Evaluating the Use of the SCALE-UP Teaching Methodology for an Undergraduate Database Systems Course

by

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ABSTRACT

In this study, the majority of sampled undergraduate students recognize the importance of teamwork within the Computer Science discipline. However, a number of students have not had the opportunity to work in teams or, if so, some have had negative experiences with teamwork. Within the context of a database systems course, teamwork is actively supported in the classroom by providing in-class activities that students complete in assigned teams. A pedagogical methodology known as SCALE-UP (Student-Centered Activities for Large Enrollment Undergraduate Programs) was modified while redeveloping the extant curriculum to satisfy instructor, student and course requirements. The results of the concurrent evaluation surpassed expectations both with regard to course delivery and student perception of teamwork. While this work is primarily exploratory, the results of the evaluation plus recommendations for redeployment are offered in order to encourage further investigation.

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Dedication

For Maxwell Keawe a Mahi Wolfe.

Alice laughed, "There's no use trying," she said, "one can't believe impossible things."

"I daresay you haven't had much practice," said the Queen. "When I was your age, I always did it for half-an-hour a day. Why, sometimes I've believed as many as six impossible things before breakfast." – Lewis Carroll, *Alice in Wonderland*

Overview

This thesis documents the development, execution, and results of a study investigating the application of a teaching methodology to a database systems course while providing a concurrent pedagogical evaluation. I aim to present a comprehensive report on this project for instructors and researchers involved in undergraduate Computer Science courses or SCALE-UP teaching.

This thesis contains seven chapters summarized as follows:

Chapter 1 introduces the research problem;

Chapter 2 provides an academic context for this research project;

Chapter 3 describes the methodology used;

Chapter 4 documents the data collection procedures;

Chapter 5 answers the chosen research questions by analyzing the collected data;

Chapter 6 offers recommendations for those interested in performing similar studies; and

Chapter 7 presents conclusions about the results of this project.

Chapter 1 Introduction

The discipline of Computer Science is problem-oriented. Both students and practitioners strive to solve abstract and concrete problems by using mathematical and programming methods. However, most undergraduate courses in Computer Science at the University of Victoria (UVic) are typically taught using traditional teaching methods with students listening to lectures in class and solving problems on an individual basis during labs and at home. While traditional teaching is effective enough to be widely used within the department, other pedagogical methods are being considered—in particular, those methods which more closely mimic the working style used by practicing computer scientists. Efforts to experiment with alternative teaching methods are part of a larger movement to improve Computer Science education. [1, 2]

Several studies support the assertion that problem-based learning (PBL) can improve knowledge acquisition, communication skills and self-directed learning. [3, 4, 5] Not only does PBL reflect the working style of many computer scientists, but it has also been found to be a very effective teaching method in a variety of academic disciplines. With respect to Computer Science courses, PBL affords the opportunity to promote teamwork both inside and outside the classroom. It is our expectation and experience that the vast majority of Computer Science professionals will have to work effectively in a team. Therefore, UVic's Computer Science department has a vested interest in preparing

graduates for the workplace by ensuring that students are able to solve computing problems within a team environment.

In an effort to meet these teaching goals, a new methodology (SCALE-UP) was brought into a Computer Science classroom at UVic. SCALE-UP's ability to provide support to student teams and successful application at other academic institutions suggested that this pedagogical methodology might be especially useful for UVic's Computer Science classes. By applying SCALE-UP to an introductory database systems course, we hoped to improve student learning, both in terms of academic results and hands-on teamwork experiences.

This thesis tracks the implementation of SCALE-UP for an undergraduate database systems course and its subsequent evaluation. Academic results for this course were within range, in comparison to previous sections of the course taught by the same instructor. A number of students indicated in interviews and focus group sessions that team members helped each other learn the course material. The majority of sampled students stated that they enjoyed working with their teams. When this same group was asked if they would recommend this course to another student, the results were overwhelmingly positive. Extensive feedback from students and the instructor can be found in Chapters 4 and 5 which detail the data collection and analysis respectively.

Chapter 2 Background

2.1 What is SCALE-UP?

A teaching methodology known as SCALE-UP (Student-Centered Activities for Large Enrollment Undergraduate Programs) was developed by Dr. Robert Beichner at North Carolina State University (NCSU). SCALE-UP's primary goal is to "establish a highly collaborative, hands-on, computer-rich, interactive learning environment for large, introductory college courses" [10]. This pedagogical method deviates from traditional didactic instruction by incorporating team-based activities into lectures, providing laptops to student teams and by encouraging semi-Socratic dialogues between students and instructors. These classroom interactions are intended to help students resolve cognitive conflict and are referred to as semi-Socratic since they are partly led by the instructor.[1]

2.1.1 History of SCALE-UP

Dr. Beichner's teaching experience and his interest in pedagogical research led him to develop SCALE-UP, which was originally created for undergraduate Physics courses. He is a member of NCSU's Physics Education Research (PER) group and the newly appointed director of the university's Discipline Based Education Research Center.

[1] R. Morse, "The classic method of Mrs. Socrates," *Phys. Teach,* **32**, 276 (1994).

Dr. Beichner's experimentation with studio-style teaching began with NCSU's IMPEC (Integrated Math, Physics, Engineering, and Chemistry) project in 1993. Thirty-six students were taught in studio courses that "were highly successful in minimizing attrition, improving student understanding of the course material and providing a positive learning experience." [10] Since this style of teaching proved to be unfeasible in the long-term due to the small class size, the SCALE-UP project aimed to achieve the same, highly desirable results for courses as large as 100 students.

The SCALE-UP method has been refined after extensive experimentation with physical and technical infrastructure as well as actual teaching. NCSU and other adopters of SCALE-UP have found this teaching method to be highly successful. Since developing SCALE-UP, Dr. Beichner has made many presentations at various universities as part of his efforts to reform undergraduate Physics education in the United States. SCALE-UP has also been successfully applied in other disciplines.

2.1.2 The SCALE-UP teaching method

The SCALE-UP method is based on educational research indicating that students learn more Physics when they "interact with faculty, collaborate with peers on interesting tasks, and are actively engaged with the material they are learning."[10] In order to facilitate active learning, lectures are shortened and instructors circulate within the classroom, acting as coaches for teams and for the class as a whole. Students are assigned to heterogeneous teams that include both academically weak and strong members, based on the premise that peer teaching occurs within the team itself.

When developing teams, female and minority students are typically paired together. To justify this decision, Beichner *et al*. refer to Linda L. Carli's paper "Gender and social influence"[2] and explain why students are grouped in this way:

> "…we ensure that students who are commonly underrepresented in engineering are not alone in a group. For example, if there is one female in a group, at least one of the other two students in that group will also be female. Similar rules are applied to minorities. This is done because women and minorities are often not as influential in group settings as they should be." [10]

Partway through the course, all students are reassigned to different teams. Note that for later team assignments, matching women and minorities together is no longer found to be necessary and that Beichner *et al.* intend to explore this result further.

Within their teams, students complete in-class activities designed to encourage collaboration. In Dr. Beichner's curricula, these activities are referred to as **tangibles** and **ponderables**. Tangibles allow students to make observations and collect data from physical phenomena. Ponderables are more open-ended, requiring students to research possible answers, make estimations, and eliminate unnecessary information. Students are evaluated collectively in order to provide an incentive for collaboration. In an effort to minimize conflict, team contracts delineate individual student responsibilities and expectations.

2.1.3 The SCALE-UP classroom

In order to maximize the potential for collaborative learning, the allotted time for the course (labs and lectures) is combined into interactive classes within redesigned classrooms. At NCSU, three

[2] L. Carli, "Gender and social influence," *J. Soc. Issues* **57**, 725 (2001).

groups of three students are seated at 6 or 7 foot diameter round tables. However, just as SCALE-UP curricula differs between individual institutions, so does the classroom setup. In general, SCALE-UP classes are taught in "restaurant style" classrooms that place students close together facing one another and that allow instructors to circulate easily between the teams.

At MIT, the TEAL (Technology-Enabled Active Learning) project has adopted some aspects of the SCALE-UP methodology. Students are taught introductory Physics while placed in groups of three, with nine students sitting at each table.

Figure 2.1: *TEAL classroom at MIT.*
(Photo courtesy NCSU: http://scaleup.ncsu.edu/. Accessed Feb. 11 2008)

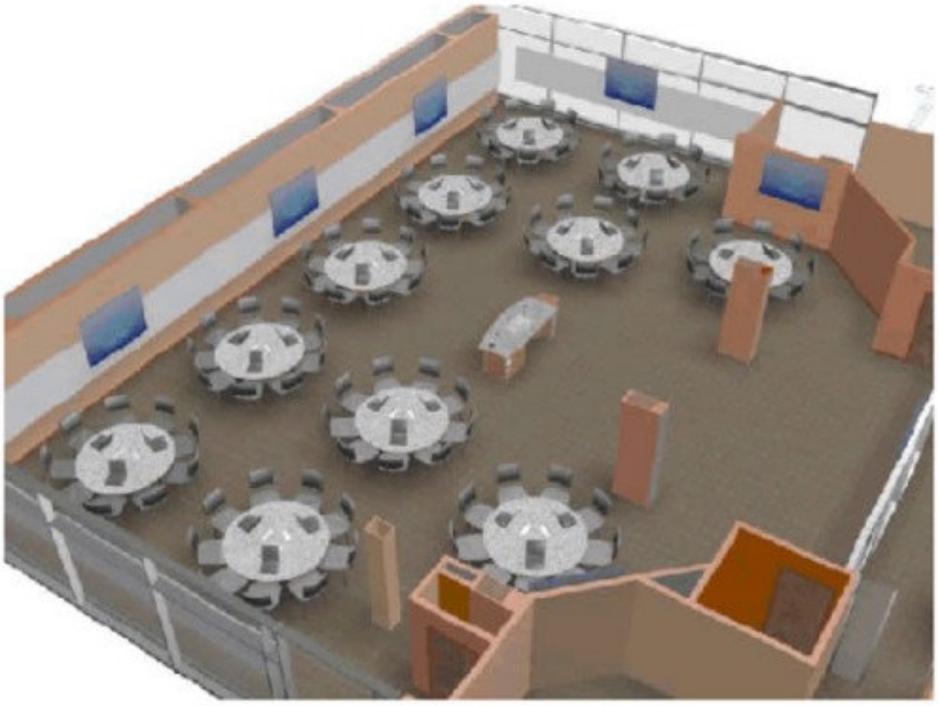

Figure 2.2: *Overhead diagram of TEAL classroom at MIT.*
(Photo courtesy NCSU: http://scaleup.ncsu.edu/. Accessed Feb. 11 2008)

Similar to SCALE-UP, the TEAL project at MIT has significantly improved student learning:

> … [A]n appropriate learning environment that fosters social constructivism is instrumental in improving the achievements of students at all academic levels. The technology-rich engagement atmosphere and the group interactions enabled the high achievers to blossom while teaching their peers. This setting also facilitated upward mobility of the intermediate and low achievers, thereby reducing failure rate and obtaining overall better results. [28]

Social constructivism is a theory of social learning developed by post-revolutionary Soviet psychologist, Lev Vygotsky. According to Vygotsky, all learning is a product of social interactions and is not simply the acquisition of knowledge; it is the process by which learners are integrated into a knowledge community.[3]

[3] Vygotsky, L. (1978). Mind in Society. London: Harvard University Press.

2.1.4 Theoretical Basis for SCALE-UP

Social constructivism is relevant to our discussion of the theoretical basis for SCALE-UP. Miniature knowledge communities develop within each student team and collaborative learning is a critical part of this pedagogical method. The SCALE-UP framework advocates carefully creating a specific type of learning environment and close attention is paid to student-student and student-instructor interaction.

As previously mentioned, SCALE-UP was developed based on research specifically addressing the needs of undergraduate Physics education: Physics Education Research (PER) literature. Dr. Beichner has explored common elements of successful research-based physics curricula (such as student-faculty interaction, peer collaboration, and active learning) and has incorporated these elements into the methodology.[4,5,6]

Beichner *et al*. also provide support for a broader application of the SCALE-UP methodology by referring to other pedagogical sources that primarily address collaborative and active learning in the classroom. Both Alexander Astin's book *What Matters in College*[7] and the Johnson *et al*. meta-analysis of cooperative learning[8]

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[4] R. Knight, *Five Easy Lessons: Strategies for Successful Physics Teaching* (Addison Wesley, San Francisco, 2002).
[5] E. Redish, *Teaching Physics with the Physics Suite* (John Wiley & Sons, Hoboken, 2003).
[6] L. McDermott and E. Redish, "Resource Letter: PER-1: Physics Education Research," *Am. J. Phys*. **67**, 755 (1999).
[7] A.W. Astin, *What Matters in College: Four Critical Years Revisited*. San Francisco, Jossey-Bass, 1993.

emphasize the impact of peer involvement and student-instructor interaction in undergraduate learning environments. The frequency and nature of these interactions have significant consequences for retention of subject material, academic achievement, improved attitude, and psychological change. Employer prioritization of strong team skills when hiring graduating students (as found both at NCSU and UVic) provides an additional incentive for ensuring effective student collaborations.

Beichner *et al*. also cite Johnson, Johnson, and Smith's characteristics of successful cooperative learning:

1) *Positive interdependence*. Team members have to rely upon one another and benefit from working together.

2) *Individual accountability*. Each member is responsible for doing his or her own fair share of the work and for mastering all the material.

3) *Face-to-face interaction*. Some or all of the group effort must be spent with members working together.

4) *Appropriate use of interpersonal skills*. Members must receive instruction and then practice leadership, decision-making, communication, and conflict management.

5) *Regular self-assessment of group functioning*. Groups need to evaluate how well their team is functioning, where they could improve, and what they should do differently in the future.[9]

Not only does Beichner advocate cooperative learning (used interchangeably with 'collaborative learning' in this context), he also promotes a hands-on approach, or active

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[8] D. Johnson, G. Maruyama, R. Johnson, D. Nelson, and L. Skon, "Effects of cooperative, competitive, and individualistic goal structures on achievement: A meta-analysis," *Psychological Bulletin* **89**, 47 (1981).

[9] D. W. Johnson, R. T. Johnson, and K. A. Smith, *Cooperative Learning: Increasing College Faculty Instructional Productivity* (The George Washington University, School of Education and Human Development, ASHE-ERIC Higher Education Re-port No.4. Washington DC, 1991).

learning style. In support of active learning in the classroom, three main bodies of work are referred to: Felder and Brent's recommendations for student-centered learning environments,[10,11] Edgar Dale's Cone of Learning,[12] and Carmean and Haefner's work on deeper learning.[13]

In two papers about the intellectual development of science and engineering students, Felder and Brent "explicitly recommend a student-centered learning environment where students are simultaneously challenged and supported, given clear expectations, and are presented with a variety of learning tasks."[10] In reference to this particular study, research that investigates the intellectual development of students within our discipline also directly supports our own inquiry into the use of SCALE-UP for Computer Science courses.

Dale's Cone of Learning suggests that the more actively students are engaged, the more learning occurs. As shown in Figure 2.3, the in-class activities promoted by SCALE-UP would be categorized as active learning tasks, suggesting improved synthesis and understanding of the academic material. Dale's paradigm also supports our own observations about the importance of hands-on activities for database learning, especially during the initial stages of understanding basic database concepts.

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[10] R. Felder and R. Brent, "The intellectual development of science and engineering students. I. Models and challenges," *J. Eng. Ed.* **93**, 269 (2004).
[11] R. Felder and R. Brent, "The intellectual development of science and engineering students. II. Teaching to promote growth," *J. Eng. Ed.* **93**, 279 (2004).
[12] E. Dale, *Audio-Visual Methods in Teaching* (Holt, Rinehart, & Winston, 1969).
[13] C. Carmean and J. Haefner, "Mind over matter: Transforming course management systems into effective learning environments," *Educause Rev.* **37** (6), 26 (2002).

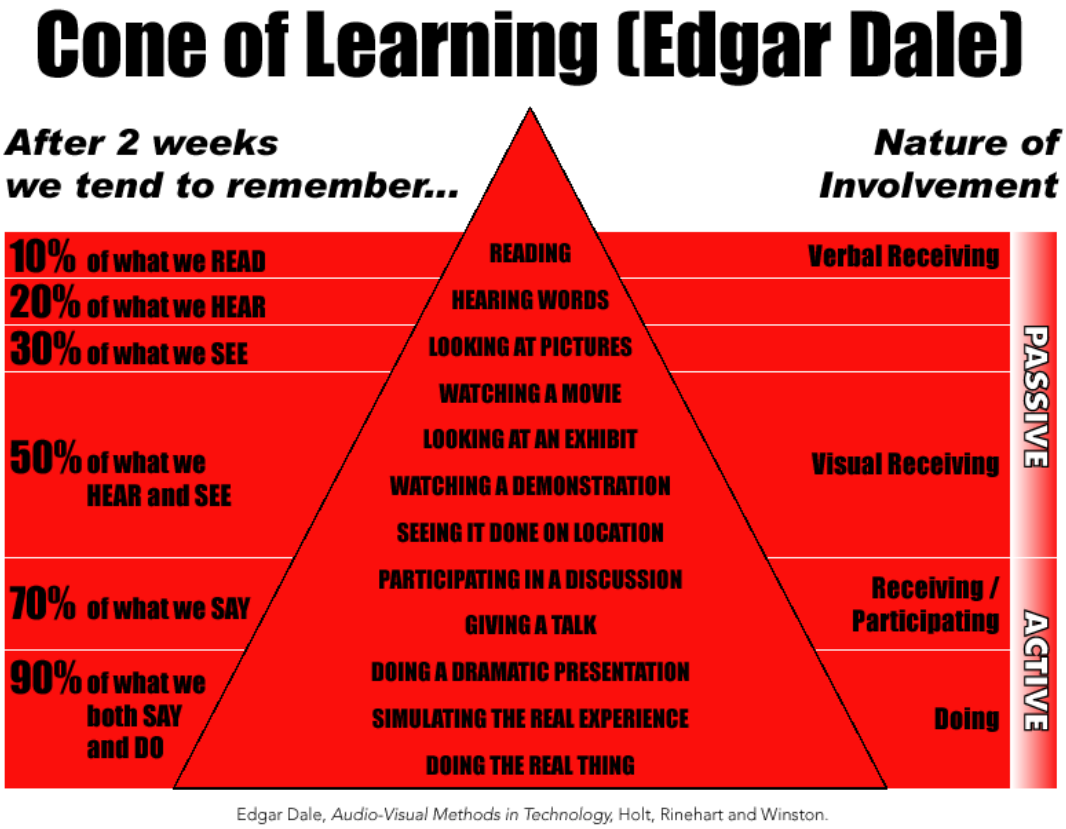

Figure 2.3. *Edgar Dale's Cone of Learning.*

Carmean and Haefner's work synthesizes pre-existing pedagogical research and presents the concept of deeper learning or "an engaged learning that results in a meaningful understanding of material and content."[14] Deeper learning occurs when learning is characterized as: 1. Social, 2. Active, 3. Contextual, 4. Engaging and, 5. Student-owned. Carmean and Haefner's propositions suggest that the use of SCALE-UP in this context therefore not only presents the opportunity to strengthen team skills frequently required for working with databases in a real-world environment, but also has the potential to improve student learning about databases in general.

[14] C. Carmean and J. Haefner, "Mind over matter: Transforming course management systems into effective learning environments," *Educause Rev.* **37** (6), 26 (2002).

