & Gasevic, 2012). In fact, application of LA may assist teachers in designing curriculum or selecting adequate teaching methods and techniques that would fulfil the learners' needs, and, finally, it may ease the transition from more teacher-oriented to a more learner-centred approach (Chatti, et al., 2012; van Harmelen & Workman, 2012; Siemens, 2015). Besides, some studies have revealed the fact that teachers often face some difficulties in designing course curriculum that would provide students with a coherent learning experience (Bennet & Lockyer, 2004). Taking into consideration the fact that LA is gathering learner-produced information from contexts where the learning process takes place, application of LA may support teachers in the development of course curriculum that would benefit learners by fulfilling their real-time needs, thus, it can be claimed that LA promotes the idea of personalized learning. Nonetheless, in order to design online courses for personalized learning, teachers have to demonstrate certain competencies and be familiar with the various features of a virtual learning environment, including LA (Salmon, 2000).

As already mentioned, LA assists teachers in monitoring a learner's progress and providing feedback. Considering the fact that learning/teaching and assessment processes are interrelated, teachers can use LA for the purposes of assessment, especially assessment for learning (AfL, henceforth), which aims at promoting learning. AfL not only encompasses such characteristics as metacognition, constructivist thinking, and collaboration (Swaffield, 2011), but it also strongly relies on data collection about the students' learning in a manner of feedback (Klenowski, 2009), which should be strictly directed to students' assignments and their learning process rather than leave any gap for false interpretations (Hattie & Jaeger, 1998). As Black and William (2009) note "evidence about student achievement is elicited, interpreted, and used by teachers, learners, or their peers, to make decisions about the next steps in instruction that are likely to be better, or better founded, than the decisions they would have taken in the absence of the evidence that was elicited" (p.10). Consequently, it can be stated that the application of LA techniques can be useful for implementing assessment strategies that would enhance learning.

Metacognition and Teaching

As it can be observed in the educational scholarly literature on online learning, perceptions of learning, effective learning, collaboration, self-directed or self-regulated and personalized learning have become of crucial importance. It should be noted that metacognition can be considered to be an inseparable part of the aforementioned and a critical element of successful learning because it deals with the self-regulation and self-reflection of a learning process (Medina et al., 2017). Metacognition is considered to play a

key role in supporting both students in their learning and teachers who are directing the teaching/learning process (Akpunar, 2011). Some authors support the idea that LA can be used as a metacognitive tool, which allows for reflecting on teaching/learning and developing metacognitive skills in both teachers and students (Durall & Gros, 2014).

Flavell (1979) introduced the term of metacognition and explained that it is a phenomenon which includes active control over cognitive processes in learning in two different ways such as one's thinking and learning and a critical awareness of oneself as thinker and learner. At first, metacognition was investigated in the field of developmental psychology (Baker & Brown, 1984; Flavell, 1987); later, researchers started exploring the phenomenon while looking at how educational experts engaged in metacognitive thinking and how metacognition can be used to enhance learning (Hatano et al., 1986). Furthermore, it should be noted that metacognition comprises two elements, such as a metacognitive experience and metacognitive knowledge, which refers to knowledge about certain cognitive processes and knowledge, controlling a variety of different cognitive processes (Flavell, 1979; 1987). Cognitive processes are dealing with the application of various strategies, including organizing, monitoring, and adapting; in the meantime, metacognitive processes are concerned with the monitoring and regulating of cognition (Pintrich, 2002).

Another interesting fact that should be mentioned is that there is a link between metacognition and critical thinking (Medina et al., 2017). Metacognitive strategies are necessary for the development of critical thinking skills (Halpern, 1998) because these strategies are used to control the thinking process (Medina et al., 2017). As a result, critical thinkers become responsible for their thinking process. To illustrate, critical thinkers employ various cognitive strategies to solve problems in a more efficient way; consequently, it can be stated that there is an awareness of control of the cognitive process (Halpern, 1998; Hessels-Schlatter et al., 2017). Thus, it is obvious that metacognition is related to critical thinking because metacognitive strategies are used to manage the thinking process.

When talking about metacognition in teaching, researcher Griffith (2017) has indicated that teachers should think about teaching and learners in a very systematic manner and also participate in a so-called "metacognitive decision-making" process which may result in more fruitful and appropriate didactic decisions. The fact that teachers are constantly re-thinking their pedagogical knowledge and pedagogical content knowledge enables them to improve their teaching expertise and choose most appropriate didactic approach and methods (Griffith, 2017). It is rather important for teachers to understand their beliefs, objectives, and knowledge about planning, assessing, and revising because this helps to

develop skills and knowledge to make fruitful decisions regarding teaching (Griffith & Bauml, 2016). Metacognitive decision-making in teaching includes identifying, drawing attention to, reflecting on, and evaluating teaching decisions and is the act of raising awareness about specific teaching decisions and the reasons behind those decisions (Griffith & Bauml, 2016). Therefore, metacognition can be treated as an inseparable part of the teaching process.

Methodology

Case study

A method of case study has been selected in order to reach the aim of the research, which is formulated as follows, to evaluate the usage of LA as a metacognitive tool to enhance students' learning success and to reveal teacher practices in using LA in the teaching process. Application of a case study research enables researchers to thoroughly examine teacher practices in using LA to design online or blended study courses. Besides, it should be mentioned that the research attempts to examine the usage of LA to increase the learner's metacognitive activities.

The research aims at providing answers to the following research questions:

5. Which data from learning analytics tools and which teacher metacognitive strategies may help to improve teaching and learning?

6. Which teacher metacognitive strategies, based on LA data, may help to improve learning design?

7. How can teachers create learner metacognitive strategies to improve the learning process?

8. How can teachers create learner metacognitive strategies to improve learning design?

9. Which Moodle tools are most reflected in case studies and teacher interviews in terms of creating metacognitive strategies?

