Team Projects As a Valuable Teaching Technique

Reza Sanati Mehrizy
Associate Professor
sanatire@uvsc.edu

Afsaneh Minaie
Assistant Professor
minaieaf@uvsc.edu

School of Computer Science and Engineering
Utah Valley State College
Orem, Utah 84058

Abstract

Teamwork experiences are greatly appreciated by employers in almost any field. Students participating in group projects get experience beyond the subject matter of the curriculum. In developing countries, there is a high competition among students for getting into universities. Therefore, some students may not be willing to share information in that environment and do not realize the fact that they will learn more by sharing their information and discussing their problems. A cooperative teamwork environment should be created for the student to understand that the students will benefit from being exposed to each other's perspectives and will learn from each other in addition to learning from the instructor. In this paper we want to share our experience of teamwork projects given to our students in a database design course. As a component of this course, the teams will design and implement database projects close to what is done in the real world. During the last week of the class, the teams present their projects to the class for evaluation. The practical experience of design, implementation, and presentation of a real database that the students gain makes them more marketable in this highly competitive job market. In this paper we will discuss the process of teaming, project assignment, what the students are involved with, the evaluation of these projects, and the experience and benefits that the students will gain from these teamwork environments.

Introduction

Database is a major component of any manufacturing system. Computer Aided Design (CAD) and Computer Aided Manufacturing (CAM) are good examples of using database in engineering and technology. Those who are involved with these processes need to understand how database plays a major role in these areas. It is well known that Software Engineering course is a typical course for student to work on team projects. This paper shows that Software Engineering course is not the only suitable course for group projects. Team project will be equally beneficial for teaching other

course such as Database Design course.

Although it is very valuable, teaching textbook theory without practice may provide students with only a shallow understanding of the subject. It is very important for students to experience the applications of theory in the real world problems[1]. People do not learn swimming unless they practice it in the water. My experience shows that the students do not appreciate pure theory and lecture using power point presentations. They prefer to learn by doing the work rather than just listening to the instructor. Some students are not willing to read their textbook (and may even not purchase it), but when it comes to doing the projects, they never complain. Rather they appreciate bonus projects for extra credit. By doing the work, students will discover problems that they will never face just by reading their textbook.

There is evidence that effective teamwork contributes significantly to increased productivity and to improved quality of outcome[2]. The experience gained in group dynamics, teamwork, project management, presentation and technical writing provides students with skills that are more valuable than just reading the material and listening to lectures. The students will learn the entire process of the design and implementation of a complete system in a teamwork environment. They will also learn how to cooperate during the teamwork process. The cooperation of team members is very important. Experience shows that teams with very strong team members have not been successful just because of the lack of cooperation. There are many criteria to be considered when forming teams such as: the quality, background, gender of team members, the number of team members, etc. If the teams are not formed properly, the result will be even less efficient than individual work. To support forming the teams, sophisticated software systems have been developed[1, 2, 3, 4]. Margaret Heil[2] describes the details of the teaming process and management of team activities. In the following section we explain how we form the teams and assign the projects to them in our database course.

Teaming and Assigning Projects in a Database Course

At this point, our department offers only one course in database. The database students have a broad range of background. Most have not taken any course in database prior to this class while others may have practical working experience with some sort of database application and/or design. After the basics of database is covered in this class and students are familiar with definitions, terminology, concepts, database components, database management systems, database models, etc., and the principles of teamwork, the teams will be formed. There may be about thirty students in the class which form teams of 2-3 self-selected members with some advice from the instructor.

The teams will be provided a list of projects with clearly specified requirements. The teams select a project from this list to work on throughout the semester. If a team prefers to work on a project which is not listed in this list of projects, it may do so after the instructor is convinced that their project is worthwhile to work on. The following represents a list of projects that the teams may select from and sign up for:

Projects	**Team Members**	
1. Student Records.	1.	2.