2.1.5 Evaluations of SCALE-UP

Since the initial development of SCALE-UP, extensive evaluations of this teaching methodology have been performed at NCSU. Data collected for evaluation purposes has included classroom video and audio recordings, interviews and focus groups, conceptual learning assessments, and collected portfolios of student work. Dr. Beichner has also conducted conceptual learning assessments by running tests that are nationally-recognized within the United States and that were used in a pre-test/post-test manner. To date, the NCSU SCALE-UP project has collected data that compares the attitudes and academic results of nearly 16,000 traditional and SCALE-UP students. [10] Some initial evaluations of SCALE-UP have also been performed at Clemson University; these results are discussed in Section 2.2.2.

2.1.6 Benefits of SCALE-UP

The outcomes of these evaluations indicate that SCALE-UP is advantageous for many students. Dr. Beichner has found that SCALE-UP enhances learning in the following ways:

- Conceptual understanding is increased
- The top third of the class show the greatest improvement in conceptual understanding
- Ability to solve problems is as good or better
- Attitudes are improved

- Class attendance is higher, typically > 90%
- Failure rates are drastically reduced (typically by 50%), especially for women and minorities
- Performance in the second semester physics class is improved, whether taught traditionally or in SCALE-UP
- Failure of at-risk students in a later Engineering Statics class is cut in half [10]

2.2 SCALE-UP Implementations

The learning impact of SCALE-UP has increased the popularity of this teaching methodology. SCALE-UP is typically implemented in phases, given the scale of transition involved. Many universities are in the process of building SCALE-UP classrooms or creating adapted versions of the teaching materials in order to meet specific academic requirements.

2.2.1 Academic Institutions Using SCALE-UP

SCALE-UP has been applied at over fifty academic institutions. A summary of the schools using SCALE-UP and the courses offered is provided in Table 2.1. Ongoing updates to this information can be found on the SCALE-UP wiki which is available online: http://scaleup.ncsu.edu/groups/adopters/. (Accessed April 10 2008).

Academic Institution	Departments	Courses Taught
University of Alabama	Physics, Mathematics	First year algebra, calculus-based physics
American University	Physics	
University of Central Florida	Physics	
Clemson University	Mathematical Sciences; Business Management; English; General, Civil, and Mechanical Engineering, Physics, Nursing, Computer Science.	Introductory math classes up to differential equations, including Calculus III; comparative literature.
Coastal Carolina University	Physics	
University of Colorado	Biology	
Florida State University	Physics, Computer Science	Physics of sound, information studies
Ithaca College	Physics	PH101, 102, 117, 118, 175 (astronomy)
Massachusetts Institute of Technology (MIT)	Physics	
University of Minnesota	Biology, Engineering	
University of New Hampshire	Math, Physics	Calculus
North Carolina State University	Physics, Chemistry, Geographic Information Systems	
Old Dominion University	Physics	(to be started in Fall 2008)
Penn State Erie, The Behrend College	Physics	Calculus-based mechanics
University of Pittsburgh	Physics	
Rochester Institute of Technology	Physics	
Southeastern Louisiana University	Physics	
University of Tennessee	Physics and Astronomy	Physics 135/136 (calculus-based intro course for science, math, and computer science majors).
Wake Technical Community College	Physics	
Western Kentucky University	Physics	Algebra-based physics
Raleigh Charter High School	Physics	
The University of Puerto Rico	Biology	
Ort Braude College, Israel	Physics	

Table 2.1. *Academic Institutions Using SCALE-UP as of April 2008.*

As shown in Table 2.1, most universities have applied SCALE-UP to Physics courses. Clemson University has the greatest number and variety of SCALE-UP courses which demonstrates the versatility of this teaching method.

2.2.2 Use of SCALE-UP at Clemson University

At Clemson University, the leading proponent of SCALE-UP, this teaching method has been used in over sixteen courses with more SCALE-UP classes planned for upcoming semesters.

Figure 2.4: *SCALE-UP classroom at Clemson University.*
(Photo courtesy NCSU: http://scaleup.ncsu.edu/. Accessed Feb. 11 2008)

At Clemson, some initial evaluations of SCALE-UP have been performed. In the Engineering courses offered, standard conceptual tests (such as Statics Concept Inventory) have been given at the beginning and end of the semester. Raw scores from these tests and normalized gains have then been compared to results of previous students in the older standard versions of the courses. Failure rates (D, F, W rates) have been compared to historical rates. Attitude interviews of a self-selected group of students have been performed and standard student course evaluations have been reviewed. Due to the high number and variety of SCALE-UP courses taught at Clemson, this university is well-positioned to perform comparative evaluations of the teaching methodology across many disciplines.

2.2.3 Use of SCALE-UP for Computer Science courses

As of December 2007, a redesigned introductory programming course has been offered in Clemson's Computer Science department. This course uses a modified form of SCALE-UP similar to the method used in this course at UVic. A course in Information Studies is being offered in the Computer Science department at Florida State University. As far as has been reported, there are no other Computer Science courses currently taught using SCALE-UP, including database systems courses. Note that some implementations of SCALE-UP may not be reported or published.

2.2.4 Conclusion

SCALE-UP's methodology has proven to be useful in a variety of disciplines. SCALE-UP improves academic learning and provides students with an opportunity for supported teamwork experiences. It seems likely that Computer Science students would benefit from SCALE-UP teaching if the curriculum and infrastructure became available. In addition, the novelty of SCALE-UP Computer Science courses provides researchers and instructors with a rich potential for developing the curriculum, adapting the teaching methodology for the discipline-specific requirements, and evaluating the results of the implementations.

Chapter 3 Methodology

3.1 Introduction

This chapter documents the development of this study's methodology. I explain the design of the study and the rationale behind it. Specifically, I describe the data collection techniques and how each technique will be used to answer the research questions.

3.2 Concept Development

The concept of applying SCALE-UP to an undergraduate database systems course was developed by Dr. Daniel German. In January 2006, Dr. German participated in the Course Redesign Workshop sponsored by UVic's Learning and Teaching Centre (LTC). He sought to improve the instruction of CSC370, an undergraduate database course that he had taught five times previously. Dr. German first heard about SCALE-UP when Dr. Robert Beichner gave a presentation about this teaching method at the LTC on May 2nd 2006. Dr. German wanted to explore whether SCALE-UP would be beneficial for the instruction of courses covering database systems and other Computer Science topics. Specifically, Dr. German wished to experiment with SCALE-UP to determine if the database curriculum could be deployed effectively using this method while additionally providing students with a learning environment that actively supported teamwork in the classroom.

3.3 Funding and Support

After learning about the benefits of SCALE-UP for undergraduate instruction, Dr. German decided to apply this teaching method to a section of CSC370 that would be taught in January 2007. Since Dr. Beichner had described SCALE-UP's use of laptops in the classroom, Dr. German responded to a request for proposal (RFP) from Hewlett-Packard (HP) which offered twenty tablet PCs for teaching research. He also applied to the LTC for a grant to provide additional support when evaluating the use of SCALE-UP. Unfortunately funding from HP was not obtained; however, after consulting with the LTC, Dr. German decided to apply SCALE-UP to CSC370 without the tablet PCs. In Dr. Beichner's own pilot implementation of SCALE-UP, laptop computers were not used; this lack of technical infrastructure was not ideal but did not prevent the project from proceeding.

3.4 The Need for Evaluation

In July 2006, I began planning how to evaluate the use of SCALE-UP for database instruction. Dr. German and I discussed the research questions; then I developed the methodology that would be used to answer these questions. Since SCALE-UP had never been implemented at UVic previously, the need to evaluate its use was particularly clear. This use of SCALE-UP and its subsequent evaluation directly supports UVic's strategic goal to closely integrate teaching and pedagogical research at the University. Other UVic

faculty members have expressed interest in this teaching method but have yet to employ it. I hope this evaluation will prove useful to instructors considering the use of SCALE-UP for database and other Computer Science courses.

3.5 Initial Research Phase

My first step in designing this study was to research the existing literature on SCALE-UP and relevant pedagogical research. This initial investigation resulted in an annotated bibliography including references regarding SCALE-UP [6, 7, 8, 9], pedagogical evaluations [11, 12], undergraduate database instruction [13, 14], organizational behaviour [15, 16, 17, 18], and collaborative learning [19 - 25]. As a result of this investigation, I had a better understanding of SCALE-UP as well as some of the other issues surrounding our research objectives such as team management, evaluating SCALE-UP's effectiveness and redesigning the database curriculum. In addition to creating this bibliography, I discussed the parameters of the project with Dr. German and the results that I wished to obtain. Once we decided that the project was feasible, I developed a research schedule. This schedule was developed in September 2006 at the end of the Initial Research Phase.

Timeframe	Project Phase	Outcomes	Section
July – Aug 2006	Initial Research	investigation of research subtopics, project schedule, research questions, study design (draft)	3.5
Sept – Nov 2006	Study Design	ethics application, study design (finalized)	3.6, 3.7, 3.8, 3.9
Nov 2006 – Jan 2007	Course Preparation	team assignments, data collection materials	3.10
Jan – April 2007	Data Collection	raw data, signed participant forms	Chapter 4
May 2007	Data Anonymization	data in anonymous form	Chapter 4
June – October 2007	Data Analysis	analyses of data sets	Chapter 5

Table 3.1. *Project Schedule*

3.6 Study Design Phase

During this phase, the design of the study was finalized and then described in the ethics application I submitted to UVic's Human Research Ethics Board ('the HREB'). This section explains how specific factors impacted the study's design.

3.6.1 Ethical Application Process

One of the most important challenges facing any study involving student participants is the ethical approval process. Ensuring that our study was approved by the HREB had a significant impact on the study's parameters. The study had to be designed according to the guidelines of the board when determining how to gain participant consent and collect

data. In particular, the board places a heavy emphasis on preserving the anonymity of the participants, minimizing any power-over relationships, and ensuring that informed and ongoing consent was maintained. It was pointless to design a study that would later be rejected by the board. In order to work within these restrictions, I consulted extensively with Leah Potter (HREB Assistant) before submitting the ethics application to ensure that if I had to make revisions to the design of the study, these revisions would be minor.

3.6.2 Exploratory Nature of the Study

Another factor that influenced the design of this work is its highly exploratory nature. During the study, SCALE-UP would be used for the first time for database instruction; it would also be the first time that I evaluated the use of this teaching method. Dr. German and I would be deploying redesigned curriculum and an untested evaluation process in tandem. It was also the first time that Dr. German had used SCALE-UP as a teaching method.

In order to address the exploratory aspect of the study, my evaluation was designed to be very flexible so that I could make dynamic adjustments if needed. I intended to gather as much data as possible using a variety of data collection techniques. If any data collection techniques proved to be ineffective or unfeasible, I planned to abandon that particular technique partway through the study. Since I required ethical approval in order to do any type of data collection, it made sense to request permission for the maximum possible number of activities.

3.6.3 Potential for Meta-Evaluation

Another incentive for experimenting with different data collection techniques was the potential to perform an informal meta-evaluation determining which data collection methods would be most effective in this particular context. Since it is possible that other faculty members at UVic will use SCALE-UP in the future, recommendations regarding the effectiveness and popularity of specific evaluation techniques with student participants are useful. I also intended to report on the initial consent rate for each of the data collection activities individually compared to actual participation; I specifically designed the consent form to afford this opportunity.

3.6.4 Assistance from Experts and Non-Participants

During this design phase I hoped to avoid errors and learn from the experience of others; subsequently, I consulted with non-participants and subject experts.

Firstly, Dr. German reviewed the design of the study and Survey 1 (S_1), the first written survey. I also asked two university students (neither of whom attends UVic) to complete a draft of S_1 in order to ensure that the survey was not too long and that the language used was unambiguous.

The study design and S_1 were also reviewed by Yolanda Olivotto at UVic's LTC. Ms. Olivotto has extensive experience performing pedagogical evaluations. For S_1, she

recommended that a distinction be made between the students' past experiences with teamwork versus their opinions of teamwork in general.

S_1 was also reviewed by Mary Sanseverino of UVic's Computer Science department. Ms. Sanseverino has been involved in pedagogical research for many years. I had worked with her previously on another project involving Computer Science instruction. She recommended that I consider team leadership issues as a vehicle for exploring team dynamics both in the surveys and the interviews. She also suggested occasionally inverting positive statements on the survey in order to encourage students to pay close attention to the questions asked. Ms. Sanseverino was included as a member of our research team in my ethics application since I could not have any contact with Dr. German during the data collection phase due to ethical constraints.

In addition to discussing the study with researchers who specialize in educational and Computer Science studies, I wished to consult with an organizational behaviour expert. I felt that presenting the study's design to someone with a lot of experience and knowledge about designing teams would help ensure that our teams were successful. Dr. Craig Pinder, a Distinguished Professor of Organizational Behaviour at UVic's Faculty of Business, was able to provide feedback regarding our team formation. He recommended that we reduce the size of our teams from six to four members based on his concern that coordinating six different schedules would be very challenging for the students. Dr. Pinder also gave us a mini-lecture on team-building (Tuckman's 'Forming-Storming-Norming-Performing' model of team development[26]); this was very helpful. Due to Dr.

Pinder's explanation of the different stages of team development, we were able to anticipate challenges we might encounter in the design of the study and the deployment of the redesigned curriculum.

To learn more about different ways of teaching database curriculum, I compared UVic's Computer Science department's instructional methods with those practiced at another university. I reviewed online information about Computer Science departments at Canadian and American universities. Specifically, I looked for a university that adhered to a dissimilar teaching philosophy so I could make a more meaningful comparison. At the Jodrey School of Computer Science at Acadia University, class sizes are much smaller and there is a heavy emphasis on hands-on practice. I emailed Dr. Darcy Benoit at Acadia and asked him to share his experiences instructing undergraduate database courses. Despite never having heard of SCALE-UP, Dr. Benoit revealed that the techniques he used for teaching databases were very similar to those used in this teaching method and, more importantly, that these techniques were very effective.

Lastly, Dr. Beichner answered questions about his teaching method and provided us with additional resources. In particular, he answered questions about his own evaluations of SCALE-UP and provided us with links to sample team contracts which we could give to the students enrolled in CSC370. Please see Appendix J for these sample contracts.

3.6.5 Development of Research Questions

In addition to considering broader aspects of the study, we also developed the research questions for this study very early during the design process. During the Initial Design Phase, we continued to discuss them in order to ensure that we were committed to answering them and that we had addressed any potential obstacles.

As a minimum measure of successfully implementing SCALE-UP for database instruction, we decided to focus on the students' academic performance. CSC370 had to be delivered effectively and our use of SCALE-UP could not be detrimental to the students' database learning. We were also interested in the students' perception of teamwork and we hoped to facilitate a positive experience of teamwork within the classroom.

The research questions were phrased as follows:

1. Is SCALE-UP an effective, if not superior, method of teaching large undergraduate classes about databases?

Motivation: As a minimum measure of success, we wished to ensure that SCALEUP meets the learning needs of the students. If SCALE-UP improved learning in comparison with traditional instruction methods, I intended to explore why.

2. Does SCALE-UP encourage and support teamwork and collaboration within the classroom?

Motivation: Teamwork and collaboration are important skills for any Computer Science graduate, and especially for those developing database systems. I hoped that CSC370 students would have a rich and positive experience collaborating in teams and that this experience would help prepare them for working in a real world environment.

In addition, I planned to examine the learning outcomes in relation to an adapted version of the course goals developed by the original SCALE-UP research team (see Appendix E). This comparison would allow my results to be analyzed in relation to other SCALE-UP courses and with subsequent iterations of CSC370 held in upcoming years.

3.7 Constraints of the Study

As well as being impacted by the factors described in Section 3.6, I encountered a number of limitations that shaped the design of the study.

Time. The amount of time available to me to (a) prepare the study's design, (b) write the ethics application and (c) collect the data was barely adequate. The ethics application had to be approved prior to January 3rd 2007 when the data gathering would begin. Since I was gathering data during a single semester, I would only have four months to collect the data I needed in order to answer the research questions.

Resources. Another constraint I encountered was a lack of resources. I would be working primarily on my own, especially during the data collection phase.

Participants. Since the class size had been capped, the maximum number of participants in the study was 40 students. While a small class size ensured that we would have workable teams, I was concerned that I would not have enough participants in the study in order to make any meaningful conclusions.

Number of academic terms. Since I only had one academic term to execute the study, this constraint added a lot of pressure to be successful both in the recruitment and data collection activities.

Control group. I did not have a control group that allowed me to compare results against the same course simultaneously taught using traditional instruction. However, a comparison of this nature cannot be done in a rigorously scientific manner given the innately high variability of this type of research. In addition, given that this would be a pilot implementation of SCALE-UP, setting up a control group with meaningful bases of comparison would be very difficult. Instead, I intended to focus on gathering rich feedback from our participants that would allow me to answer my research questions.

Ethical approval process. Meeting the restrictions set by the HREB compromised my ability to design a study that involved gathering data and reporting on this implementation of SCALE-UP to the extent that I would have liked.

Classroom used. Since we had very few classrooms to choose from (none of which were ideal for teaching using the SCALE-UP method), our ability to implement SCALE-UP and evaluate its use were limited.

3.8 Data Collection Techniques

The data collection techniques that I would use in this study were described in detail in the ethics application. An overview of the data collection activities as well as an explanation of each technique is provided.

3.8.1 Data Collection Overview

As previously explained, I was uncertain which data techniques would be effective and hoped to use as many different types of data collection as possible, later discarding evaluation types that did not prove to be successful. I planned to use the data collection techniques shown in Table 2.

Technique	Motivation	Justification
Consent form	Permit data collection	Gain permission to gather data and answer research questions
In-class observations	Observe student team and instructor performance	Document strengths and weaknesses of SCALE-UP in classroom
Database Background Quiz	Assess student database background prior to course	Explore academic results in CSC370 in relation to prior background
Written Surveys	Gather feedback regarding course and team activities	Compare student attitudes towards teamwork (pre/post-test) and solicit feedback regarding curriculum
Interviews	Probe survey responses in greater detail	Focus on team experiences and any challenges with course material
Photography session	Document team formation, instructor interaction and classroom used	Provide more detailed reporting on study
Room diagrams	Show team position/formation throughout the course	Record team positions using a method less invasive than taking photographs
Review of student notes and assignments	Examine student work in terms of professionalism and team member contribution	Assess team functioning based on results; look for common errors indicating difficulties with curriculum
Collaboration rubric	Encourage team members to assess each other's contributions	Assess team collaboration using a form with tabulated scores
Student peer evaluations	Encourage team members to assess each other's contributions	Assess team collaboration based on open-ended evaluations

Table 3.2. *Summary of data collection techniques.*

In designing the study in this way, I was using a mixed methods approach that would give me a variety of qualitative and quantitative results. I also hoped to use triangulation

techniques for individual participant data in order to draw more concrete conclusions regarding my results. In this study, I found that I derived the richest results from the written surveys, the student interviews, and the in-class observations.

All of the data collection study was performed by me (Elizabeth Wolfe). This strategy simplified the data collection process and reduced my anonymity concerns.

3.9 Data Collection by Type

The following sections outline the data collection activities by type. I describe the process in greater detail (the 'Description'); the reason for using this type of data collection (the 'Motivation'); and how the data collected will support my research goals (the 'Justification').