Data Collection

The data has been collected in semi-structured interviews with teachers and through observation and examination of 12 study courses in social sciences and humanities in Moodle.

Research Sample

A total of 12 online and blended study courses that are taught at the university level for degree studies or continuous professional development (CPD) with allocation of study credits upon their completion have been chosen for the analysis to examine the way teachers apply LA to enhance learning and teaching. The study courses have been selected in regards to the following criteria: first, the course has to be either blended or online, then, the teacher agrees to share the contents of the course for the research purposes, teacher uses LA in the course, metacognitive strategies have been applied and are evident in the virtual learning environment, and, finally, the teacher has at least 5 years of experience in blended teaching.

Findings

The study has revealed the fact that metacognition is often used in order to increase awareness of the students and to facilitate or enhance learning and teaching processes.

Metacognitive Activities

There is a lot of evidence of metacognitive activities in the analysed courses. Usually, both teacher and student metacognitive activities can be observed in the recordings of the lecture, synchronous online meeting activities, and course assignments.

Metacognitive Strategies

Teachers often apply metacognitive strategies when there is a need to establish a safe learning environment for students, to better understand what type of learners they are, and to learn about their learning needs and expectations. To illustrate, at the beginning of the semester, several teachers have asked students to introduce themselves in either the discussion forum, during video lectures or by preparing a short slide presentation:

> *"Students not only have to introduce themselves in the first session, but also present themselves on the Moodle platform, in the study subject environment. It helps to create a sense of community between the members of the group and allows me to meet their learning needs by choosing the right direction for their homework." (from the interview with teacher 2)*

Profile Information

The research has shown that teachers often check a learner's Moodle profile information, which can be edited by the learners, and use log data, including access logs to Moodle and the time spent, and resources accessed in order to learn about how attentive a student is to learning the material:

> *"However, here the data from Moodle logs was of great help, looking at the reasons why students failed at some of the assignments, trying to establish the link with the resources accessed (if they study resources provided in the course or not) and with their attendance in synchronous lectures or review of their records." (from the interview with teacher 1)*

Learning Design

The research has indicated that in trying to improve learning design, teachers spend a lot of time planning, selecting the material, types of assignments, and providing relevant information, including goals to be achieved, deadlines, assignments and criteria for assessment, and learning outcomes, in a very structured and clear way. The frequency and style of presentation of this kind of information depend on the individual teacher. For instance, some teachers provide a course plan with scheduled activities, learning objectives, outcomes and evaluation criteria as a part of course description, while others tend to provide students with learning objectives and tasks on weekly basis:

Week 4. Solutions. Objectives:
1. Finding and describing solution
2. Finishing a presentation
3. Reporting on events. Paraphrasing practice
Submit:
1. Presentation 1. <u>First draft with voiceover due</u>
2. Test 4

Figure 1. Example of Planning Activities in the Study Course on Moodle

Monitoring Performance

Another important thing that the research has indicated is the importance of monitoring a student's performance through various Moodle tools because it enables teachers to identify, in realtime, the problems and difficulties, students are dealing with, and to come up with ways to improve learning design to better serve the learner's needs. The research has also suggested that teachers are actively using various internal Moodle tools such as discussion forums, logs, the activity completion tool, task assessment tools, progress bar, and calendar, as well as external tools, including Adobe Connect, Google docs, Padlet, and mapping tools in order to improve learning and teaching. However, some teachers note that students often do not evaluate the potential benefits of the progress bar, which would allow them to track their progress during their learning process and make them more autonomous and responsible:

> *"Only a few students took advantage of the progress bar. And it was probably because they were not presented with its benefits but left to their free choice to use or not" (from the interview with teacher 2).*

Also, it should be mentioned that discussion forums have received a lot of credit when it comes to following students' progress. As a result, discussion forums can be rather beneficial in creating metacognitive learning strategies for students because the teacher can monitor student involvement and participation.

Feedback

The research has emphasized the importance of feedback provisions. In addition to continuous monitoring of a students' learning process, feedback plays a key role in fostering learner's learning:

> *"When a student reads another's work and provides feedback, he or she begins to re-evaluate his or her own work, thinks how he or she can better present, and often improves it. In this way, it is a dual benefit for the colleague and himself and a great responsibility that forces him to analyse deeper the subject and develop as learner." (from the interview with teacher 2)*

In fact, feedback can serve a double purpose, e.g. feedback from both peer-students and the teacher helps learners in their learning process, while feedback from students to teacher can be used to improve learning design. Finally, the research has shown that the student's learning can be improved significantly if the teacher establishes the links between the assignments and learning outcomes, whereas, feedback is provided in accordance to clearly listed evaluation criteria.

Conclusions

In short, metacognitive activities can be traced in all the courses analysed, e.g. in the recordings of the lectures, synchronous online activities, and various course assignments. The research has also shown that teachers apply metacognitive strategies when there is a need to establish a relationship between students and teachers, to find out more about students, and, overall, to create a friendly learning atmosphere. Furthermore, LA as metacognitive tool is often used to monitor students' progress and to evaluate how attentive they are to learning material. For that reason, teachers check students profile information and log data on regular basis. LA has enabled the monitoring of students' performances through a number of different tools, including internal Moodle tools such as discussion forums, logs, the activity completion tool, task assessment tools, progress bar,

and calendar, as well as external tools, including Adobe Connect, Google docs, Padlet, and mapping tools. The usage of such tools supports teachers in identifying real-time problems that students are facing, and improving learning design to enhance learning experience. Finally, the research has revealed that the provision of feedback becomes rather significant because it may facilitate student learning as well as assisting teachers in improving learning design to suit learners' needs better.

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