2.	Employee Records	1.	2.
3.	Airlines Reservation Records	1.	2.
4.	Bank Account Records	1.	2.
5.	Car rental records.	1.	2.
6.	Library Catalog Records	1.	2.
7.	Car Registration Records.	1.	2.
8.	Charge Account Records.	1.	2.
9.	Police Department Records.	1.	2.
10.	Telephone Company Records.	1.	2.
11.	Social security records.	1.	2.
12.	Automobile Insurance records.	1.	2.
13.	Patient Records.	1.	2.
14.	Part Inventory Records.	1.	2.
15.	Software Inventory Records.	1.	2.
16.	Museum Records.	1.	2.
17.	Post Office System.	1.	2.
18.	Driver's license Office.	1.	2.
19.	IRS Files System.	1.	2.

Each team is required to do the followings:

1. Select an organization which the team members like to work on.
2. Collect information about this organization and analyze it.
3. Design an ER/EER model for this organization
4. Convert your ER/EER model to a set of schemas.
5. Convert your set of schemas to BCNF or higher normal form.
6. Use a DBMS to create a DB for your selected organization. Create a table for each schema. Include about 3-5 attributes for each schema.
7. Enter 10-15 tuples in each of your tables.
8. Print every table in a nice tabular form.
9. Run a set of queries on your DB.
10. Print each **query** and its **result** to show your DB works correctly.
11. Submit a few pages of report to indicate what you learned from this project and the problems that you had (if any), hard copy of every thing, plus your DB on a disk for grading.

The teams are responsible for getting / buying the DBMS software package which they decide to use. The school has Interbase and MS access loaded on all computers in our labs.

Teaching Methodology

The team project is considered as 30% of student's class workload and the remaining 70% is covered by class assignments and exams. As the course progresses, the class lectures cover the processes of requirements collection and analysis, conceptual design, logical design, normalization process, physical design, implementation using a DBMS software package, and testing. The class

lectures are based on Fundamentals of Database Systems[8] and Modern Database Management[9]. These books cover the entire process of database design in great detail.

After a team selects its project, the team members will go through the following process using the system development life cycle[10].

a. The team members interview an agency or a company related to their project to learn about the activities of that agency or company. In this process the team members will learn about the entity types, the attributes of each entity type, the relationships between these entity types, the type of these relationships, and so on that they need to include in their Entity-Relationship (ER) model.

b. The team then represents its collected information by an ER diagram using a case tool for drawing. Each team converts its ER diagram to a set of schema and goes through the normalization process and normalizes this set of schema to remove any anomalies that may exist.

c. The team implements its database which means creating a table for each schema and entering data into these tables using the Data Definition Language (DDL) of a database management system which the team decides to use.

d. At this point, the team is through with the design and implementation of the database and it is time to test its database. To test this database, the team runs a set of ad hoc queries on its database and verifies the results of these queries. If the results of these queries are not as they are expected, the team needs to figure out what the problem is which may require them to cycle through previous steps until the result of the queries are satisfactory and then move on to the next step.

e. In this step, the team members need to write a few pages of report to explain their accomplishment in this teamwork. To do this, the teams may use the following model used in the University of California Irvine[5].

Team Members	• Identifies each team member and a short narrative for their contribution to the project • Provides a link to each team member's home page • Provides a short narrative describing the team's overall assessment of the project's successes, shortfalls, and whether/how additional resources (more time, more people with specified skills, investment capital, etc.) would update the nature of the project's results
Enterprise Description	Provides a narrative description that identifies the business, its strategic vision, its primary products or services offerings, its estimated annual operating budget, and any other factors you think are significant
Business Model(s)	Provides a narrative description for each model you choose that explains why you believe this is a good Business Model to utilize