3.9.1 Consent Forms

Description. Consent from each participant (preferably written) is required before any data collection can be done. Based on a template provided by the HREB, I developed a combined information sheet/consent form that would be given in duplicate to each potential participant on the first day of the course. If a student was willing to participate, one copy would be signed and returned to me while the other copy would be retained by the student. On the form, participants would be asked to indicate which of six types of data collection activities they were willing to participate in, creating many different tiers

of participation. At a minimum, participation would involve simply permitting me to perform observations in the classroom. Full participation would mean that a participant was agreeable to every activity listed on the form. Students were given the option to submit the form via a locked box in the Engineering Computer Science (ECS) building after requesting more information about the study and/or reflecting on whether they wished to participate. On the form I asked participants to provide an email address that I could use to contact them about particular data collection activities.

Motivation. I designed the study to include a written consent form not only based on the suggestion of the Ethics board but also to simplify the consent process. Written consent is very straightforward. Since the participants would be taking a copy of the consent form with them, a combined information sheet/consent form was very practical logistically. By providing different tiers of participation, I created an opportunity for a very simple form of data collection. I wished to know which data collection activities were appealing to this particular group of students. Another benefit of the tiered participation was the increased likelihood of full class participation in terms of in-class observations. The minimum level of participation was simply permitting class observations—it seemed likely that many of the students would agree to this even if they would not agree to other forms of data collection.

Justification. Without consent from the participants, the data collection activities could not be conducted and it would be impossible to answer our research questions in a satisfying manner. Knowing which activities students wished to participate in allowed me

to rate the activities based on their appeal—this information could inform other evaluations of SCALE-UP. I also speculated that I may be able to explore the popularity of different activities if time permitted—it was of great interest to me to know which activities the students were willing to do. Asking students to indicate their interest in specific activities also helped me to plan for the rest of the study—for example, if many participants who wished to participate in a focus group, I could arrange for more support when running the group, taking notes, etc.

3.9.2 In-class Observations

Description. I planned to observe the participants on a weekly basis within the classroom setting for the four-month duration of the course. Since I was keenly interested in the participants' learning experiences, I planned to ensure that in no way did I interfere with the regular, day-to-day functioning of classroom activities. Initially with my observations, I planned to answer these questions:

1. Are the students engaged?
2. Do all groups participate?
3. Does one group dominate?
4. Does the instructor interact with all groups? Or one group primarily?
5. Do students appear to be comfortable within this setting?
6. Are icebreaker activities used?
7. Do teams work together with other teams (i.e. talking, sharing notes, etc)?
8. How do individual team members work together—in pairs, with one person leading, etc?

Observations were scheduled to begin on the first day of the course.

Motivation. I wished to observe one class per week in order to have a general sense of how the class was going, to observe the instructor teaching via the SCALE-UP methodology, and to see the students working together in their teams. I felt it was important to be in the classroom myself as well as receiving secondhand accounts from participants.

Justification. If students were experiencing problems with the curriculum, I hoped to be able to observe this and, if possible, record the reasons why. Also, if teams were not functioning well (due to conflict, absenteeism, etc) then I hoped to record this. I was keen to document successful aspects of this use of SCALE-UP both in terms of academic performance and team collaboration.

3.9.3 Database Background Quiz

Description. We planned to distribute a quiz to all of the students on the first day of class. The questions were composed by Dr. German. At the time of deployment, he would indicate to the students that the quiz would not be graded for marks. Only five questions were included, each of which covered basic database topics on a very simple level. In designing the quiz, Dr. German assumed that students who were unable to successfully answer all of the questions at the end of the course would fail the final exam. There was no plan to redistribute the quiz.

Motivation. Students would be asked to complete the quiz so that their database background prior to CSC370 could be assessed. It was important that we were aware of the students' background in database systems in order to make meaningful commentary on the effectiveness of this implementation of SCALE-UP. Deploying this quiz was also helpful for the instructor in preparing or making any adjustments to the course.

Justification. In determining the validity and possible causes of any reported academic challenges, I wished to have some insight into the students' background in database systems. In addition, the quiz results would allow us to assess the class as a whole and determine variations in prior database knowledge that may impact individual student or team performance.

3.9.4 Written Surveys

Description. I created two surveys for this study (S_1 and S_2). Drafts of both surveys were submitted with the ethics application on October 25th 2006. S_1 continued to be revised until immediately prior to deployment on January 3rd 2007. I planned to revise S_2 once the course had started and after I had looked at the results of S_1. In S_1 I had four sections covering the following topics:

(1) participant demographics,

(2) previous academic teamwork experiences,

(3) personal opinion about teamwork, and

(4) general attitude toward teamwork.

I hoped to create a basis for comparison by taking a 'snapshot' of participant attitudes towards teamwork both at the beginning and end of the course. In more technical terms, this comparison could be described as a one-group pretest-posttest experiment [27]. In designing the surveys, I tried to avoid recreating the teaching evaluations administered by the university and instead focused primarily on questions that directly supported my research goals.

Motivation. I had many motivations for creating the two written surveys. I had experience working with written surveys in the past. Distributing a survey is a relatively straightforward form of data collection. Survey results are easy to interpret and can be re-analyzed long after the study has been completed. I wished to obtain written feedback from the participants with both qualitative and quantitative results—consequently I designed the surveys to support both types of data collection. I hoped that by incorporating elements of one-group pretest-posttest design into the surveys, I would have the opportunity to see if participant attitudes had changed during the course. I also hoped to determine whether SCALE-UP was causing students to improve or worsen their perceptions of teamwork.

Justification. The justification for using these surveys is very simple—the questions posed directly addressed our research goals. In addition, like all other forms of participation in the study, tracking survey completion is a primitive form of assessing participant attitudes towards collaboration.

3.9.5 Interviews

Description. Two sessions of one hour interviews were planned: one after S_1 had been completed and one after the deployment of S_2. The instructor, also a participant in the study, was interviewed before and after the student data collection period (January – April 2007). A draft of the questions to be used in the interviews was submitted to the HREB. The interviews were intended to be very informal and to simply address our research goals in greater depth and, if available, in reference to the survey data for each participant.

Motivation. I wished to interview the participants so that I could probe their experiences with their teams and the course material in greater detail. By reviewing their survey responses prior to the interview, I hoped to be more efficient and to have richer interview responses.

Justification. The topics addressed during the interview sessions would be directly related to my research questions. Specifically, I would be asking the participants about any difficulties they may be experiencing with the course material and their experiences working with their teams. I would also be asking them about their prior experiences working with teams before taking CSC370 in order to establish some basis for their initial opinions of teamwork.

3.9.6 Focus group

Description. I planned to hold a one hour focus group towards the end of the semester. Similar to the interviews, this focus group was intended to be very informal. A draft of the questions to be used was submitted to the HREB. I hoped that I would do very little facilitation during the focus group and that the participants themselves would direct the conversation within the outlined topics.

Motivation. I chose to do a focus group as another form of experimentation with data collection, employing very similar questions used during the interviews and on the written surveys. I hoped that having a focus group would stimulate a revealing discussion between the participants about their experiences and cause them to reflect more intently than they might do in a one-on-one interview with me. I also speculated that the group setting may yield dissimilar (and therefore potentially interesting) results compared to the interviews. The focus group was scheduled for the end of the course so that participants could reflect more fully on their teamwork and academic experiences in the course.

Justification. Like the surveys and the interviews, the questions posed in the focus group session were intended to directly address my research goals. Essentially I would be asking the participants for the answers to my research questions but in a more intricate manner.

3.9.7 Photographs

Description. I planned to take photographs of the instructor and students working in their teams in the classroom on a single occasion. Students would sign photo waivers and be made fully aware that the photographs would not be anonymous. Although ethical approval to take photographs was granted by the HREB, this data collection activity was not included on the consent form since I would be using a photo waiver. The photographs would not be linked to other participant data.

Motivation. In taking photographs, I wished to record this use of SCALE-UP visually. In particular I wished to be able to show others the classroom we used, the size and number of the teams, and the configuration/position of teams within the classroom.

Justification. This data collection activity does not directly support our research goals but is useful when reporting on the study.

3.9.8 Room diagrams

Description. The purpose of these diagrams would be to illustrate the positioning of the teams, instructor and observer within the classroom and also demonstrate how the tables were used by the teams. I intended to do these diagrams by hand on at least two occasions depending on how often the teams relocated. Creating diagrams is less invasive than taking photographs. In all of my in-class data collection activities, I attempted to avoid

creating an environment in which the students or instructor would feel overly self-conscious and therefore behave in a very unnatural manner.

Motivation. I hoped that having the diagrams would be useful when doing data analysis and to support my in-class observations. Depending on the results of the data collection, the diagrams might lend additional interest to reports about the study.

Justification. I hoped that these diagrams would provide additional insight into my inquiries and allow me to improve my in-class observations. In addition, drawing room diagrams by hand is less invasive and distracting compared to taking photographs.

3.9.9 Review of Student Assignments and Notes

Description. I intended to review student assignments at the end of the course. I also requested permission to photocopy student notes on the consent form.

Motivation. I wished to review the students' assignments and notes so that the quality of the academic work could be assessed.

Justification. I was uncertain if I would find anything of interest in the assignments or notes that would support my research objectives. To a certain extent, deep learning of database concepts is very difficult to measure simply by looking at class notes and team assignments. However, frequently identified errors on student assignments could possibly

indicate a weakness in the curriculum. In terms of collaboration, I would be checking to see if the work appeared to be completed by just one or two students.

3.9.10 Collaboration Rubric

Description. Students would be asked to complete a collaboration rubric for each of their team members. The rubric specifically addresses team members' ability to: (1) contribute, (2) take responsibility, and (3) value others' viewpoints. This rubric was given to teams of students at San Diego State University working on a study about tidepools.

Motivation. Asking the students to complete the rubric would force them to evaluate other team members in a quantified fashion. Feedback from other team members could potentially be useful in identifying strengths and weaknesses both in terms of team self-assessment and meeting our research objectives.

Justification. Since the collaboration rubric provided a tabulated score, I would be able to place a numerical value on each team member's peer evaluation. The rubric itself directly supported my second research question regarding SCALE-UP's potential to facilitate collaboration within this particular course.

3.9.11 Peer Evaluation

Description. I also hoped to review another form of peer evaluation designed by the student teams or by the instructor. Prior to the beginning of the course, the format for the peer evaluations had not been developed.

Motivation. In support of the data gathered from the collaboration rubric, I hoped that qualitative results would be extracted from the peer evaluations (which would be completed by the students as mandatory assignments that would not be graded by the instructor).

Justification. This data collection activity did not seem likely to yield any results regarding academic performance. However, I hoped that some insight into team functioning would be attained.

3.10 Ethics Application Submission

Sections 3.8 and 3.9 detail the data collection techniques as provided to the HREB on my ethics application. The ethics application essentially constitutes the final design of the study since any major changes to the study could not be made once the application had been approved. The application was submitted to the HREB by the end of October 2006. On November 15th 2006, I was notified that minor revisions to the design of the study had to be made. Along with a number of very small changes, the indirect power-over

relationship between Dr. German and I had to be explained to the students. I also had to provide a locked box for students to submit consent forms after the initial recruitment session held on the first day of the course. After making these changes to the study, the certificate of approval was granted on November 29th and I was authorized to begin collecting data.

3.11 Course Preparation

Before data collection could begin on January 3rd 2007, a number of tasks needed to be completed. Survey 1 (S_1) had to be finalized. Dr. German developed the Database Background Quiz and the consent form was prepared for deployment. In addition, I assigned the students to their teams.

3.11.1 Team Assignment

Pre-assigning students to teams based on a number of criteria is part of the SCALE-UP teaching methodology. Students are typically assigned based on academic scores obtained prior to the beginning of the course. In the United States, standardized test results are used for sorting the students; since Canadian universities do not provide access to similar test results, I used student GPA (grade point average) which indicates overall academic performance. SCALE-UP teams are set up to ensure diversity of academic performance; gender and ethnic minorities are typically paired together in teams in order to ensure that minority students do not become isolated.

The team assignment for CSC370 was finalized on January 2nd 2007 based on an initial class list and student GPAs, both of which were provided to me by UVic's administration. The team assignments were made primarily by using the student GPAs. Typically, teams consisted of one strong student, two average students and one weak student. Due to ethical restrictions, the course instructor (Dr. German) could not be privy to the students' GPAs and was not aware how the teams had been chosen.

I attempted to follow the SCALE-UP model by placing female students in teams together. Due to university policy, I did not have access to student gender when assigning students to teams and some student names were gender neutral. As our student population is very ethnically diverse, grouping minority students together did not seem necessary or valuable. Even if I had wanted to group students by ethnicity, this would not have been possible since this information is not available.

3.12 Summary

As of January 2nd 2006, the data collection and course materials required for the first day of class had been prepared and were ready for deployment. Resources that would be used later in the course would be developed on an ongoing basis throughout the semester.

In this chapter, I have detailed the process used to design this study. For each of the intended data collection techniques I have provided a description, motivation and

justification. I have also explained the limitations that I encountered and how these limitations impacted my methodology.

Chapter 4 Data Collection Procedures

4.1 Introduction

This chapter documents the data collection process used during this study. I explain the recruitment process and describe the student participants. This use of SCALE-UP and the corresponding evaluation techniques are detailed. In addition, I explain the data anonymization techniques that were used after the data collection was completed. A brief discussion of the limitations encountered is also provided.

Overall, the data collection process for this study proceeded very smoothly. Despite a relatively low number of potential participants and the strict time constraints, a substantial quantity of data was collected. The actual deployment of the study closely followed the plan proposed in the ethics application. I continued to make very minor changes to the design during the data collection period based on the data that had been gathered up to that point. I will explain and justify these changes in Section 4.5. With the exception of the instructor interviews, I gathered data from January 3rd until April 30th 2007. After the data collection period ended, I anonymized my results during May 2007. Data analysis for this study was completed on October 31st 2007.

4.2 A Customized Implementation of SCALE-UP for Database Instruction

Owing to a number of constraints, we were not able to implement what would be considered a *bona fide* instance of SCALE-UP. Our use of SCALE-UP for database instruction closely resembles Dr. Robert Beichner's own pilot implementation. The physical and technical infrastructure, the curriculum and the course delivery are considered.

Physical and technical infrastructure

Within a SCALE-UP context, the classroom used has a significant impact on the effectiveness of the teams. For this study, CSC370 was taught in C112 in the David Strong Building on the UVic campus after Dr. German requested that the course be moved to this location. He requested that the course be moved so we would have classroom furniture more suitable for in-class team activities. This classroom was not particularly well suited for a SCALE-UP implementation. However, it was the best room available and allowed us to see how a dedicated classroom would greatly enhance the effectiveness of this teaching method. Unfortunately UVic currently does not have a classroom ideal for SCALE-UP instruction.

C112 has a seating capacity of 59 students and during this course approximately 17 2' x 6' tables were provided. An overhead video projector was available for the instructors' use. The projector is oriented towards the front of the classroom and cannot be adjusted;

the projected image is displayed above the blackboard which allows the instructor to use both the projector and blackboard at the same time.

Figure 4.1: *DSBC112 classroom.*
(photo courtesy of UVic's Audio/Visual Services, date unknown)

The limitations of C112 in terms of classroom furniture and audio-video infrastructure necessitated the 'ecclesiastical' orientation of a traditional classroom be maintained. Lecturing for this subject typically requires a significant amount of writing equations and code on the blackboard—a requirement that further reinforced the traditional classroom setup.

While most SCALE-UP classrooms rely heavily on whiteboards for team collaboration, we did not have large whiteboards installed at the time or portable ones available. Students used small whiteboards on a few occasions for in-class activities, but this was not especially helpful since the whiteboards were too small for writing out full solutions. Similar to Dr. Beichner's pilot implementation, we also did not have laptops available for every student. A few students provided their own laptops. However, the instructor did not rely on these machines because not all students had them, or brought them to class consistently; in addition, these laptops did not have the required database software installed. On a few occasions, students were observed surfing the Internet or working on assignments for other courses, which suggested that laptops in the classroom were a distraction from lectures and in-class activities.

Figure 4.2: *SCALE-UP classroom at NCSU.*
(Photo courtesy NCSU (http://www.ncsu.edu/PER/scaleup.html. Accessed Jan. 11 2007))

In comparison, the SCALE-UP classroom shown in Figure 4.2 provides students with large round tables and has a central podium for the instructor's use. Networked laptops are supplied for each student. A whiteboard is also available.

Curriculum

The curriculum for this course was developed by Dr. German and Dr. Alex Thomo, an assistant professor in the Computer Science department. The course materials were created by Dr. German during a course re-design workshop held at the LTC and on an ongoing basis during the study. Samples of in-class activities are provided in Appendix F. Students could not access the in-class activities in advance. Solutions to the activities were not provided online, although answers to some of the questions were discussed in class when it became clear that more than one team was struggling with a particular problem. Students would work on the in-class activities in teams of 3 or 4 students. Despite being given the opportunity to be switched to a different team, all of the students remained in their pre-assigned teams. The instructor would circulate between the teams providing assistance as needed. We did not have a teaching assistant assigned to this course; however, a marker assisted Dr. German with grading assignments. It was unfortunate that Dr. German did not have the in-class assistance typical of a conventional SCALE-UP implementation.

Course Delivery

Classes were typically split into twenty minutes of lecturing and twenty minutes of in-class activities. Initially the process of converting to a new teaching style appeared to be stressful for the instructor. However, the students were very cooperative and responsive to this new style. No discipline issues were observed—the students were respectful of the instructor both in their in-class behaviour and in opinions expressed in gathered data.

During our implementation of SCALE-UP for CSC370, the effectiveness of the in-class activities was a primary focus both in terms of ongoing curriculum development and my pedagogical evaluation. When Dr. Beichner developed his classroom activities for introductory Physics courses, he created what he refers to as 'tangibles' and 'ponderables'[10]. 'Tangibles' are activities that are very hands-on and quite simple; 'ponderables' tend to be more abstract. The nature of our discipline and, in particular, database and software development meant these two types of activities did not translate particularly well from the Physics to Computer Science curriculum. Computer Science problems are typically highly abstract and time-consuming to solve; hands-on problem solving can produce more than one correct answer. Solutions often cannot easily be explained in front of the classroom and even an expert may need to test them against a database.

Consequently, we did not employ the Socratic dialogue that Beichner describes [10]. Typically, students worked together in teams on problems or activities provided on handouts, while the instructor circulated and provided assistance to each team in turn.

Often teams would submit their (sometimes incomplete) solutions at the end of the class to be reviewed by the instructor.

4.3 Participant Overview

In January 2007, the course instructor and 26 undergraduate students (out of 40) enrolled in CSC370 participated in this study. I gathered information about participant demographics in my first survey (S_1) which was deployed on January 3rd 2007. (This demographic information can be found in Chapter 5.) The majority of students taking this course were highly motivated, third year students enrolled in Computer Science or Engineering programs. Based on the cumulative GPAs provided by the administration, the class average for this course was 5.13 on a 9.0 scale. (Note that cumulative GPAs are not available for transfer students so one student's GPA could not be included in the calculation.) The average GPA of participants was 5.11 (based on the available GPAs of 24 participants). The average GPA of non-participants was slightly lower at 4.92 (based on the available GPAs of 13 non-participants).

Based on data from S_1, the participation rate, and my initial interactions with them, I discovered that the students understood the importance of teamwork and had varied levels of knowledge about databases. However, a significant number of students had not had the opportunity to work in teams or if so, had had negative experiences with teamwork.

4.4 Recruitment Process

Student participants were recruited on the first day of the course (January 3rd 2007). Partway through the class, I held a recruitment session and explained the purpose of the study based on a script that had been provided to the HREB. In order to protect the anonymity of the participants, the HREB suggested that Dr. German should not be present for this recruitment session. I used an informal style, addressed the students as peers, invited them to ask questions and emphasized that minimum participation involved simply permitting me to make in-class observations.

