Effective Learning with Project-Based Approach in Database Course

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ABSTRACT

This paper discusses the results of an on-going study on the effect of project-based learning (PBL) on students' learning outcomes in Database Course. Project-based learning can be a deeply successful model for the teaching and learning of Database, one of the core courses of Computer Science in undergraduate level. In most database courses, PBL is the active methodology that is widely used. The approach focuses on the development of a project by student teams that designs and builds a database. Database management and querying skills are a key element of a robust information system curriculum and active learning is an important way to develop these skills. This paper represents a survey conducted to a set of students who employed Project-based learning in Database Course from the University of Computer Studies (Pinlon). Moreover, this paper describes the empirical results of student perception and to determine the effectiveness of Project-based learning method.

KEYWORDS

Project-based learning approach, Database course, Active methodologies

1. INTRODUCTION

Database technology is one of the most widely used computer science and technologies. So "database" is a very important course for computer science and other related professional major programs in universities. Databases and database systems in the field of computer science are crucial because they manage and store all the data of information systems and many of the applications (web, mobile, etc.) use every day. Therefore, proper engineering of databases (design, implementation, testing) is critical in order to avoid catastrophic consequences, as it can bound the scalability and effectiveness of applications, as well as the integrity of data and security.

Consequently, the introductory database course is fundamental for computer science students in order to effectively build databases for any application involving data storage. The course plays an essential role in developing the necessary skills that students will need once they enter the workforce, regardless of the area within computer science, as web development, mobile development, and software engineering all require the use and implementation of databases [5].

To better the computer students for this changing world database, computer university and instructors should develop and be able to formally evaluate the effective teaching and learning approach to teach database course to address these problems and to make students more understanding in database by using PBL. Now active methodologies are most using for effective teaching and learning approach. Active methodologies refer to encompassa range of more learner-centred instructional methodologies such as collaborative and project-based learning. There are many studies that argue that active methodology is especially effective in engineering education. In particular, in computer engineering education, there are instances of the use of active methodologies in different courses such as programming, computer architecture and operating systems. In most of the courses, including the database ones, the

preferred active methodology used in the literature is project-based learning [3]. This paper discusses using project-based approach in Database Course. The discussion is based on the finding the survey conducted from the students (2017-2018 Academic Year) of the University of Computer Studies (Pinlon).

The remainder of this paper is organized as follows: Section 2 covers the Project-based Learning (PBL) Approach is explained in detail. Section 2.1 presents studying project-based learning approach in Database Course. Section 2.2 discusses the implication. Finally, Section 3 concludes the paper and addresses some future work.

2. PROJECT-BASED LEARNING (PBL) APPROACH

Project-based learning mainly consists of open-ended student assignments to carry out tasks that lead to the production of a final product that simulate challenges that the students are likely to encounter as professionals. It includes teamwork to be done by students in and out of the classroom throughout the entire course and is especially suited to apply and integrate previously acquired knowledge. In the database area, project-based learning has been applied to empower skills related to a global understanding of database design and other advanced database topics [3]. In [8] both knowledge and skills are identified as main points to undertake database design. Knowledge consists of general database concepts, database analysis, design, implementation, business processes, and project management concepts. On the other side, the skills should take account of problem solving, critical thinking, creativity, verbal and written communication, team working, and time management.

In this context, active student-centred methods could be more helpful than traditional ones in order to acquire the necessary knowledge and skills. The former methods are based on learning by doing, whereas the latter on memorization and repetition. One promising method in this field is based on the development of projects [10, 11] which, in some sense, directly corresponds with the major activity of an undergraduate on Computer Science and Information Systems [8].

"A *project* is a temporary endeavour undertaken to create a unique product, service, or result". The main characteristics of a project include: it has a beginning and an end, it implies progressive elaboration (*i.e.*, it is developed in steps and continued in increments), and the uniqueness of the product, service, or result obtained. *Project management* is the application of knowledge, skills, tools, and techniques to project activities to meet project requirements [9].

The concept of project appears in different learning contexts. On the one hand, following constructivism guidelines, a learning method based on developing projects has been built: Project-Based Learning (PBL). This method is defined as an authentic instructional model or strategy in which students plan, implement, and evaluate projects that have real world application beyond the classroom. Projects should be student-centred and student-directed, with a meaningful content, and they produce a tangible real world product. These projects should have relations among academic, life, and work skills. In doing so, opportunities can rise for reflective thinking and student self-assessment.

Students build their own knowledge by active learning and by interacting with the environment while the instructor plays the role of guide and consultant. Students ask questions (to specialists, peers, etc.), make predictions, design investigations, collect and analyse data, make products, and share ideas. Besides, PBL would be better supplemented with cooperative learning. There are many profits of PBL covered in the literature. For instance, the possibility of connecting learning with reality, of increasing motivation, the

opportunity to develop problem-solving, develop social and communication skills, and enable students to make and see connections among disciplines.

