On Exploring the Problem-Based Learning Method of General Education Course

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Abstract. With rote study in traditional education increasingly inefficient, problem-based learning (PBL) is proposed as a novel approach to enhance efficiency of teaching and learning. Based on the dynamic data collection, we divided the teaching procedure into three stages. Meanwhile, we analysed the influence factors during students’ learning process and formed a problem design framework. The higher degree of students’ academic performance and satisfaction through the general education course “Internet plus and Smart Economy”, has truly proved the glamour of PBL. This paper concludes that PBL sets a good example to shift educators from pure imputers to facilitators, students from passive listeners to active learners, it proposes a novel approach to explore the problem-based learning method of general education course.

Introduction

PBL is designed to aid educators in all disciplines to design and develop effective PBL materials and become skillful coaches in classrooms and education settings. PBL is underway in a number of U.S. leading business schools [1]. The typical PBL model challenges students to work in a team, solving complex, unstructured business problems together. The role of the instructor shifts from pure presenter to a facilitator, motivator, enabler, coach or even psychological expert. An important goal in this approach is to develop skills in problem definition, given only a ‘scenario’ and a set of ‘symptoms.’ Once students recognize the nature of the problem they see what domains of business knowledge are relevant. With faculty coaching, problems are more likely to be pointed in the right direction through tutorials, discussions, and self-study. Proponents of PBL claim its advantage to be that since learning is goal-oriented, the learning is deeper [2]. With PBL, students are challenged to defend their problem specification through oral presentations as well as cogent writing, and to learn theory with a critical eye towards its applicability.

PBL is very different from traditional teaching in that teachers’ roles change from givers of information to facilitators, which may be a difficult transition for many teachers. In a PBL classroom, teachers “facilitate discussion, provide coaching, encourage students to think independently and manage group work”. In the PBL model, students are intellectually challenged to first define problems and then search for relevant theory [3] [4]. The goal of this project is to combine the case-oriented PBL approach with a competitive game. By itself, the case study approach is a highly effective and pedagogical mode, but what the game approach offers far exceeds this. It has been repeatedly verified that the use of simulation games in business education helps to enhance students’ learning of both theory and its application.

In PBL, the teacher functions as a facilitator and guides students through the learning process. The learning climate promoted by PBL allows students to make choices and assume more responsibilities for their own learning [5]. In addition to promoting this autonomy, students who work in PBL groups often share the same goal, feel supported, value the learning, become more competent, and are more likely to persevere when facing learning challenges. Studies suggest that PBL has the potential to
improve students’ higher-order thinking skills, comprehension and application of knowledge, learning attitudes and motivation [6] [7].

This paper describes the pedagogical experience in one application of PBL in the teaching of Internet plus and Smart Economy in the undergraduate general education program at Shanghai University of Finance and Economics. Students are intellectually challenged to define and decompose problems in the teaching process.

**Method**

In order to solve problems students are stimulated to look themselves for appropriate methods, which determine their information requirements. Their ‘learning-by-doing’ process is supported by timely feedback on their intended Smart Economy strategy. Even before the class starts they can adapt their collaborative teams, to make strategic, tactical, and operational decisions. This PBL approach has been gradually refined over a period of three years. We present first results on evaluating its effectiveness.

In the era of general education, PBL has important characteristics and innovative value in technology and teaching application. Problem-based education is realized in the classroom teaching. The evaluation of learning is instantaneous, and the data acquisition and evaluation can be run through the whole process of pre-class, in-class and after-class. Based on the dynamic data collection, analysis of learning behavior and learning diagnosis, evaluation and feedback can be reconstructed on the spot. The interaction between teachers and students, students and students, can create barrier-free communication. According to the record and analysis of learning behavior data, it can meet both the personalized and diversified learning needs of students.

In the stage of pre-class, the teaching activities include teaching design and preview; in the stage of in-class, the teaching activities include problem import, inquiry learning, assessment, teaching analysis, and summary; in the stage of after-class, the teaching activities include homework and evaluation.

The PBL general education course teaching procedure covers many links in the whole process of pre-class, in-class and after-class. Teachers, students, and administrators could get involved in any process if necessary. It describes the teaching and learning process involved in behavior and activity, includes the state of the operation of the teaching system. The results provide a comprehensive basis for analyzing and improving the teaching and learning process.