An estimated 40 students were approached during the recruitment session. UVic has a lengthy add/drop period which makes data collection during the first weeks of class very challenging. Students entered and left the classroom constantly during the first class at their own discretion. At the same time, I wished to begin gathering data at the beginning of the course; therefore, I tried to recruit participants on the first day. Between two and four participants were recruited later during the first two weeks of the course. Of the approximately 40 students approached on the first day of class, five students were female.

Type of Participant	Number of Students
Initial Recruitment (5 female, 35 male)	~ 40
Ongoing Recruitment (first 2 weeks of class)	2 – 4
Total Participants	26
Total number of students in course	37

Table 4.1. *Types of Participants.*

4.5 Data Collection Overview

The student participants gave permission to gather six types of data collection by signing the consent/information forms distributed on January 3rd 2007. This table compares the number of participants who initially consented to each activity with the actual participation. The instructor is not included in these calculations since he did not participate in the same activities as the students.

Activity	Initial Consent Rate	Actual Participation Rate	Percentage Change
Observations	26 (100%)	26 (100%)	0%
Survey 1	21 (81%)	34 (131%)	+50%
Survey 2	21 (81%)	27 (104%)	+23%
Interviews	18 (69%)	8 (31%)	-38%
Focus Group	14 (54%)	2 (8%)	-46%
Notes Photocopied	18 (69%)	0 (0%)	Not applicable
Notes Read	20	20	0%

Table 4.2. *Comparison of Initial Consent and Actual Participation Rates.*

A distinction between S_1 and S_2 was not made on the consent form; students were simply asked if they agreed to complete 'brief written surveys.' With both surveys, the actual participation rate exceeded the consent rate due to non-participant survey respondents completing surveys. Participant notes were not photocopied due to time constraints.

Eleven of the twenty-six participants (42%) initially consented to participate in all of the data collection activities. Note that the less collaborative activities (in-class observations

and surveys) were more popular when compared with the more collaborative ones (focus group and interviews) and also declined the least dramatically.

As previously explained, I was uncertain which data techniques would be effective. I intended to use as many different types of data collection as possible and then later discard the evaluation types that did not prove to be successful. The following forms of data collection were used: consent forms, observations, database background quiz, written surveys, interviews, focus group, photographs, room diagrams, assignment review. Student assignments were reviewed on one occasion and during a few in-class observations I had the opportunity to monitor student note taking during class.

4.6 Data Collection Process by Type

This section provides an account of each type of data collection used. For each of these data collection activities, only one recruitment session was held (i.e. no attempt was made to re-recruit participants for individual activities). If participants indicated on the consent form that they were willing to participate in an individual activity, they were contacted via email to confirm interest and for scheduling purposes.

4.6.1 Consent Forms

Consent forms were completed by 26 participants on January 3, 2007. Despite a high level of student flux during the add-drop period at the beginning of the semester, I

obtained participant consent on the first day of class from 26 students so that in-class observations could begin immediately. Additional consent forms were gathered on a second occasion in order to allow students enrolling later in the course to participate in the study. Potential participants were given the option of submitting consent forms via a locked box in the Engineering and Computer Science Building; however, no consent forms were submitted in this manner.

4.6.2 Observations

Twenty-seven participants were observed on a weekly basis in the classroom setting (26 students and one instructor). Since I was keenly interested in the participants' learning experiences, I attempted to ensure that in no way did I interfere with the regular, day-to-day functioning of classroom activities. Initially I was seated with a team at one of the tables; however, my presence interfered with the team's functioning and I relocated to a chair in the back corner of the classroom. Observations were recorded on paper. Due to my close proximity to the students and based on previous experiences observing student participants I chose not to use a laptop. Using pen and paper is much quieter and far less distracting.

4.6.3 Database Background Quiz

On January 3, 2007, the students' database background was assessed prior to the beginning of instruction. Six database quizzes were completed by non-participants;

twenty-four participants completed the quiz. The students were not given their results or the answers to the questions on the quiz.

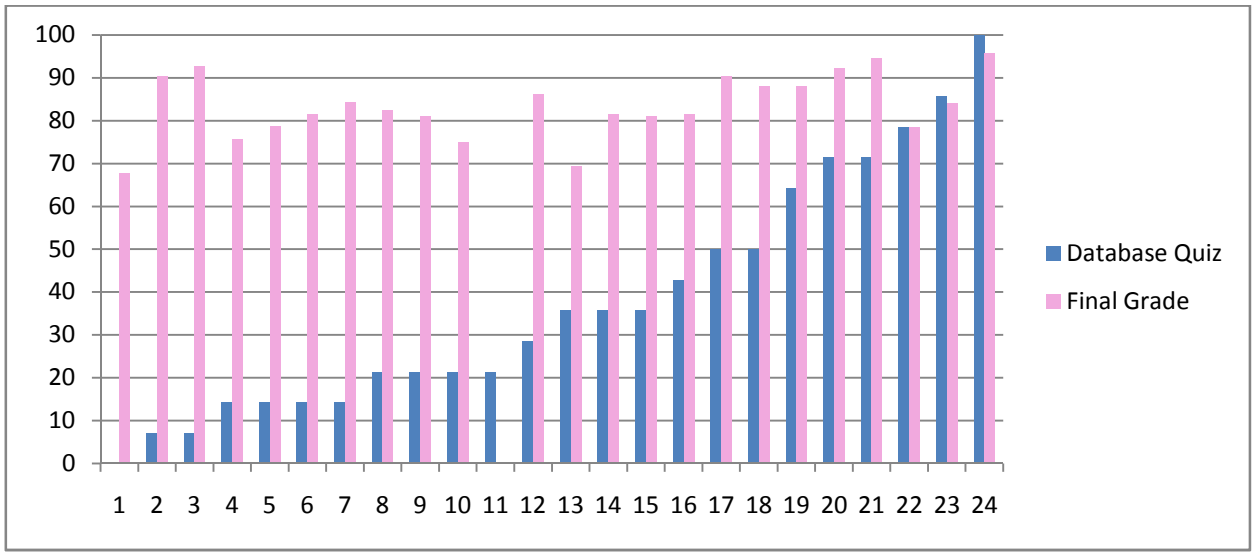

Figure 4.3: *Comparison of Database Quiz Results with Final Grades (Participants Only).*

Note that participant numbers are not displayed on this chart in order to maintain anonymity. Note that one participant scored zero on the quiz and another completed the database quiz but did not finish the course.

4.6.4 Written Surveys

Two surveys were deployed during the course: one on the first day of the course (January 3rd 2007) and one at end of the course (March 28th 2007). When the first survey (S_1) was deployed, students who were not participating in the study were also invited to complete the survey. Since all the students were fully informed about the nature of the study, they were providing informed consent by completing the survey. Identifying information

about these non-participant surveys was removed—the surveys were completed on an anonymous basis. A similar situation occurred with the second survey (S_2)—several non-participants completed S_2. This modification to the study's design was reviewed by the HREB and a new Certificate of Approval was provided on July 18th 2007, confirming that this form of data gathering is considered ethical based on the study's design and implementation. Students who did not formally participate in the study but completed a survey are referred to as *survey respondents*. 18 participants and 16 survey respondents completed S_1. 16 participants and 11 survey respondents completed S_2.

I allowed non-participating students to complete the written surveys so that I was able to gather information about the class as a whole. Also, I tracked whether the survey results were submitted by participants or survey respondents in order to determine if there were significant differences between the two groups' results. In particular, I wished to explore whether survey respondents (who are technically non-participants) had different attitudes and opinions compared with their participant colleagues.

4.6.5 Interviews

Interviews were given in person or via email. Seven participants were interviewed in person on February 5th 2007 and March 6th 2007. Two participants submitted their responses via email. The instructor was also interviewed before and after SCALE-UP was implemented. A second set of interviews was not performed at the end of the course as originally planned because of time constraints. Since I was conducting the interviews by

myself and had more participants than anticipated, the length of each interview was shortened—especially if the participant indicated that they were ready to leave early. Interviews varied in length from 20 to 45 minutes. Participants who gave interviews via email answered a set of numbered questions used as the basis for the interviews given in person.

4.6.6 Focus group

The focus group was held on April 3, 2007 for one hour. Two participants (P_4 and P_{12}) attended. Another participant (P_{10}) intended to attend but forgot and later sent an email apologizing for the absence. The timing of the focus group did not prove to be ideal—most of the participants were very busy preparing for exams and completing assignments.

4.6.7 Photographs

Photographs of the instructor and students working in their teams were taken on March 21st 2007. Twenty-eight students signed photo waivers. I took thirty-eight photographs during a fifty minute class. Note that the photographs and the waivers were not anonymous and are not related to other participant data. The process of taking photographs was slightly invasive and distracting; however, in general the students ignored my camera and continued working on their activities.

4.6.8 Assignment Review

Student assignments were reviewed very briefly at the end of the course. Observations were made regarding mistakes in SQL syntax, authorship of work and professionalism of presentation.

4.6.9 Room diagrams

Two room diagrams were completed during in-class observations. The purpose of these diagrams is to illustrate the positioning of the teams, instructor and observer within the classroom and also demonstrate how the tables were used by the teams.

4.7 Anonymization Process

In order to satisfy the constraints of the ethical approval process, the data gathered had to be anonymized before it could be seen by anyone other than the principal investigator. Note that the anonymity of our participants was protected partly by the study's level of participation. First, there were 27 participants and only one observer. In addition, there was no way for me to learn the identity of a participant unless he or she attended an interview or the participant was referred to by name in class during observation sessions. By the end of the four month data collection period, I could identify 16 of the 27 participants by name.

The main priority of the anonymization process was to ensure that the instructor would not be able to identify any of the students who participated in the study. I performed a two phase anonymization process. First, I removed any data that I suspected might reveal the identity of the participant and submitted this sanitized data to the instructor to confirm that no one could be identified. (Access to this data was not provided until after final grades had been submitted for this course and students had been given the opportunity to dispute these grades.) Then I assigned participant numbers to individual data—in the event that the instructor was able to identify anyone, delaying the participant number assignment prevented him from also knowing the participant number indicating the relationship between different types of individual participant data. The anonymization was done by data set in order to ensure that any mistakes would not create a link between different data belonging to the same participant.

As far as I am aware, the participant anonymity has been maintained with the exception of one incident. The anonymity of one participant was compromised when the instructor unintentionally observed me interviewing this participant outside the classroom. This incident consisted simply of the instructor seeing that the student was giving an interview which meant that the instructor knew only that the student was one of the participants. Given our very high participation rate, I did not feel that this lapse in anonymity was especially problematic. At the time, the incident was addressed with the participant and he was not concerned. Other than the fact that this participant provided an interview, the remainder of his data has remained anonymous. To date, there have been no other known lapses in student anonymity.

Data Type	Subjects	Anonymized?
Consent Form	Participants	Yes
Surveys	Participant/Survey Respondents	Yes
Observations	Participants	Yes
Focus Group	Participants	Yes
Interviews	Participants	Yes
Background Quiz	All students	No
Grades	All students	No
Photographs	All students	No

Table 4.3. *Anonymous and Identifiable Participant/Student Data.*

Providing students with this level of anonymity has, to a certain extent, compromised our ability to gather data and report fully on our implementation of SCALE-UP. For instance, since we had only two female students, we were not able to include gender in our participant data. In addition, since we had a few teams with only three members, we were not able to report on participant activities by team without compromising student identity.

4.8 Summary

In this chapter, I have detailed the process used to implement this study. In particular, I have discussed our data collection techniques and explained the limitations that we encountered.

Chapter 5 Data Analysis

5.1 Introduction

This chapter contains an analysis of the data collected during this study. Using a subset of the data, I explain how this selected data answers the original research questions and supports the research objectives. Additional results are also provided for the sake of clarity and to ensure that a thorough report on this study has been completed.

Since this is an exploratory study the conclusions drawn are applicable to this instance of CSC370 only. However, I hope this chapter will provide some insight into whether the methodology used was helpful for teaching an undergraduate database systems course.

5.1.1 Terminology Used

During the anonymization process, I developed a simple set of terms that are used in this chapter.

For this study, three different classifications of students have been identified. A **participant** formally participated in the study by signing a consent form. Students who completed both surveys are referred to as **Pre/Post-Test participants**. Some students did not participate in the study but completed written surveys on an anonymous basis; they are referred to as **survey respondents**.

In order to maintain anonymity, each participant in this study was assigned a participant number, such as 'P_1.' The majority of the participants were involved in more than one data collection activity; consequently, most participant numbers have more than one type of associated data. For example: "P_n completed two surveys and attended an interview, resulting in three associated data sets."

Survey respondent data was numbered randomly and is not associated with any other data collected. The survey results are numbered as ${}_nS_1$ and ${}_nS_2$, for Survey 1 and Survey 2 respectively. For example: "There are three unmarked S_1s completed which are now numbered as ${}_1S_1$, ${}_2S_1$ and ${}_3S_1$." Since the identity of the survey respondent is not known, the number is assigned to the survey itself, not the participant.

S_1 and S_2 were specifically designed to serve a Pre/Post-Test purpose. Fourteen participants completed both S_1 and S_2: P_2, P_4, P_7, P_9, P_{10}, P_{12}, P_{13}, P_{15}, P_{18}, P_{19}, P_{20}, P_{21}, P_{23}, and P_{24}. The classification of the students is indicated in the diagrams below. Shown below are two Euler diagrams, the regions of which proportionally indicate the populations of the student classifications. Two Euler diagrams were required since there is no known intersection between the two groups of anonymous survey respondents for S_1 and S_2.

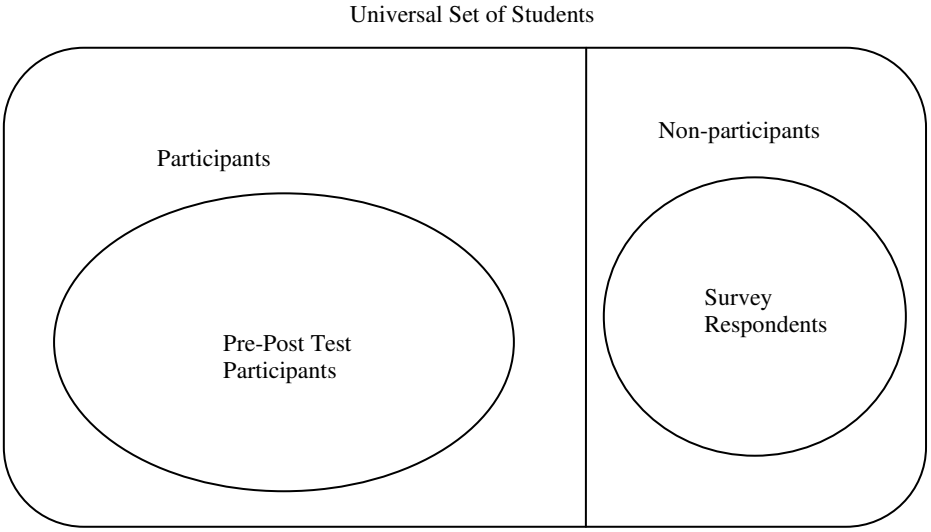

Figure 5.1: *Euler diagram showing classifications of students when S1 was deployed.*

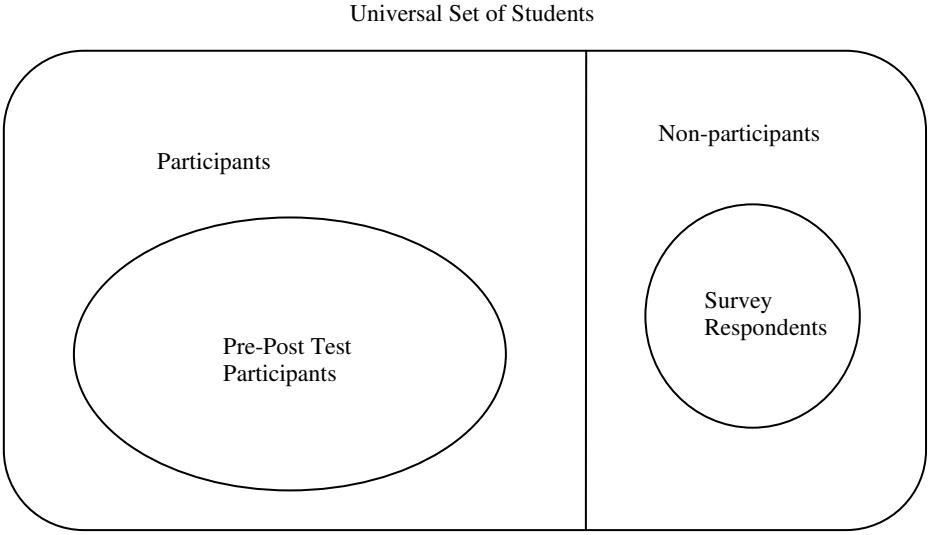

Figure 5.2: *Euler diagram showing classifications of students when S2 was deployed.*

5.2 Overview of Data Results

The research questions developed during the Initial Research Phase are phrased as follows:

Question 1. Is SCALE-UP an effective, if not superior, method of teaching large undergraduate classes about databases?

Question 2. Does SCALE-UP encourage and support teamwork and collaboration within the classroom?

In order to investigate these questions more concretely, these questions were broken down into a second set of questions devised during the Analysis Phase. Note for that Question 1, it is assumed that this course is being directly compared to previous classes of CSC370 as taught by Dr. German.

5.3 Detailed Data Results

The two primary research questions of this study are explored in greater detail in this section.

Question 1. Academic Results

a. Can this customized use of SCALE-UP be considered a valid instance of SCALE-UP teaching?

It is important to determine whether this project can be considered a valid instance of the SCALE-UP teaching methodology, particularly if there is any inclination to compare our use of SCALE-UP with other implementations. The use of this teaching method most closely resembles Dr. Beichners' pilot attempts [10]. Like Dr. Beichner's early use of SCALE-UP, we lacked the technical, instructional and physical infrastructure that is now considered typical in most SCALE-UP courses. We also customized the teaching methodology in a number of ways (see Section 4.2) to meet the requirements of CSC370 and the students enrolled in the course.

Note that this use of SCALE-UP would **not** be recognized as such when compared to what is now considered a standard SCALE-UP course. (From this point forward I refer to our use of SCALE-UP as 'the methodology used.') However, in-class observations indicated that, for the most part, students were functioning as described in SCALE-UP literature [10]. In our implementation, the priority was placed on developing and maintaining effective teams and in this respect, we were successful in that the teams were able to complete their assignments in a collaborative manner and none of the students requested to be reassigned to different teams. As described in upcoming sections, the vast

majority of the students surveyed viewed their learning experiences as members of their teams in a positive light.

b. Were the learning objectives of the standard CSC370 curriculum achieved?

The standard curriculum for CSC370 covers the design of databases, SQL and database programming. UVic's academic calendar describes CSC370 as follows:

> *An introduction to the use and operating principles of database management systems. Topics to be covered include: data entities and relationships; data modeling using Entity-Relation Diagrams: hierarchical, network and relational models of databases; query languages; physical representation of data in secondary storage; relational algebra and calculus as applied to the design of databases; security and integrity in the context of concurrent use; and basic ethical issues associated with database design and use.*

With the exception of the ethical issues, the topics specified in the calendar were covered during this course. (A copy of the course outline is available in Appendix H.) In addition to reviewing the calendar description, a comparison of the coursework to previous sections of CSC370 confirms that this course meets the guidelines for CSC370 at UVic.