DBM Application(s)	Provides a narrative description for each application you choose that explains why you believe this is a good DBM Application to utilize
Issues on Collecting and Managing Data	Provides a narrative description and provide examples of these issues, and how your business or database management application will address/mitigate these issues
Database Model Type	Identifies a generic data models type and provides a brief description for this choice
Data Types in DB	Identifies types of data objects and provide a brief description for each
Estimated size of the target DB	Provides a brief description for your estimate for the size of the database
Enterprise System Database Architecture	• Conceptual system architecture design diagram • Rationale for each component and connector in architectural design • Rationale for the kinds of client and server processors and repositories in the system architecture
DataBase Adminstrator (DBA) Tasks	Provides a narrative description and examples of these tasks, and how your business or DBA will address/mitigate these tasks
Database Data Model design	• Provides a logical database data model as an Entity-Relationship (ER) diagram • Provides a narrative of all tables/entities, attributes, domain-ranges (acceptable values), and relations appearing in your ER model. • Provides sample instance value data for entity/relation tables in your database • Provides SQL description of your ER data model
Concept Demonstration or Prototype	Provides a demonstration of the DBM concept for the project

f. Now the team is ready to present its work to the class. Each team receives 15-20 minutes to present its project to the other teams in the class. At the end of each presentation, the other teams may ask questions that may be answered by anyone in the class including the instructor. If there is any problem, it will be discussed in the class to clarify it.

g. The final step is to submit the work for evaluation. Each team submits its entire teamwork including: the description of the agency/company which the team has chosen to design a database for, the ER model, the set of schemas, the set of populated tables, the set of queries and their results, and the final report.

Benefits of Teamwork and Relates Issues

The final reports of students indicate that students strongly appreciate teamwork environments. They have said, collectively, that they have learned the entire process of the design and implementation of a practical database. In their reports, the students have mentioned that the class has been a good learning environment and they have learned from each other as well as from the instructor and the textbook. They have been pleased to see the application of the theory that they have learned in class in the real world. Also, they have expressed that the teamwork has been very helpful to them to learn the fact that cooperation in teamwork and group decision for a common goal is a critical issue[7].

The overall assessment of team members indicate[5] "Creating this project was a very good experience. Our group feels confident that we will be able to develop a working prototype of our system after class ends. We were able to draw from each other's strengths and delegate tasks according to our expertise. The guidelines of our project were very well organized and helped us understand essential database concepts and the necessary requirements to implement a real-world database project". Other team members have mentioned[6, 7] that overall they think their projects have been successful and meet the fundamental requirements from business model, database choice, architecture designs to data modeling, etc.

Some team members have discovered that some agencies have not been very cooperative in giving information out because of the nature of their activities. Other team members have been concerned about some issues such as accessibility of Database Management System software, size of their project, adequate budget, etc[6, 7].

Conclusion

The student will be divided into small teams and the teams select an agency or business to design and implement a database for. They will test their database by executing several queries against their database and generate report(s). Then the teams will present their project to class. Finally the teams will be required to turn in their entire work for final evaluation and grading. In their process the students will learn the entire process of designing, implementing and presenting a complete database, and they will put the theory learned in class into practice. Also students will learn how to cooperation in teamwork. Working in a team gives students the opportunity to share their information and experience and to learn from each other. By presenting their project in the class, they will also learn how to present their work in front of professionals.

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Biography

REZA SANATI MEHRIZY is an associate professor of the Computing and Networking Sciences Dept. at Utah Valley State College, Orem, Utah. He received his MS and PhD in Computer Science from University of Oklahoma, Norman, Oklahoma. His research focuses on diverse areas such as: Database Design, Data Structures, Artificial Intelligence, Robotics, and Computer Integrated Manufacturing.

AFSANEH MINAIE is an assistant professor in the Computing and Networking Sciences Department at Utah Valley State College. She received a B.S., M.S. and Ph.D. all in Electrical Engineering from University of Oklahoma in 1981, 1984 and 1989 respectively. Her current interests are in computer architecture, digital design, and computer interfacing.