According to educational data, it helps us interpret classroom teaching and learning process, and data-driven decision-making can carry out to analyze students' situation and track the students' learning behavior, therefore improving teachers' teaching and optimizing learning process.

**Research Framework**

The learning process is a complex process, which is influenced by many factors. Students' academic level is affected by their physical and mental status and their cognitive structure, learning strategies, learning styles, learning motivation and external environment. It is difficult to reconcile the multi-factors in traditional classroom teaching process. Therefore, it is necessary to design the research framework from the aspects of influencing factors analysis, data acquisition, modeling, analysis process, analysis results and so on, so as to establish an overall framework of the PBL general education classroom [8].

The analysis of the influencing factors of the PBL general education classroom learning can be considered from many different perspectives, such as the whole process and all-round data analysis based on pre-class, in-class and after-class, and the data-based decision-making, real-time evaluation, three-dimensional interaction. Based on the analysis of the role of the main factors such as teaching, learning and management in the process of classroom teaching, here we describe the problem design framework of general education course from the teaching design process, learning activities process
and learning results to select three levels of learning factors to analyze, forming the overall framework of the PBL general education [7].

According to the characteristics of Internet plus and Smart Economy in the undergraduate general education, we choose the teaching design process, learning process and achievement as the main process to form the problem design framework, the problem design framework is shown in Fig. 1.

Classroom teaching is designed to promote students' learning. According to students' characteristics and learning needs, learning resources, learning environment and problem design are effectively integrated to establish a process of solving teaching problems. Therefore, it can be analyzed from students' characteristics, learning goals and tasks, teaching situation and teaching strategies. A brief analysis is composed of factors affecting the teaching and learning process. In the process of learning activities, the study is explored from five aspects: the analysis of students' subjective behavior, objective behavior, path of students' behavior, relevance of students' behavior and problem relevance. For example, a teacher who identifies him/herself as student-centered is more likely to implement PBL. Teachers might do professional development in PBL due to curiosity or wanting to learn more for one’s own personal growth, or to fulfill the requirement for continuing education units.

Factors affect students' learning process. On this basis, the study results are analyzed, including student performance prediction, learning evaluation and analysis, forming a data mining analysis framework based on general education classroom.

**Discussion**

In PBL courses, students work with classmates to solve complex and authentic problems, which helps develop content knowledge as well as problem-solving, reasoning, communication, and self-assessment skills. These problems also help to maintain students’ interest in course material because students realize that they are learning the skills which benefits success in the field. Almost any course can incorporate PBL, and most faculty and students consider the benefits to be substantial [11].

Students must learn to be conscious of what information they already know about the problem, what information they need to know to solve the problem, and the strategies to use to solve the problem. Being able to articulate such thoughts helps students become more effective problem-solvers and self-directed learners.
The teachers' inquiry strategies, guide exploration, and help students clarify and pursue their research questions, they play a critical role in helping students become self-directed learners and create a classroom environment in which students receive systematic instruction in conceptual, strategic, and reflective reasoning in the context of a discipline that will ultimately make them more successful. Some researchers suggest that teachers “give voice to metacognitive questions” and “insert them into the classroom dialog so that students learn to attend to them, appreciate their utility, and then adopt their use as they become increasingly independent and self-directed” [4] [11].

Teamwork is also an essential aspect of PBL, teamwork boosts communication skills and students’ ability to manage group dynamics. Teamwork is interesting and motivating for students because they become actively involved in the work and are held accountable for their actions by group members. For these reasons, teamwork can enhance student achievement. However, groups do not always work effectively without guidance. Usually the teacher facilitates and monitors group interactions because many students have not been taught how to work effectively in groups. Well-designed, open-ended problems that require the input and skills of all team members are also essential to positive teamwork experiences [7] [8].

Internet plus and Smart Economy in the undergraduate general education program at Shanghai University of Finance and Economics is quite different from the structure of traditional lecture courses. We suggest that the first class meetings in a PBL course include brainstorming sessions in which issues central to the course are identified. Alternatively, the instructor can create an extensive list of topics and ask students to focus on those topics that seem most interesting. Based on student input about course topics, the teachers point out ill-structured problems. Students then work on the problems in groups of three to five students, depending on the number of students in the course.