As well as confirming that this course meets UVic's specifications, the feedback we solicited on S_2 established the course's viability while exploring more difficult aspects of

the curriculum. For Q16, students indicated which database concepts/course modules they found challenging. Five students did not indicate any difficult database concepts.

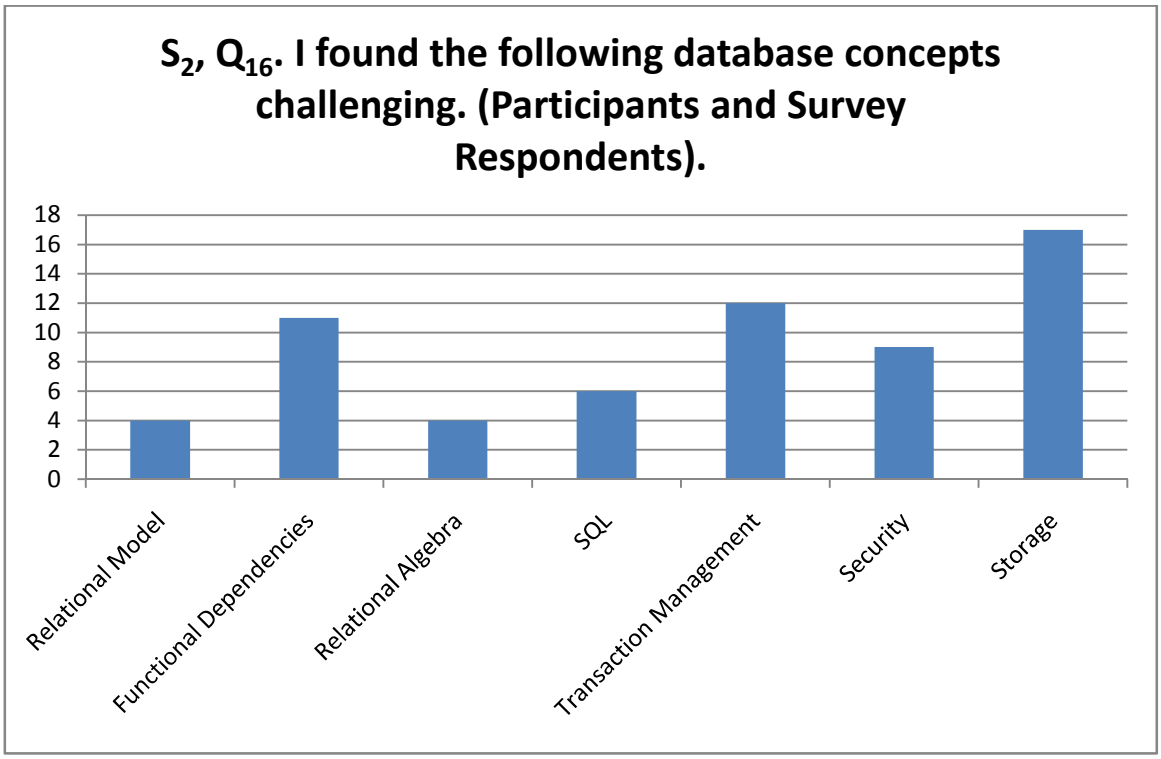

Figure 5.3: *Results of S2, Q16.*
As confirmed in participant interviews, some students found the concept of functional dependencies challenging. Many students also struggled with transaction management and storage. The database concepts shown are listed in the same order as taught in the course.

The database concepts rated as difficult are typically found to be challenging for students being introduced to database systems.

Students were also asked to rate their confidence with database work. This informal metric was used to gauge student competence since building and maintaining a database in a work environment requires using all of the skills taught in CSC370.

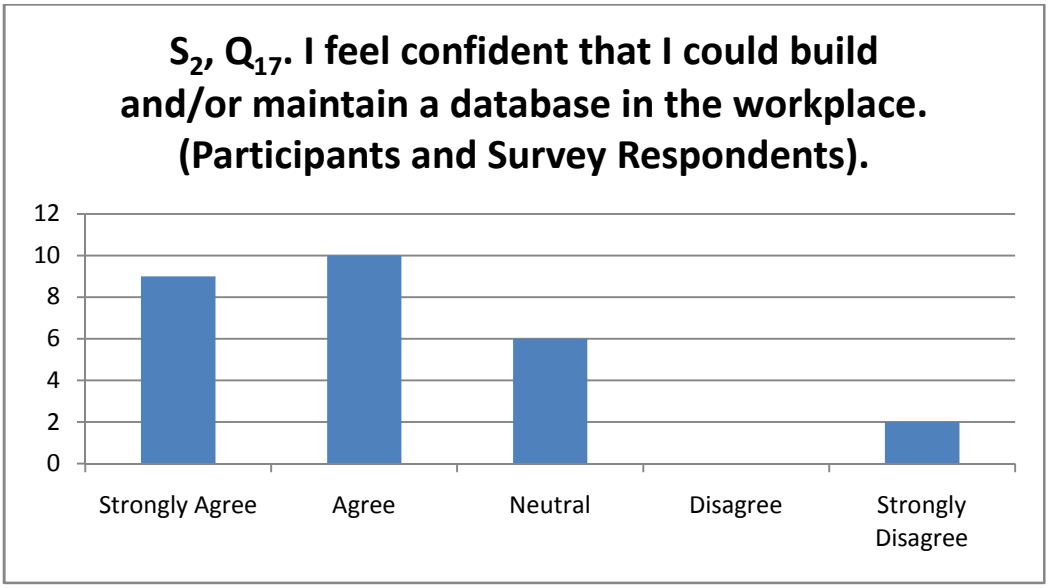

Figure 5.4: *Results of S2, Q17.*
At the end of the course, the majority of the participants and survey respondents felt that they could work with databases in the workplace. While this self-perceived capability cannot be verified without a follow-up investigation of the same students in the workplace, the results do indicate confidence with database management.

Students were also asked to indicate difficulty writing SQL on the midterm exam in Q18. Interestingly, more students identified difficulties with writing SQL in Q18 than perhaps would be expected based on the results of Q17. Writing SQL is a fundamental skill for database work.

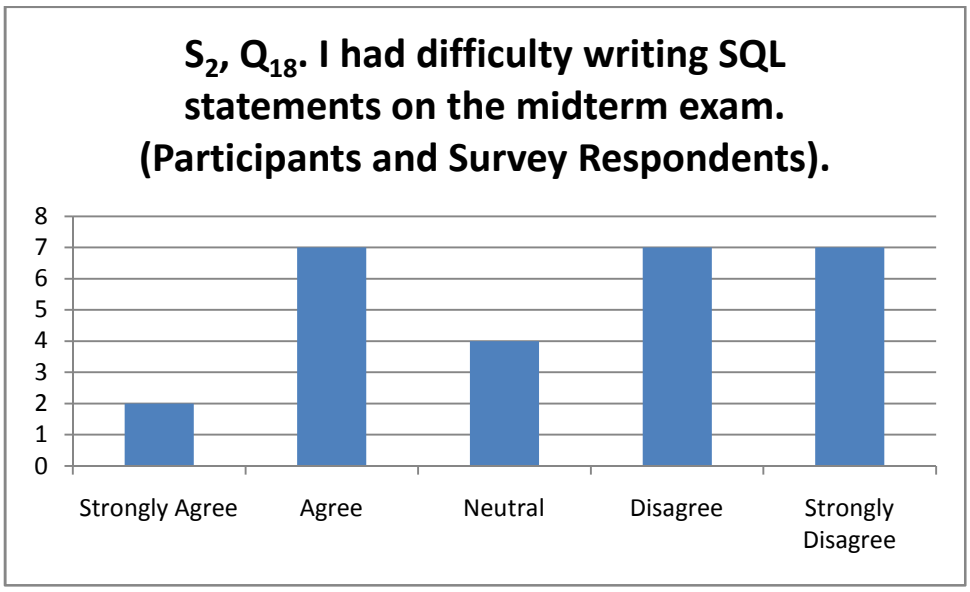

Figure 5.5: *Results of S2, Q18.*
The varying responses to S2, Q18 may also be reflection of the differences in SQL literacy identified at the beginning of the course.

While some students experienced difficulty with writing SQL (which suggests that more hands-on practice would be beneficial), overall student confidence with this topic was fairly high.

c. Were the students' academic results similar to the results obtained in previous sections of CSC370?

The distribution of the final grades for this class of 37 students is shown in Figure 5.3, with a class average of 82.58%.

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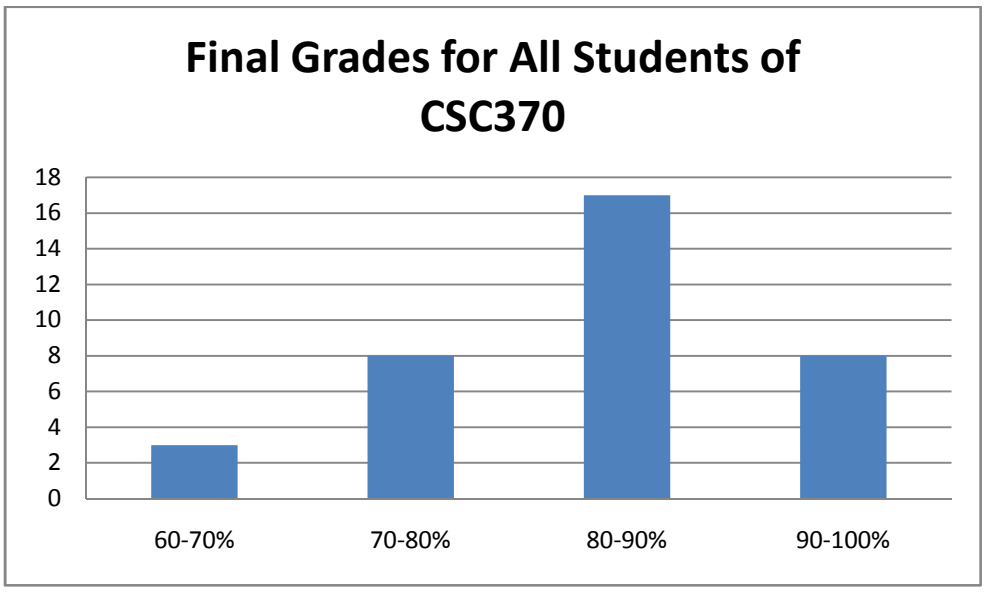


Figure 5.6: *Final grades of all students in CSC370, Spring 2007.*

Since Dr. German had taught CSC370 five times previously, a comparison of the academic statistics of these courses can be used to compare this course with previous sections. Dr. German has taught CSC370 in the following semesters: Fall 2002, Summer 2003, Summer and Fall 2004, Summer 2005 and Spring 2007. Note that in 2003, 2005 and 2007, a single class was comprised partly of Engineering and partly CS students. They are listed as separate sections for administrative reasons (K01 and K02, S01 and S02) and this is reflected in the table. With the exception of the student population (POP'N) and average final grade (GRADE), the statistics below are presented as percentages of the student population. At UVic, grades are calculated on a 9.0 scale.

YEAR	SECTION	POP'N	GRADE	A+	A	A-	1ST	2ND	PASS	FAIL	DROP
2002	F01 (Fall)	72	6.46	16.7	11.1	25	52.8	41.7	4.2	1.4	2.7
2003	K01 (Summer)	52	5.98	19.2	11.5	9.6	40.4	51.9	5.8	1.9	13.3
2003	K02 (Summer)	4	7	25	25	25	75	25	0	0	0
2004	F01 (Fall)	45	6.33	13.3	26.7	13.3	53.3	40	0	6.7	6.2
2004	K01 (Summer)	36	5	11.1	8.3	16.7	36.1	41.7	8.3	13.9	12.2
2005	K01 (Summer)	25	5.84	20	16	4	40	44	12	4	10.7
2005	K02 (Summer)	2	7	0	0	100	100	0	0	0	0
2007	S01 (Spring)	29	6.69	20.7	10.3	31	62.1	34.5	0	3.4	6.5
2007	S02 (Spring)	8	8	25	50	25	100	0	0	0	0

Table 5.1. *Comparison of course statistics for all sections of CSC370 taught by Dr. German at UVic.*

Based on the information provided in Table 5.1 this section of CSC370 can be confirmed as typical in its results. The academic results and failure/drop rates for the students fell within the expected ranges. Note that, as occurred in previous sections, none of the Engineering students dropped out and on average scored higher than their Computer Science colleagues.

d. Did students perceive the methodology used to be an inferior, superior or equivalent teaching methodology for CSC370?

This question was not directly addressed with the students. However, during interviews, participants were asked how they felt the course was going overall. None of the students directly complained to the instructor or myself about the methodology used. S_2 survey responses indicated that the majority of the students viewed the course positively enough to recommend it to other students.

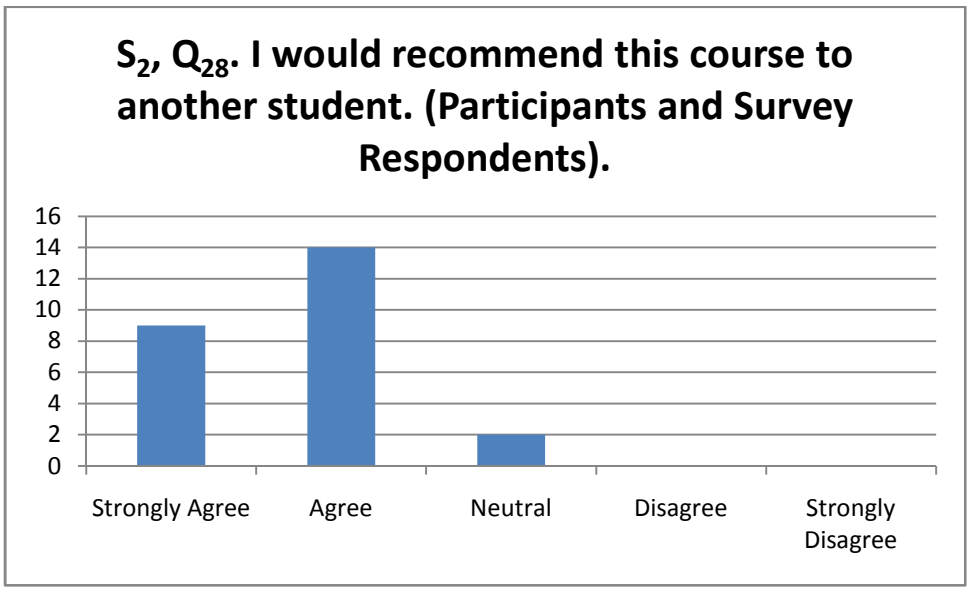


Figure 5.7: *Results of S2, Q28.*
*It could be considered significant that none of the students surveyed indicated that they would **not** recommend this course to another student.*

However, some negative feedback about the course was received in the comment section of S_2. All of the gathered comments (including participant and survey respondent) are provided below.

> $_3$**S$_2$**: *I really feel there was a lot of value in the team in-class exercises, but no so much that the assignments were in teams.*
>
> $_7$**S$_2$**: *Great course! One of the most useful courses I took at UVic. Great teacher. Assignment 3 was a little too long though ;) I wish there was a higher level db course.*
>
> $_8$**S$_2$**: *My teammates are easy to work with which makes teamwork easy.*
>
> **P$_2$**: *Not a bad learning experience, but I would have preferred a less practical-based class be used i.e. 330 or 360.*

P_7: *I know this should be a easy course, but I just can't follow the prof in class and get confused by the end of the day.*

P_9: *This is a good format for the course, the lecture style should continue to be improved as they did over the term. Teams could benefit more from a 2-3 week project rather than small assignments done in groups.*

P_{13}: *I think this course should have a regularly scheduled 3-hour final exam. 50 minutes is just not enough time show you how much I know [sic].*

P_{18}: *Great teaching style. Very few teachers have that much energy. However I strongly disagree with the concept of teaching my groupmates all of the course material every single assignment (as you said we should be doing).*

P_{19}: *In Q27 I did not check "listening to lectures" because usually I don't learn that way, but this class was an exception, probably because we had breaks to do exercises which would prevent me from getting bored and allow for a chance to catch up with the stuff Daniel had just talked about.*

P_{20}: *It has been an interesting course. Hope we can have more example in class on some of the query evaluation speed i.e. how will a query runs [sic].*

P_{23}: *Worked great, good job.*

Despite some complaints about certain aspects of the course, we view the methodology used as successful. The negative feedback received can be used to inform future applications of SCALE-UP at UVic.

e. Was there any indication that the use of SCALE-UP was detrimental to student learning, particularly minority and/or disabled students?

The students enrolled in this course came from diverse ethnic and cultural backgrounds. Demographic information about student ethnicity is not available from the university's administration and no effort was made to gather this data. (In S_1, students were asked to provide first languages but these responses do not necessarily indicate ethnic or cultural background). The class was sufficiently diverse such that concerns about ethnic minorities were not considered relevant; indeed, it was not possible to determine every student's ethnic origin based on physical appearance or name. A number of students proved to be 'invisible' minorities. Ethnic and cultural differences between students were not observed or reported to be problematic during the course.

Two students in this course were listed as disabled. One student had vision challenges which required sitting at the front of the classroom. Another student needed extra time to complete the final exam and sought administrative permission for this exemption. However, due to anonymity concerns, it is not possible to indicate whether these students participated in the study. Based on the observations of the primary investigator, there was no indication that students with disabilities were adversely affected by this methodology. Certain aspects of SCALE-UP (in-class versus out-of-class team activities, pre-assigned versus self-selecting teams, instructor support for teams within the classroom, etc) may prove to be beneficial for students with disabilities who otherwise might have difficulty with teamwork.

During the study and to date, no complaints about the study have been received by the primary investigator. Some negative feedback about aspects of the course was received via S_2; however, comments that specifically indicated harm towards minority, disabled or otherwise vulnerable students were not found.

On S_1, students were asked to indicate exclusion from teams based on their previous experiences.

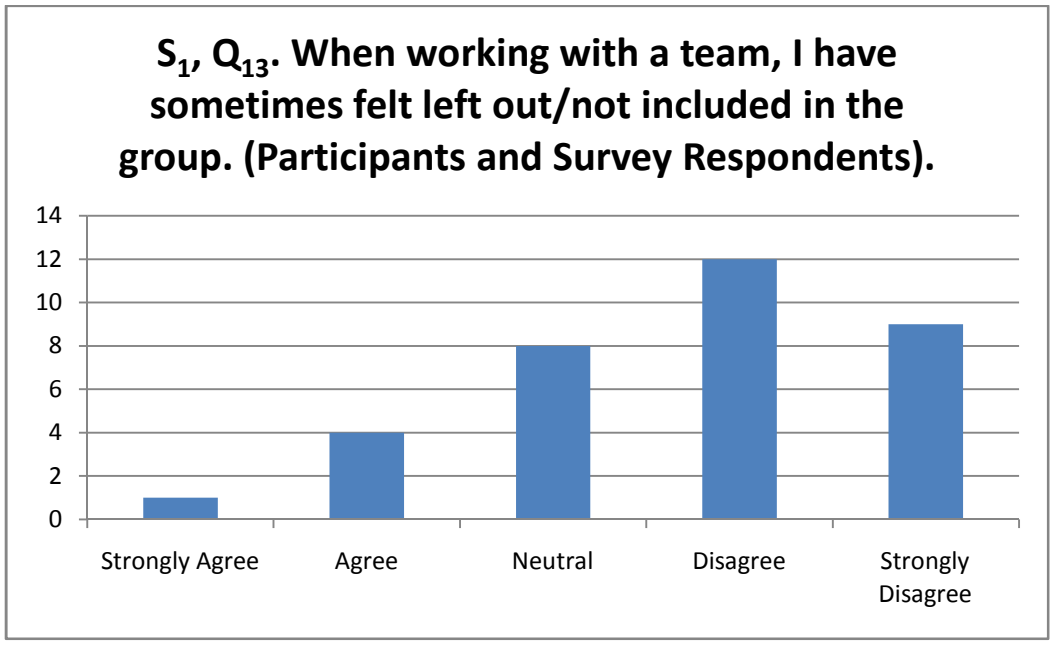


Figure 5.8: *Results of S1, Q13.*
The students surveyed were asked if they had previously felt excluded when working with other teams or groups. The majority of students had not experienced exclusion.