In order to combine both perspectives of a project in an educational environment, it should be possible to use some techniques of PBL with the aim of undertaking a database project. The result of this integration should benefit from both PBL methods and professional practices. However, some restrictions should be imposed in order to facilitate this combination. On the one hand, the project should be adapted to the project-based instruction, which assumes, for instance, student-centred problems or self-assessment. On the other hand, the projects to be developed following the PBL method should be restricted and constrained, in order to be as close as possible to a real software project (or to some parts of it)[1].

This approach focuses on the development of a project by a student team following the ideas of PBL, where a real database is designed and built using project management techniques, tools, and skills. This is an active method that gets students involved in their learning process. Some scaffolding is provided from the beginning to the teams trying to decrease project complexity, reduce the inherent uncertainty to the launch of the project, and also motivate learners. This support includes a division into works of the project and their temporary distribution. This task structure constitutes a skeleton that adapts to a great variety of student proposed domain projects and emulates the real way of working in the database project [1].

To make PBL effective, teachers play important roles in motivating students and creating a classroom environment conducive for students learning. Collaboration among the students, teachers and others in the community is important so that knowledge can be shared and distributed among the members [7].

2.1. Studying Project-Based Learning Approach in Database Course

Project-based learning approach can bring both theory and practice. The main components of database practical course are database design, SQL and implementation of database projects [4].When implementing PBL, we are trying to help students find solutions to problems contextualized precisely within the content of their courses. Typically, these experiences take the form of group projects; but the work can be pursued effectively on an individual basis as well. The process is by no means easy – developing good problems for student to solve is a critical step in providing effective instruction. These problems need to be reasonably well understandable as students begin improving their problem solving skills [6]. This approach are not solely doing project work, but also solving specific problems based upon the content knowledge that has been developed in class. They documented that team members in active teams not only shared information but also determined the areas of disagreement and clarified the goals and strategies. They also conducted some negotiations, which in turn affected their learning outcomes [12]. This study was designed to assess improvement in students' learning outcomes through using project-based learning (PBL) methodology. The findings suggest that PBL significantly improves students' ease of learning. Educators can use a project-based learning approach to facilitate students' learning. Furthermore, working together on the project improves students' teamwork skills.

A survey is recorded students' perception about their knowledge and experience from many projects. How to use instruction and guide line are followed after 6th weeks of teaching database course in text exercises was finished. To start the project proposal was in the 8th weeks. Data collection was after that 8th weeks and allowed for one week was to analysis and then started drawing database design. The implementation continued after the verification of design was checked. The book for project has to be done before a week of project was

finished. Students have great profits of understanding in theories that were taught in their class and they gradually become more interesting in database course than before. Students real construction projects that are ongoing in database course and found it to be an effective way of enhancing students' understanding of theoretical concepts.[13] It has been shown that combining theory with practical projects can upgrade students' learning and their satisfaction of a course.[14] Participation of undergraduate students in hands-on projects has been found to be significantly effective in instigating students to pursue advanced degrees and careers in computer science and technology. The researcher fined in this survey that the giant confidence surprisingly occurred on this.

The objective of the survey was towards the use of PBL in teaching and learning Database Course. Data are collected by means of a questionnaire containing choose four choices (Strongly Agree, Agree, Disagree and Disagree at all) [2]. The participants were second year students and fourth year students from the University of Computer Studies (Pinlon). There are seven survey questions reflecting on their experience as follows:

Question 1: I prefer to use database system for a project data which are being applied in the real world system, choose four choices such as strongly agree or agree or disagree or disagree at all.

Question 2: After finishing a project, database system is very interesting and I realize that how to use theory of database system, choose four choices such as strongly agree or agree or disagree or disagree at all.

Question 3: I understand the "database design" because I have done my project, choose four choices such as strongly agree or agree or disagree or disagree at all.

Question 4: After project, my thinking skill and creation skill are improved amazingly, choose four choices such as strongly agree or agree or disagree or disagree at all.

Question 5: End of my project I understand how to analyse the requirement of project, choose four choices such as strongly agree or agree or disagree or disagree at all.

Question 6: When the project is done, I certainly realize that the importance of normalization in database and how to normalize database system choose four choices such as strongly agree or agree or disagree or disagree at all.

Question 7: Advantages of successfully created projects, using database operation and data management are easier than before, choose four choices such as strongly agree or agree or disagree or disagree at all.