For example, one of the first decisions to be made is to forecast the intelligence level of smart economy. Each team should be prepared to give a 10 to 15 minutes formal presentation. It must include a description of the team’s analysis and solution and an explanation of what worked during the discussion.

We give some rules for their meetings because they are proven to be efficient if they write down issues such as: ideas, fact you know, facts you need to find, learning issues and last but not least action items and dates [9] [10].

After problems have been created and even implemented in the curriculum, they should be revised and improved, as needed.

In addition, PBL can provide an element of competition that also arouses motivation to learn. To add further to the competitive atmosphere, we created awards for student teams to try to achieve while in Internet plus and Smart Economy class. An important feature in assuring that students understand the expected level of effort and performance is to provide a grading rubric. In all, each student team must hand in several problem before the class starts, and a report after the class has finished.

Furthermore, we developed baseline solutions so as to enable objective assessment of student performance. It shows how we assess the forecast accuracy of each student team. It should be noted that we do not hand over the exact number of forecast errors but only provide a general feedback, i.e. whether the students underestimated or overestimated the real demand.

The assessment of the effectiveness of the PBL-approach involves three measures. All undergraduates were asked to complete the survey instrument but participation was voluntary. Feedback is recorded via peer review in several ways [11] [12].

Pre-class and after-class measures provided by students: The first questionnaire was administered at the beginning of the semester. We tried to get a picture about: knowledge and problem-solving skills accomplished prior to the class, preferred teaching styles, and the degree of satisfaction both in former and in the current general education course.

Unfortunately, assessment of PBL is poorly addressed in the research literature. Most studies compare students who have undergone PBL curricula with those who have not by using traditional measures, which tend to be almost exclusively content-oriented.
PBL assessments should be authentic, which is to say that they should be structured so that students can display their understanding of problems and their solutions in contextually-meaningful ways. Clearly, multiple-choice assessments and even short-answer or essay questions that require rote repetition of facts will be of little value in assessing the extent to which students have internalized holistic approaches to complex problems.

Conclusions
The use of the PBL in the teaching of Internet plus and Smart Economy in the undergraduate general education program at Shanghai University of Finance and Economics and this general pedagogical approach are still in development, preliminary indications are that it significantly facilitates student learning. Students are intellectually challenged to first define problems and then search for relevant theory. By itself this is an effective pedagogical technique. To sum up, students appear to prefer a teaching style that starts by explaining methods, exemplifying them in the next steps and then giving relevant assignments. According to the teaching style that starts by letting students identify problems and then giving them the opportunity to find possible solutions, we have observed that students have some difficulty applying the know-how learned in technical briefings.

Process-oriented objectives can be difficult to articulate, although they constitute the “hidden curriculum” of most courses. We want students to understand concepts, formulas, and skills which constitute the knowledge base of a discipline or profession. But we also want them to recognize the kinds of problems embraced by specific disciplines and professions, and the means by which practitioners go about solving them. Process-oriented objectives are those that relate to how practitioners of a discipline or profession think about and solve problems within a certain field [12].

Students learn best by constructing solutions to open-ended, complex, and problematic activities with classmates, rather than listening passively to lectures. These types of activities promote discussions among group members and motivate students to learn more. Creating ill-structured problems takes time and creativity but can be extremely rewarding when students achieve their learning goals. Use of team penalty killing motivates students to learn, by virtue of PBL orientation.

PBL builds students’ confidence in their problem solving skills and strives to make them self-directed learners. These skills can put PBL students at an advantage in future courses and in their careers [9]. While such confidence does not come immediately, it can be fostered by good instruction. Teachers who provide a good learning community in the classroom, with positive teacher-student and student-student relationships, can develop relevant and meaningful problems and learning methods, help students shape a sense of ownership over their learning, and empower students with valuable skills that will enhance students’ motivation to learn and ability to achieve.

Overall, PBL is an effective method for improving students’ problem-solving skills. Students will make strong connections between concepts when they learn facts and skills by actively working with information rather than by passively receiving information. Although active learning requires additional work on the part of students and faculty.

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References