On S_2, students were again asked whether they had felt excluded. While it is impossible to know if the same sample group is being used, fewer students indicated exclusion after the course than at the beginning of the term.

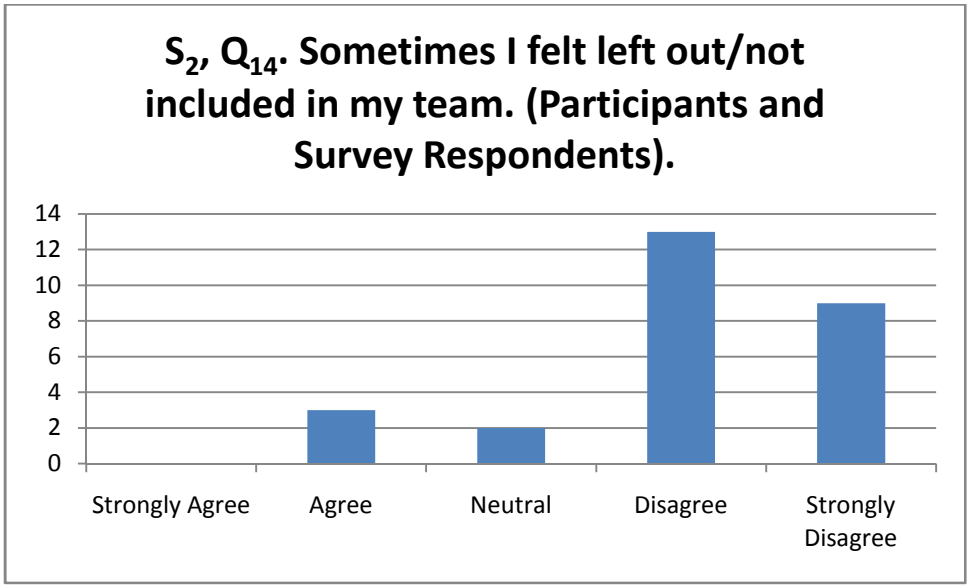


Figure 5.9: *Results of S2, Q14.*
Even without making a direct comparison to the results of S_1, Q13, the results of S_2, Q14 indicated that overall students perceived their teams to be inclusive.

Conclusion for Question 1.

Based on the results of the individual sub-questions used to answer the overarching research question, we can conclude that this teaching methodology was an effective method of instructing an undergraduate database course. Whether the methodology could be considered superior is debatable and would perhaps be better answered after repeated deployments of SCALE-UP style teaching. However, the additional benefit of providing students with a supported teamwork experience as a soft skill for entering the workplace is evident. Even students who did not particularly enjoy working in their teams were still willing to recommend the course to others.

Question 2. Teamwork and Collaboration

f. Was it possible to gather data about teamwork attitudes and collaboration?

During this study, I gathered both qualitative and quantitative data about student attitudes towards teamwork. During interviews participants appeared to comfortable discussing this topic and provided detailed accounts of working with teams in academic, work and recreational contexts.

g. Did student attitudes towards teamwork change during the course?

The most effective methods of measuring changes in attitude were found by comparing (a) the results of S_1 with S_2 and (b) the results of the interviews with the focus group. Fourteen pre/post-test participant survey comparisons and two interview/focus group outcomes are discussed.

In Section C of S_1, students were asked to express their personal opinions about working in teams.

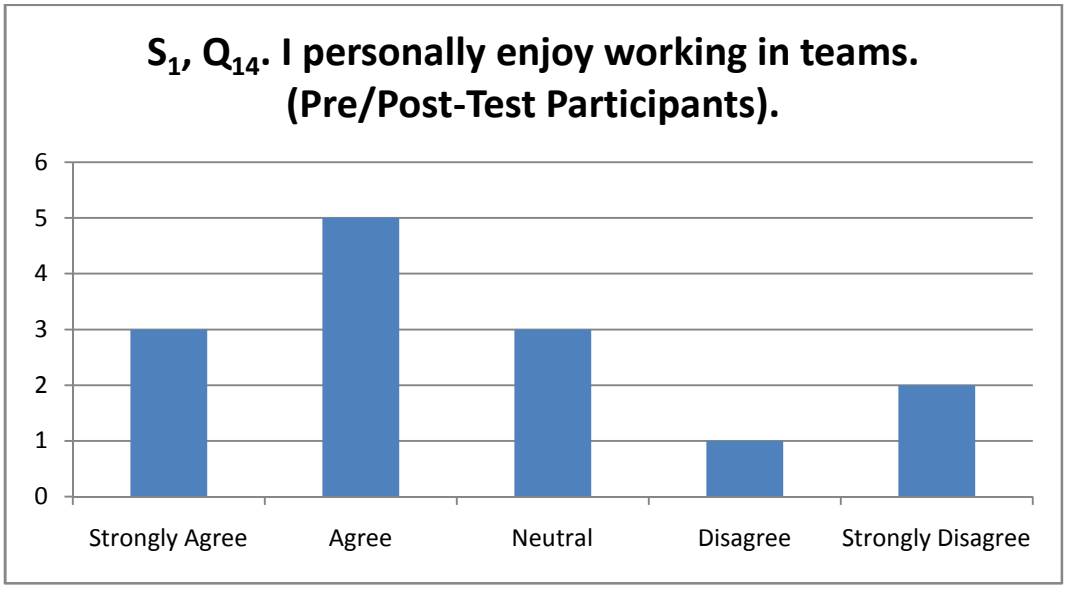


Figure 5.10: *Results of S1, Q14.*
The varied responses to S_1, Q14 provided an opportunity for richer follow-up interview questions and discussions about team dynamics.

Attitudes towards teamwork were also explored in S_1, Q16.

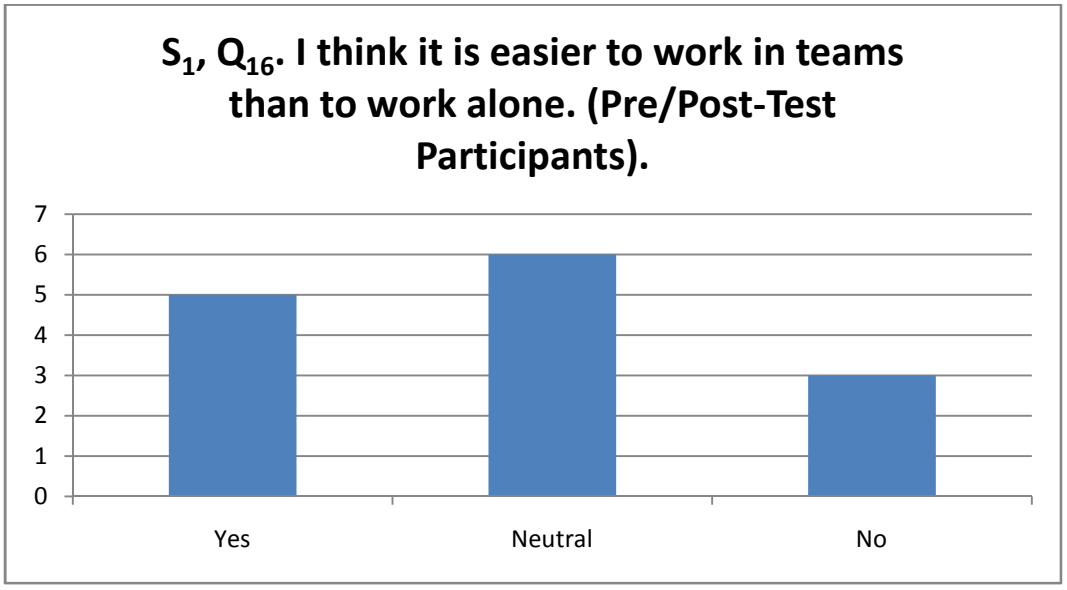


Figure 5.11: *Results of S1, Q16.*
Q16 is a difficult question to answer in such a simple format which perhaps explains why so many students chose 'Neutral' as their response.

While pre/post-test participants displayed primarily positive attitudes towards teamwork in terms of enjoyment in Q14, a relatively ambivalent response towards the simplicity of teamwork was shown in Q16. Comments explaining individual responses to Q16 are shown in Table 5.2.

Response	Explanation
Yes	"In teams, discussion speeds any periods of confusion that often experience [sic] when working alone." – P_4
	"Easier to find the correct answer." – P_7
	"Working with others is integral." – P_{12}
	"I can learn from other of something that I missed in class." – P_{20}
	"Group work keeps me on track. I am less likely to procrastinate if people are depending on me." – P_{21}
No	"The overhead to working in teams (scheduling, etc) is not worth the gain in my opinion." – P_2
	"Added energy and effort is needed for co-ordination and equality—partially compensated for by the 'two heads are better than one" observation." – P_{10}
	"I would rather work alone. Students are flakely [sic] and I always end up doing the bulk of the work. Team work great in industry when a pay cheque is involved otherwise I have had no luck." – P_{13}
	"I find it easier to learn on my own. For projects unless there is a large quantity of work it is easier to be solo." – P_{18}
	"I always seem to be more productive by myself. Sometimes in a team I don't learn about the parts of the assignment that other members do." – P_{19}
	"Some team members can't or won't do their share of work or quality work." – P_{23}

Table 5.2. *Pre/Post-Test Participant Comments for S_1, Q16. The three participants who responded 'Neutral' did not provide comments.*

Attitudes towards teamwork at the beginning of the course could be described as varied for the reasons indicated in Table 5.2.

Student attitudes towards teamwork at the beginning of the course were explored in greater depth by asking them to contrast their personal experiences with opinions about teamwork in general. Results for all students surveyed are shown below.

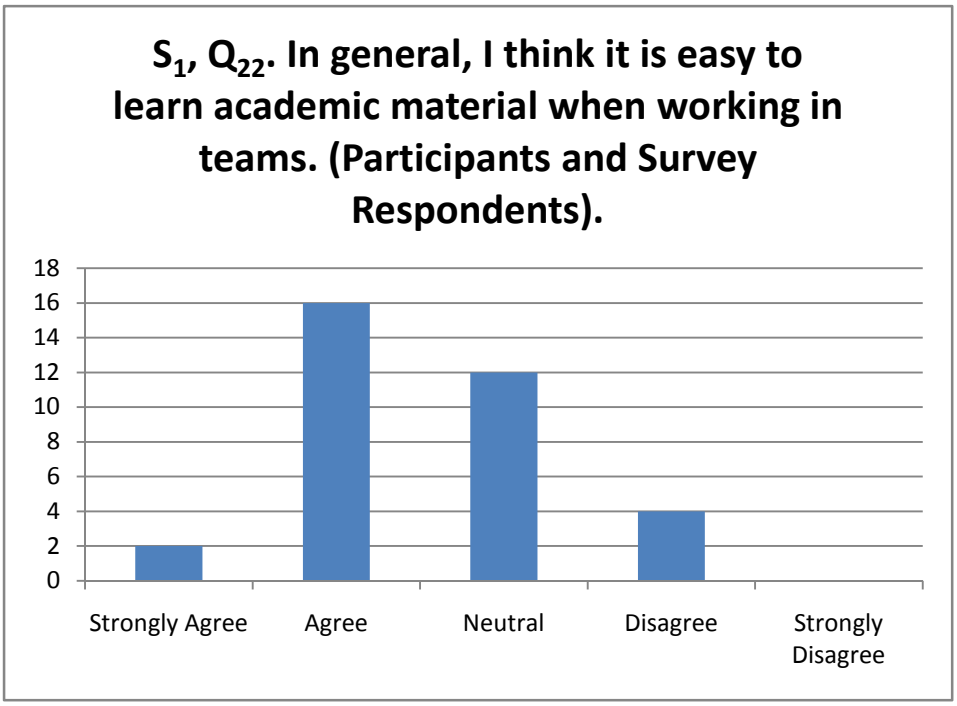


Figure 5.12: *Results of S1, Q22.*

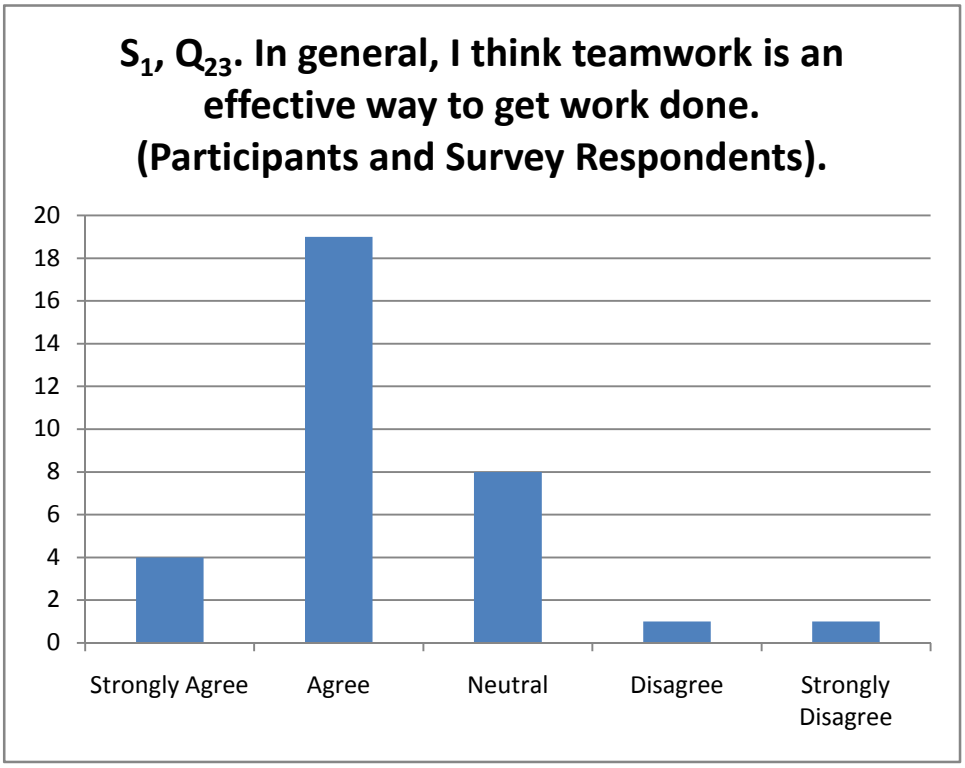


Figure 5.13: *Results of S1, Q23.*

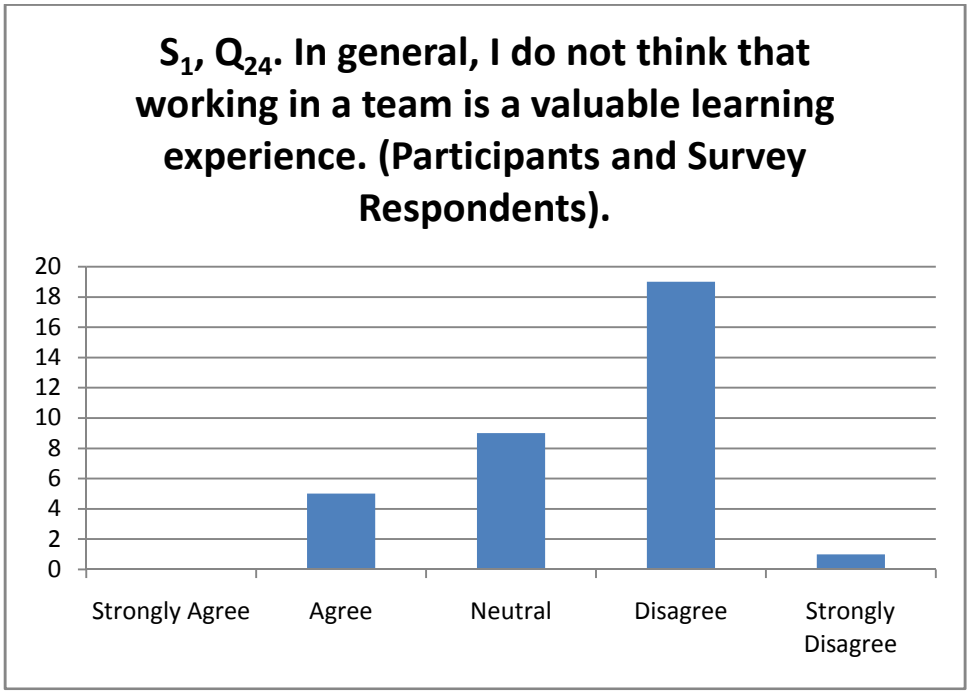


Figure 5.14: *Results of S1, Q24.*

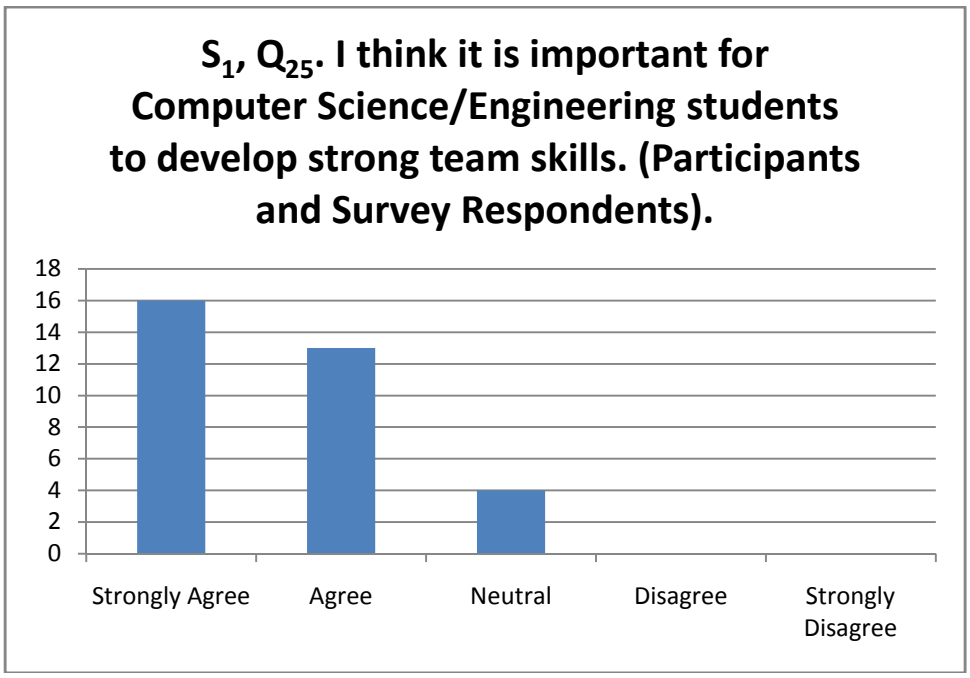


Figure 5.15: *Results of S1, Q25.*

The results in these four figures indicate the general attitudes towards teamwork (versus personal attitudes towards teamwork) of all the students surveyed. Perhaps the most interesting results are found in the responses to Q_{25} since the high level of agreement suggests that students were invested in the philosophy underlying the methodology used from the first day of class.