Table 1. Results of survey

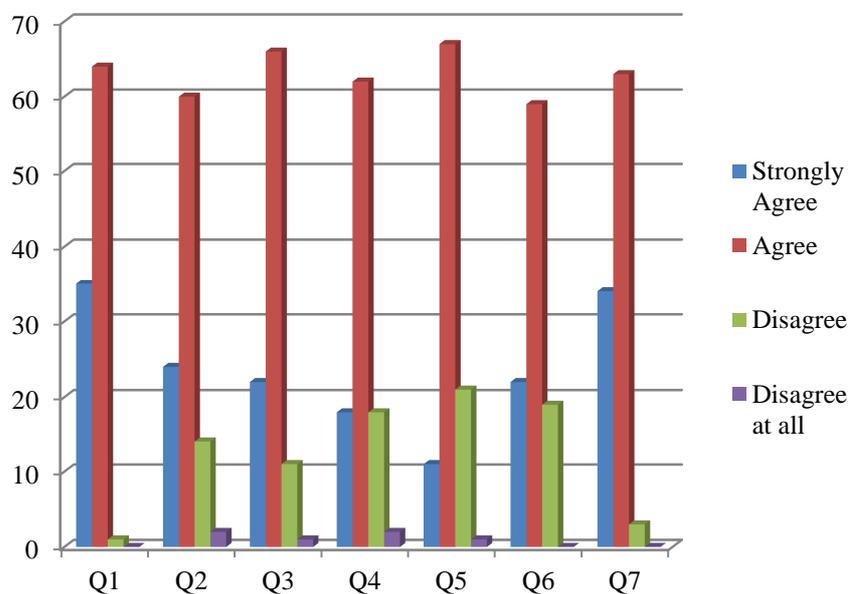| No	Question	Strongly Agree	Agree	Disagree	Disagree at all	Total
1	Q1	35	64	1	0	100
2	Q2	24	60	14	2	100
3	Q3	22	66	11	1	100
4	Q4	18	62	18	2	100
5	Q5	11	67	21	1	100
6	Q6	22	59	19	0	100
7	Q7	34	63	3	0	100
	total	166	441	87	6	700

Figure 1. Evaluation results based on survey

The Figure 1 represents the frequency of answers for each question asked to the participants. The survey is based on the students to rate their confidence -level in performing certain tasks. The results show that the use of the project-based approach significantly improved students' ease of learning the subject matter. Project based learning could be used as an effective teaching and learning strategy by educators to facilitate students' learning. Finally, this paper presents an effective analysis of the survey results obtained from the use of project-based learning techniques in database course. This paper proves the good advantages can be achieved of using together PBL method and database course.

2.2. Discussion

The PBL combines theory and practical of the project. Theory is supply in project and practical is more improving knowledge. By engaging in the PBL, students apply the concepts, techniques and methods of the discipline and improve their ability to utilize them. PBL discussions bring energy and motivation to the classroom, providing students with an opportunity to work with a range of evidence and improving their ability to apply the theory and methods they have learned in the course. We have also described other benefits of PBL, that were not measured, including reflective thinking (improved quality of the questions, more critical contributions, noticeable interest towards the subject topics, etc.), development of work skills (developing a full database design, fulfilling a set of rules, etc.), social skills (collaborating with the rest of the team members, unbroken teams, etc.), and communication skills (interaction within the work team, among different team).

Although teaching many database theories before project, doesn't take effect for the students at all. Students don't understand the theories how to apply in real world system. They don't recognize why they configure normalization the spirit of database. Moreover, they don't understand how important database design for the system. So, this project is divided into pieces and done with systematic guideline. They are allowed the first proposal of system that they are interested in. The data collection started after the system area is selected. After that they have to examine well how the system is working. Database design drawing followed if the data is fully collected for system. Database design drawing has to be drawn again an again until to match the system requirement. Checking normalization function is done together with design checking. System implementation was continued after the design finished.

In such way, after the project had finished, these students can recognize the theories which has been taught and how to apply them well. After all, they can draw the database design for any system. Students reach why they do normalization and database operation. Students' thinking skill and creation skill improved significantly. In this paper, it is unlikely with the other system because this paper especially emphasized to normalization, database design, database operation, data collection and data analysis.

3. CONCLUSION

PBL is a teaching approach that has significant potential to transform teaching from a dull and mundane process of passive learning to one where students actively engage with the material, resulting in deeper learning and significant other learning outcomes. Student centred learning which students are concerned actively in the learning process. It also progresses students' skills in decision making, problem solving, critical thinking, analytical thinking, group work and various interpersonal skills. The use of PBL is re-emerging as a teaching approach as universities aim to incorporate experiential learning into a broader range of university programs. Based on PBL and using project management techniques, tools, and skills, our approach targets on the development of projects where a real database is designed and built. Students' skills were developed when PBL method was used under the database courses. They have got understanding at that subject and more interested in.

This approach combines a variety of teaching methods and teaching resources in a sensible way and supports students a good learning environment. This approach use the constructive theory, with the students as the centre, give full play to the initiative of students, organize student interest in learning and cultivate the innovative spirit and practical ability to evolve more practical and complex talents for the society. Evidently, the experience of the PBL approach to a database course at University of Computer Studies (Pinlon) has resulting

in many positive outcomes for students. This suggests that PBL is the effective method which enables students to relate course materials to practice while improving their level of understanding about the subject matter. Some further research could be possible to adopt some methods that allow us to measure further aspects such as skills derived from PBL.

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