A New Approach for Assessing Learners in an Online Problem Based Learning Environment

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ABSTRACT

Problem-based learning (PBL) is an approach that improves students’ skills in problem solving. The application of PBL as an approach of teaching in a class requires students’ presence; such constraint cannot be fulfilled by all students. Therefore, it is important to avoid this problem by implementing an online PBL environment where students are grouped remotely and work together to solve a problem proposed by the teacher. This will guide the learning process of the learners and can evaluate their solution. In reality, we can find members who do not really contribute to solve a problem. From this point of view, the teacher’s evaluation will not be adequate to estimate the contribution of the learner in the solution of a given problem. Therefore, it is important to think of another way for assessing learners’ solution. So, the challenge is to implement an online PBL environment and to propose a new method for assessing students. In this paper, the authors present their system called Problearn. The developed system allows students to solve problems remotely in small groups. Furthermore, the system evaluates each student based on his behavioral profiles during the problem-solving process. To do so, the system must keep track of different actions carried out by the students. This system has been tested by students of a computer science department where they achieved very good results.

KEYWORDS

Assessment, Behavioral Profile, Collaboration, Learning, PBL, Problem

1. INTRODUCTION

In the last decade, the Problem Based Learning (PBL) approach has been widely applied in different fields such as medicine (Barrows, 1996), nursing (Shin & Kim, 2013), microfluidics (Bridle et al., 2016), engineering (Akili, 2011), accounting (Hansen, 2006), architecture (Bridges, 2007), etc. PBL is a teaching style in which a student is involved as an active individual in the learning process instead of receiving information from the teacher as in the traditional methods. In this approach, students are
engaged to solve authentic problems with the presence of a teacher who plays the role of a facilitator (Hmelo-Silver & Barrows, 2006). The teacher has the ability to guide and help students to learn something (Chng et al., 2011). In PBL, learners can use previous knowledge in order to solve new problems and therefore can develop their skills through the search for a solution of a proposed problem.

It originally appeared in medical area to enable students to develop clinical reasoning and skills (Barrows, 1986). In this approach, students work on collaboration in small groups where discussion is important (Ng et al., 2014) to find a common solution to the proposed problem. The collaborative learning in the PBL process can be seen as more important for determining students’ achievement compared to individual study (Yew & Schmidt, 2012). Several studies divided the problem based learning process into three phases, started by a problem analysis, then the phase of self-directed learning and the last phase is called a reporting phase (Yew & Schmidt, 2009). In these environments, students work in groups of two or more to exchange information and ideas and find solutions to problems (Jagadish, 2014).

Problems are important concepts in the PBL and are usually the starting point of all the PBL processes (Hung et al., 2013). A good quality problem is important for successful learning in problem-based learning (Keshk et al., 2016). By proposing them, students start the process of learning. The problem should create a challenge that allows mobilizing the previous ideas of the learners and generating questions that lead to the search for new ideas and knowledge (Keshk et al., 2016). Thus, a good specification of a problem allows students to better benefit from their learning.

Over the last years, Information and Communication Technologies (ICT) have been strengthened and therefore E-learning has become an important mean in the field of education (Ruiz et al., 2006), which can help learners to learn without moving. PBL is based on the fact that the learners can learn by resolving problems; this learning method can be performed online. In fact, E-learning offers many advantages for both learners and teachers. Association between E-learning and problem-based learning method can give birth to the online PBL, which allows students in the same group to interact and collaborate with each other to solve a proposed problem. In order to ensure this remote collaboration, students can use developed tools to guarantee online communication. This latter can be asynchronous such as forum, e-mail or synchronous such as chat (Ioannou et al., 2015).

At the end of the PBL process, students must submit an answer or solution to the problem proposed by the teacher. The evaluation of this solution can be done by the teacher himself or done automatically by the system (Bey & Bensebaa, 2013). In PBL, the evaluation of the students is done based on the solution proposed by the group and concerns all the members of the group (the whole group). But, did all group members contribute in the same way in the process of solving a given problem? In reality, we can find students who did not really contribute in the solution and we can even find that some of them did not take any action. So, how to estimate the participation of each learner in solving a problem? And before that, what is the structure of a problem in PBL process?

In order to answer these questions, in this work we propose a new way to evaluate the participation of each student in the process of solving a problem by taking into account the traces of students given answers to the problems.

In this paper, we propose a new method for assessing learners in an online PBL environment. This new method allows the evaluation of the participation of each member of a group in the resolution of an algorithmic problem. In this evaluation, we have focused on the behavioral profile of each student by tracking different actions carried out by him when collaborating or/and communicating during the problem solving process. All these actions will be stored by the system. Also, we present a new structure of a problem that can be used for many purposes.

The rest of the paper is organized as follows. In Section 2, we talk briefly about the PBL approach and then we give some related works on the problem-based learning. In section 3, we present the architecture of Problearn environment with detailed explanation of the proposed evaluation method. This system has been tested by students of the Computer Science Department at the University of
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