At the end of the course, S_2 was deployed and attitudes towards teamwork were explored. The first three questions of S_2 focused on the students' teamwork experiences in this particular course. An improvement in attitude can be seen in the results of S_2, Q1. Compared to the results of S_1, the majority of the students indicated that they enjoyed working with their teams during this course.

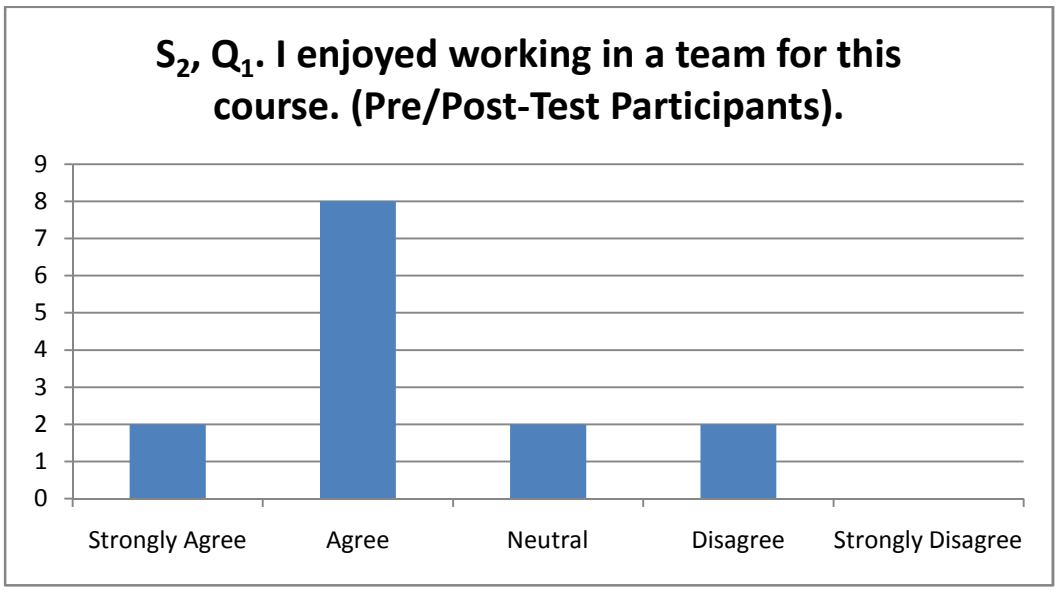


Figure 5.16: *Results of S2, Q1 (Pre/Post-Test Participants).*
The majority of Pre/Post-Test participants indicated that they enjoyed working in their teams.

S_2, Q2 also received a fairly positive response overall as shown below.

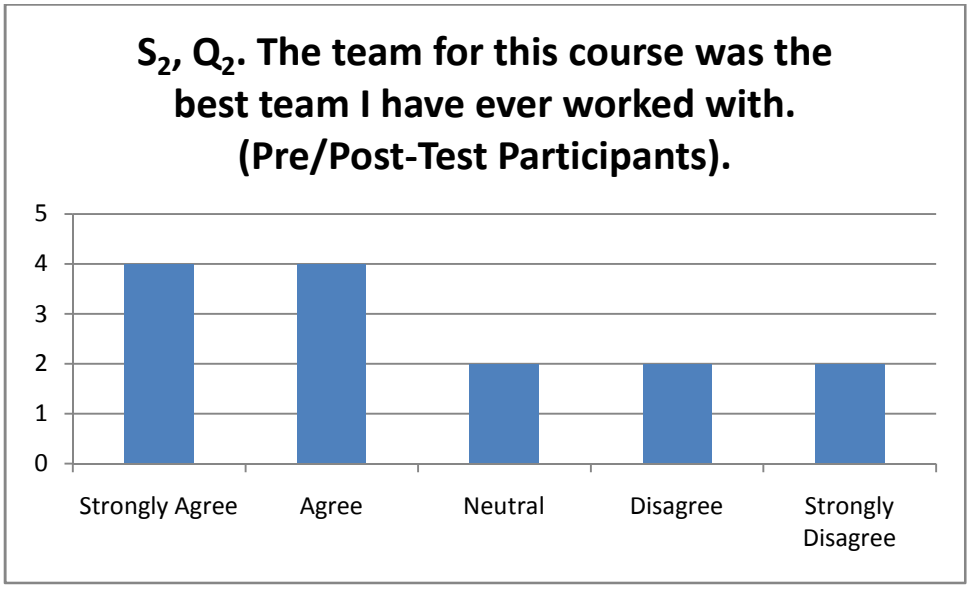


Figure 5.17: *Results of S2, Q2 (Pre/Post-Test Participants).*
As a further measure of successful team assignment, Pre/Post-Test participants were asked to indicate satisfaction with their teams in a superlative sense. Given that 8 of the

14 students agreed with this statement, it can be suggested that most of the team assignments received a positive response.

Most of the pre/post-test participants confirmed their high level of satisfaction with and loyalty to their teams when answering S_2, Q3.

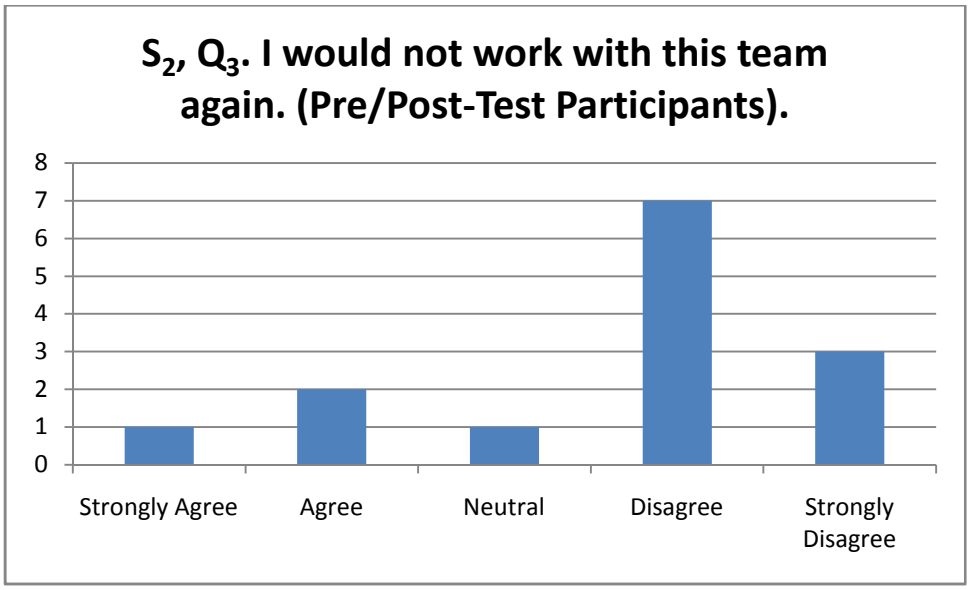
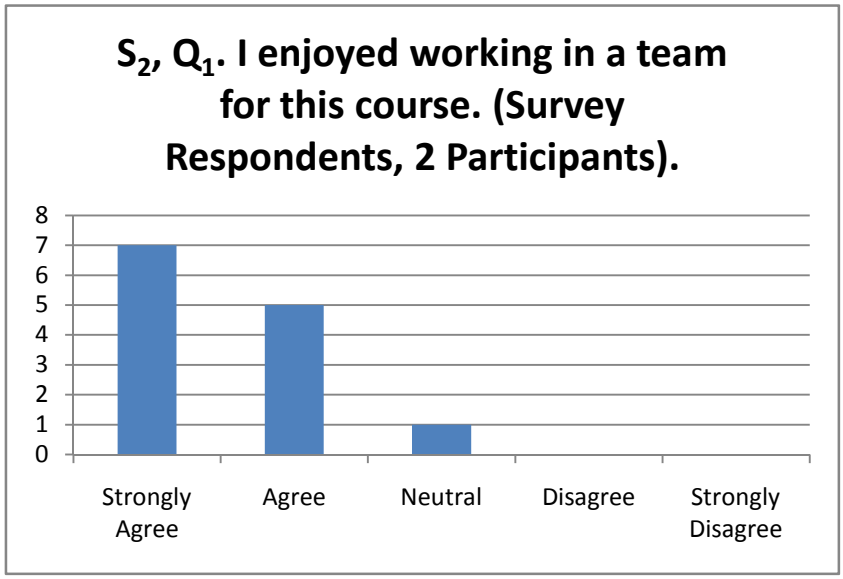


Figure 5.18: *Results of S2, Q3 (Pre/Post-Test Participants). Only 3 of the 8 Pre/Post-Test participants felt conclusively that they would not work with their teams again.*

Despite some ambivalence towards teamwork cited on S_1, the majority of pre/post-test participants indicated satisfaction with their team experiences.

For the purposes of comparison, S_2 Q1, Q2 and Q3 results for the survey respondents and two participants who did not complete S_1 are shown below.



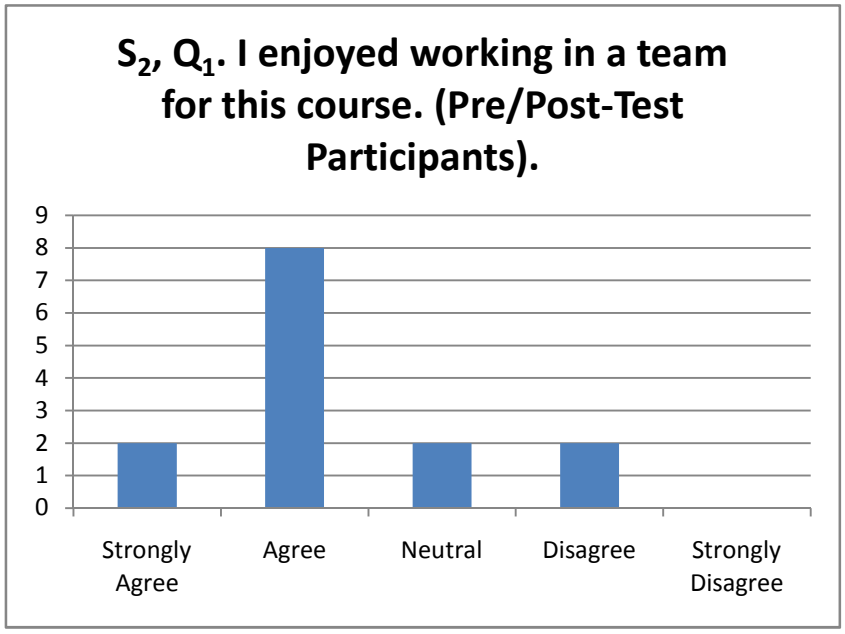
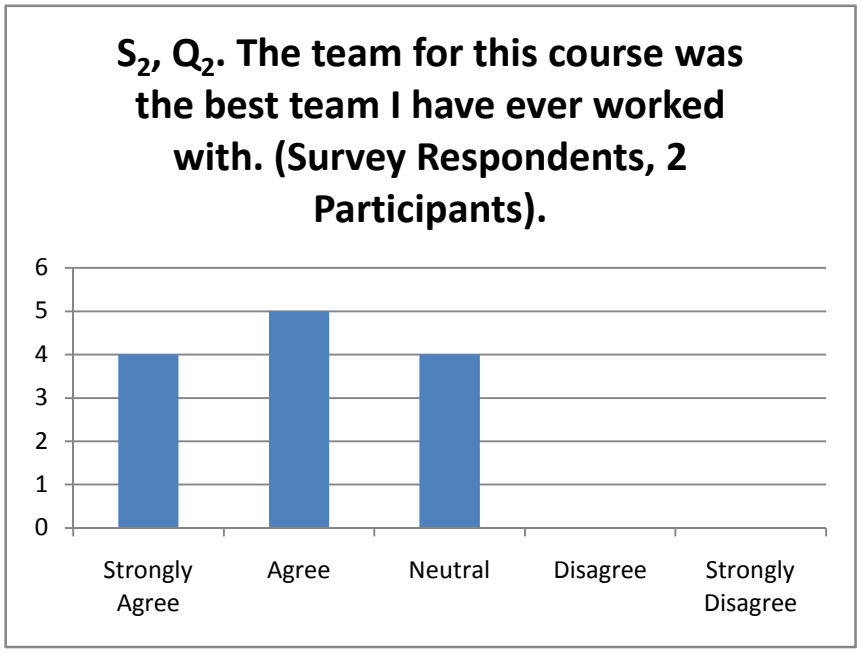


Figure 5.19: *Comparison of S2, Q1 Results.*



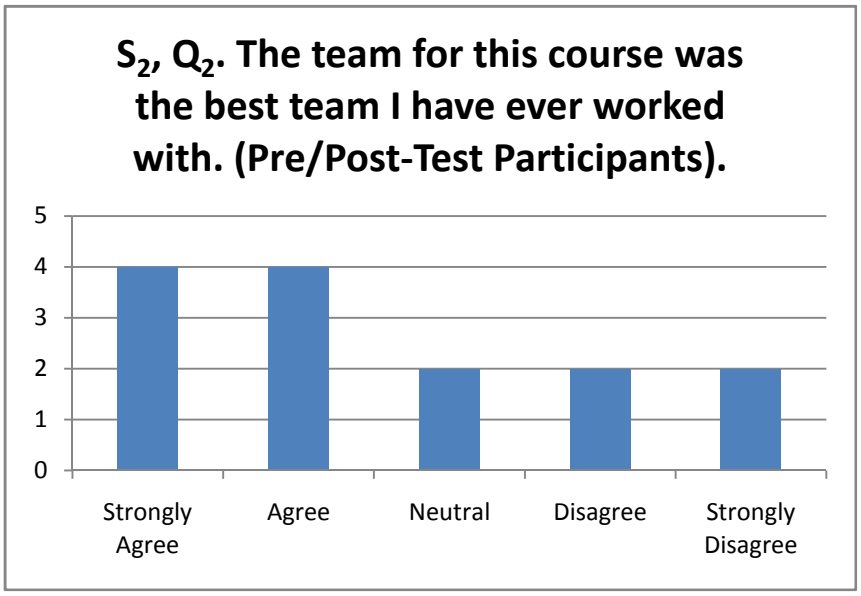
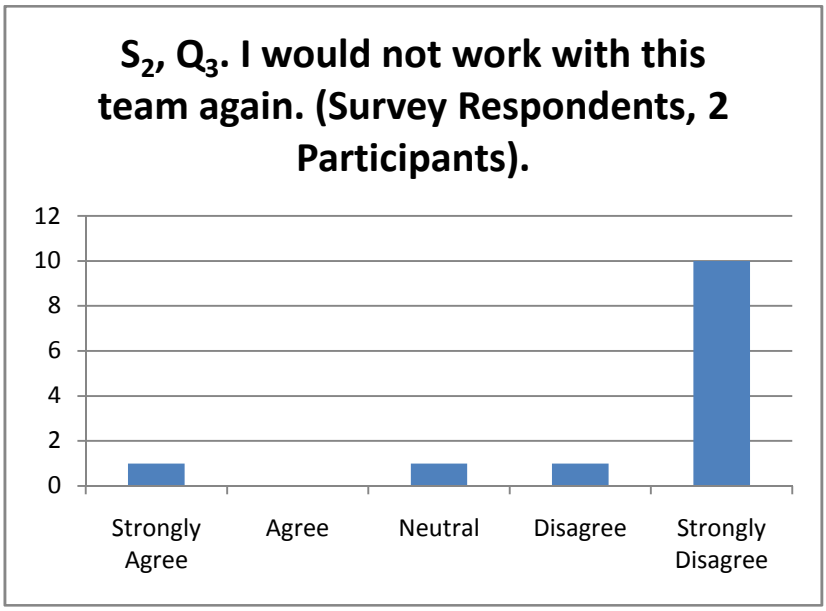


Figure 5.20: *Comparison of S2, Q2 Results.*



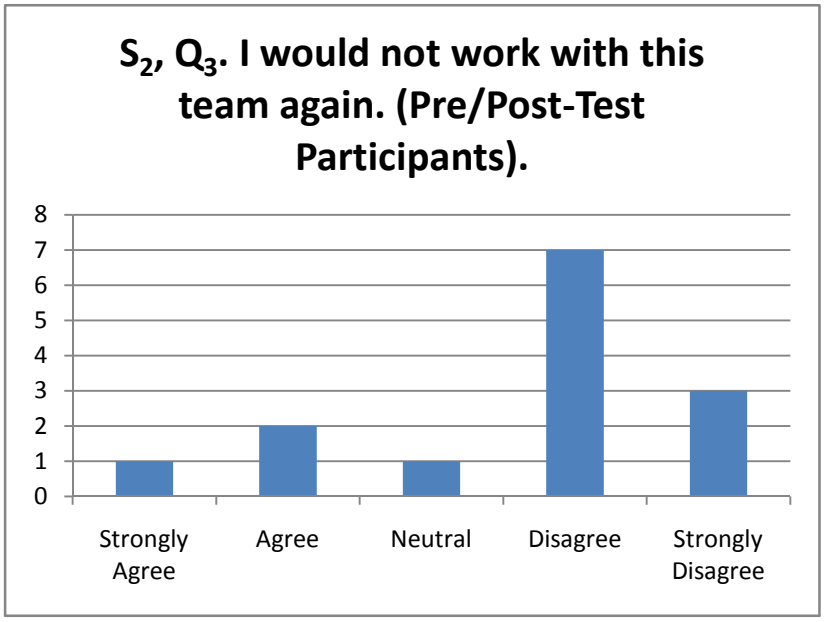


Figure 5.21: *Comparison of S2, Q3 Results.*
At the end of the course, the survey respondents indicated more positive attitudes towards their teams in comparison with Pre/Post-Test participants.

The interview and focus group sessions also provided an informal opportunity to check for changes in attitudes. Two participants gave interviews and attended the focus group session (P_4 and P_{12}).

Participant	Attitude (1st interview)	Quotation from 1st interview	Attitude (Focus group)	Quotation from focus group
P_4	Positive	"Best group I've ever worked with."	Negative	"I didn't like being dependant on someone else for my grades. I wish that I had more control of the marks, that's all."
P12	Positive	"We're just really casual. All we care about is getting the assignment done. We try to make sure everyone contributes."	Positive	"I liked having pre-assigned teams. It's a good way to meet new people."

Table 5.3. *P_4 and P_{12}'s attitudes towards teamwork from interviews and focus group session.*

While P_4 expressed some negative opinions in the focus group, the results on S_2 for P_4 were not negative overall.

Another check of pre/post-test attitudes was done by surveying the overall attitudes displayed on S_1 and S_2. One participant's attitude worsened while two improved. I also performed an informal check to see if there was any kind of correlation between grades and attitudes. In my opinion, no correlation could be identified.

Participant	Attitude (S_1)	Attitude (S_2)	Attitude Change	Final Grade
P2	Negative	Negative	No change	A+
P4	Positive	Positive	No change	B+
P7	Positive	Negative	Worsened	B+
P9	Positive	Positive	No change	A
P10	Positive	Positive	No change	A
P12	Positive	Positive	No change	A-
P13	Negative	Negative	No change	A-
P15	Positive	Positive	No change	A+
P18	Negative	Negative	No change	A
P19	Negative	Positive	Improved	A-
P20	Positive	Positive	No change	A+
P21	Positive	Positive	No change	A-
P23	Positive	Positive	No change	A+
P24	Negative	Positive	Improved	A+

Table 5.4. *A Comparison of Attitudes towards Teamwork between S_1 and S_2 and Final Grades.*

h. Did teamwork play a role in the students' learning of the course material?

On S_2, participants and survey respondents were asked to indicate whether teamwork played a role in learning the course material.

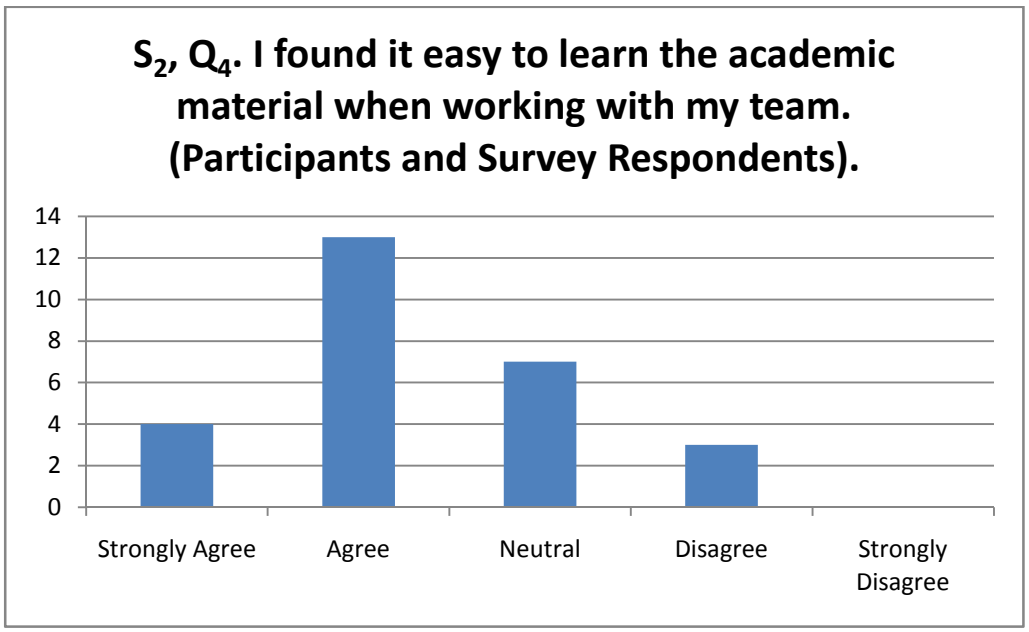


Figure 5.22: *Results of S2, Q4.*
For this question, all of the students who completed a survey were considered collectively and an overall positive response towards the effectiveness of team learning was found.

Students were also asked whether they found the in-class activities helpful.

Since the teams had been designed to have uneven skillsets, students were asked to indicate whether peer instruction had occurred within the teams.

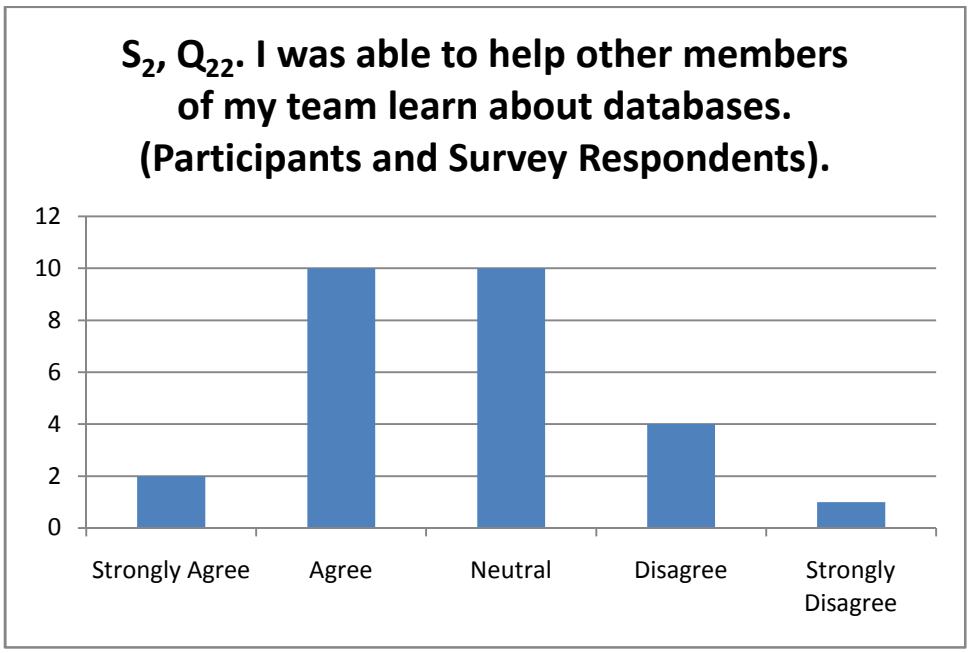


Figure 5.23: *Results for S2, Q22.*
Since this is somewhat a difficult question to answer definitively, the high number of students who answered 'Neutral' when asked if they contributed to others' learning is perhaps not surprising.

i. Did the students feel that the methodology used improved their team skills?

On S_2, students were asked to indicate whether they felt that their team skills had improved while working with their teams.

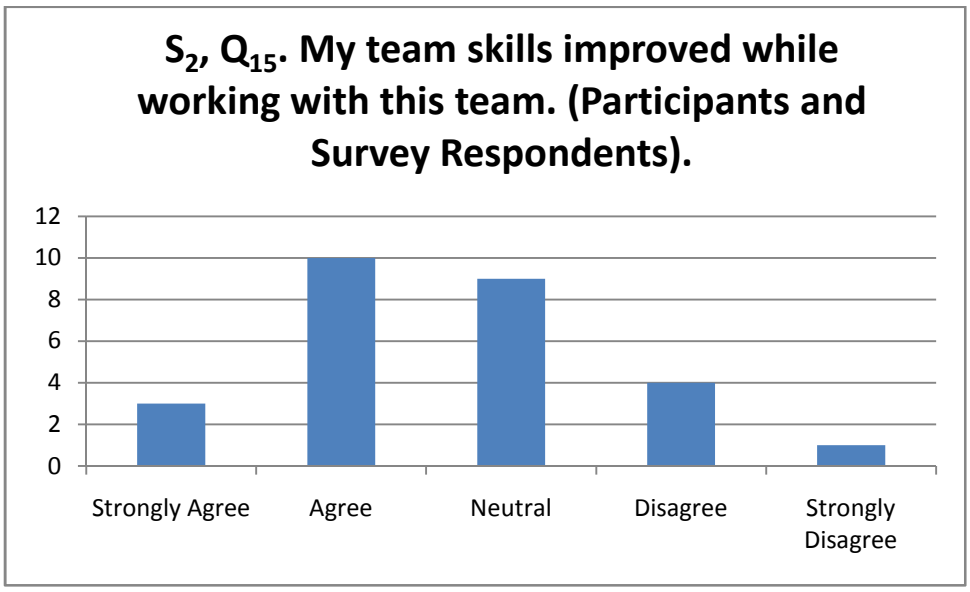


Figure 5.24: *Results for S2, Q15.*
A number of participants indicated that they felt they had strong team skills during interviews held at the beginning of the course which perhaps accounts for varying responses to this question. Regardless, the fact that 13 students in the class felt that their team skills improved while using this methodology suggests that the team activities provided more than simply academic benefits.

Conclusion for Question 2.

Perhaps one of the greatest benefits of using this methodology for database instruction is the opportunity for teamwork provided to students and which is relevant to the real-world application of this academic material. Even students who did not have wholly positive experiences in their teams gained more experience working in teams within a classroom environment that was specifically designed to support and encourage teamwork.

5.4 Additional Data Analysis

As part of the academic aspect of this evaluation, students were asked to provide feedback on the team assignments and other learning activities.

5.4.1 Team Assignments

The rating of the assignments was relatively even suggesting that none of the assignments were overly difficult.

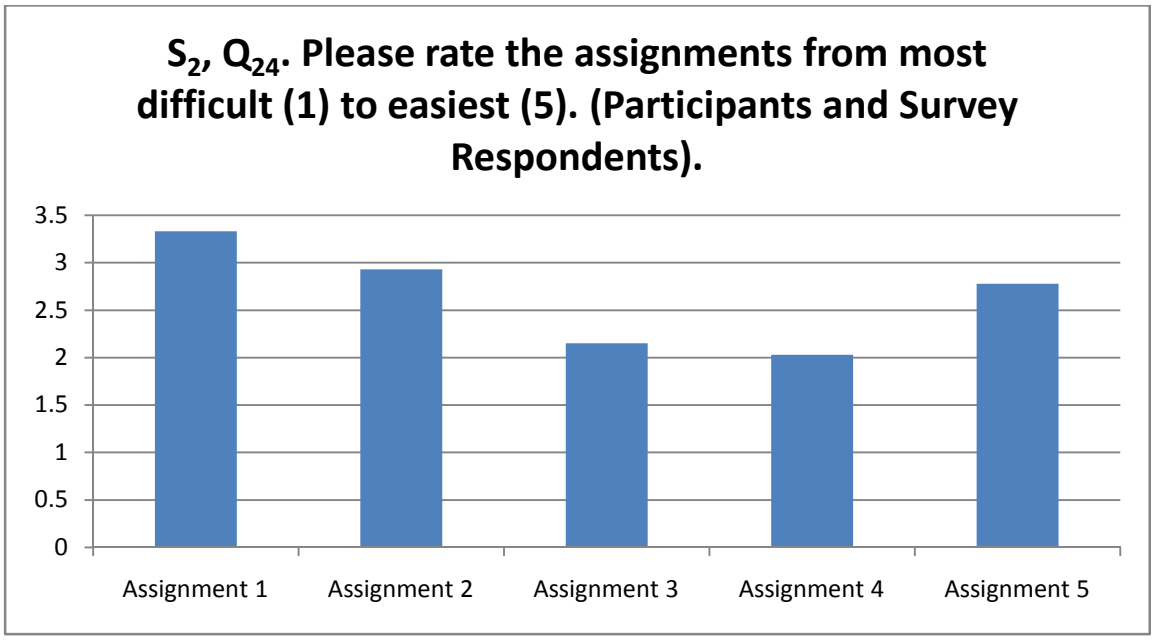


Figure 5.25: *Results for S2, Q24.*
During interviews participants indicated that difficulty with team assignments could be due to a number of factors including: team cohesion, team member's individual contributions and the academic nature of the assignment itself.

There was also a varied response to the length of the assignments. This question was relevant to the methodology used since the assignments had been specifically designed to be too much work for just one student.

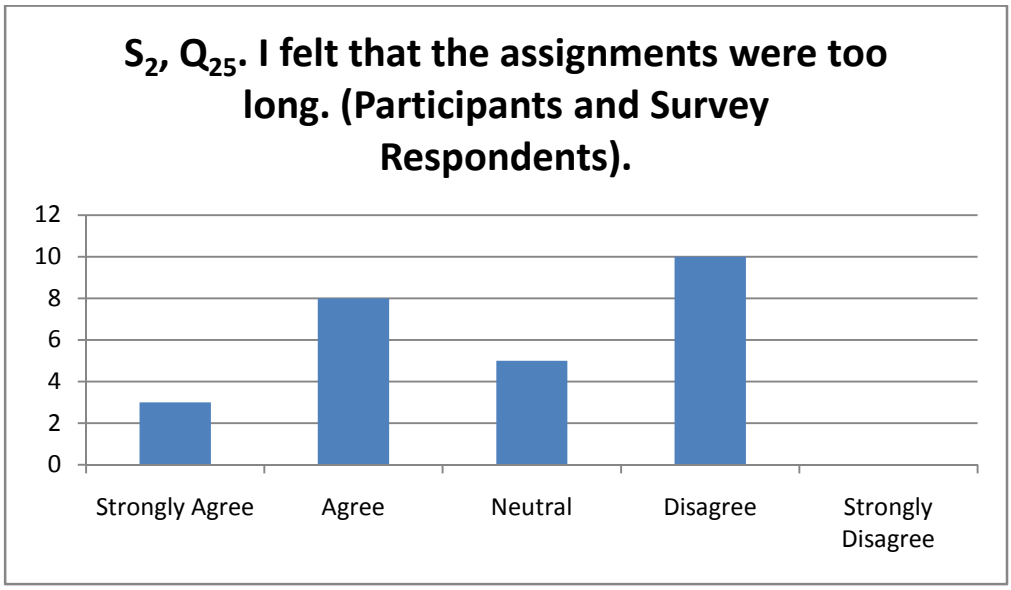


Figure 5.26: *Results for S2, Q25.*
Complaints about overly long student assignments are not unusual within UVic's Computer Science department. The varied responses to this question are a reflection of each student's opinions. The majority of team assignments were handed in fully completed.

In Q26, students were asked to indicate which aspects of the course they would change. The two least popular teaching aides (course notes and textbook) had been used in previous sections of CSC370 and had not been customized for this course. Only four students felt that the in-class activities required improvement which indicates a relatively high level of satisfaction with the new material developed specifically for this methodology.

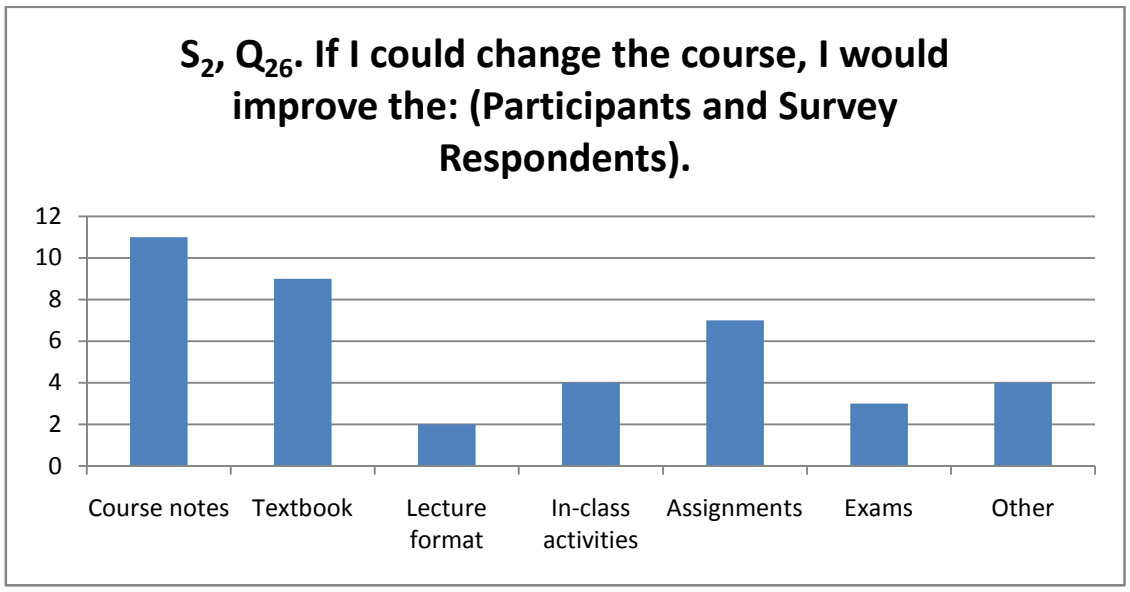


Figure 5.27: *Results for S2, Q26.*
Feedback regarding the instructional and evaluation methods used in the course can be used not only to assess the effectiveness of material developed for the methodology used but also as a general critique of the course. It is to the instructor's credit that only two of the surveyed students disliked the lectures!

Students also provided comments to explain their responses in S_2, Q26 as shown in Table 5.5.

Material	Comments
Textbook	"Never used it." – P12
Exams	"I'm disappointed with the in-class final." – P13
Other	"project" – P9; "Lecture should be 3 hrs, to allow proper group work." – P15; "Add lab" – P23; "Required attendance. I am not someone that learns in a class. (I learn better on my own). More time efficient if I am not req. to be in every class." – P18

Table 5.5. *Participant comments provided for S_2, Q26.*

Students were also asked to indicate their learning styles. Again, responses to this question were varied. Despite some negative responses to the length of the assignments,

many students felt that this work done with their teams facilitated their understanding of the material. Hands-on experience with databases was also cited as a primary form of learning which corresponds to the instructor's own method of acquiring database expertise.

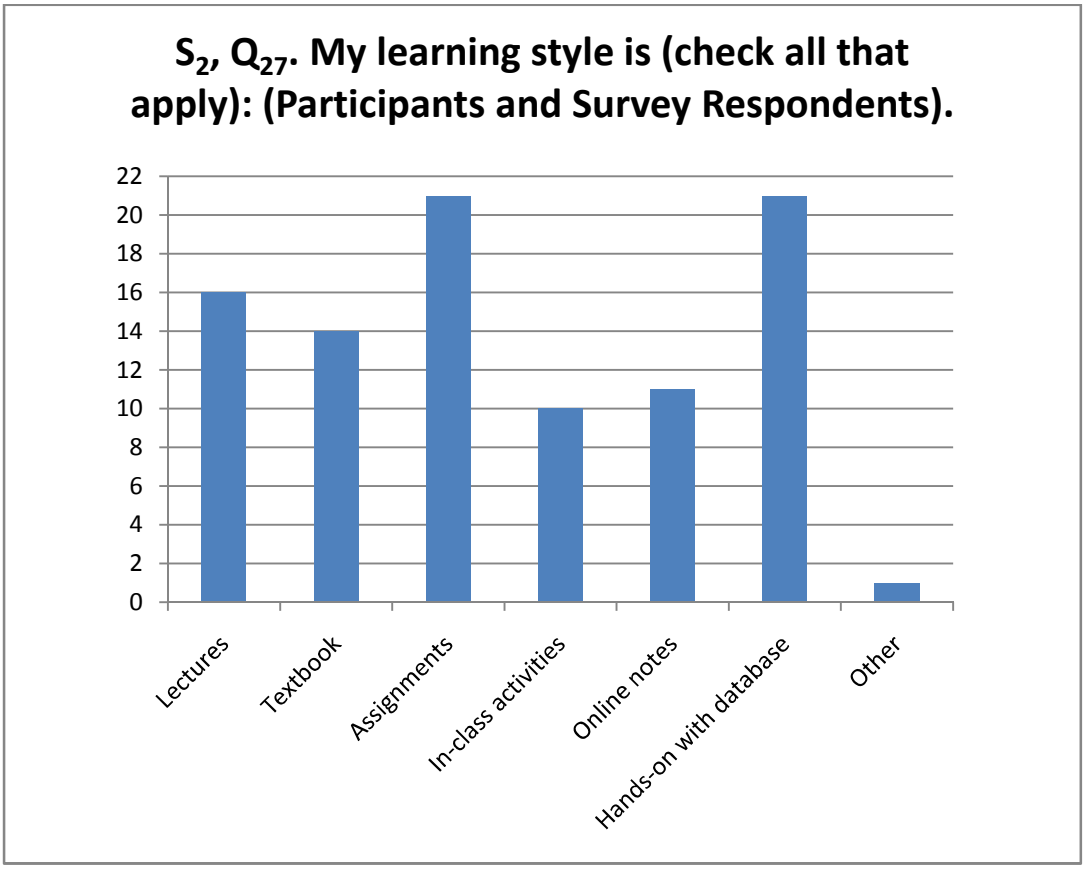


Figure 5.28: *Results for S2, Q27.*
Note that some of the assignments could also be classified as hands-on experience with the database. Students may have ranked in-class activities lower than other activities due to unfamiliarity with this learning style.

5.4.2 Team Roles

In addition to confirming team functionality, I briefly explored the formation of the individual teams. On S_1, students indicated whether they were usually group leaders.

S1, Q12. When working in a team, I have usually been the leader of my group. The majority of students surveyed indicated that they were not typically leaders when working with groups.

Preferences regarding team leadership were also provided on S_1.

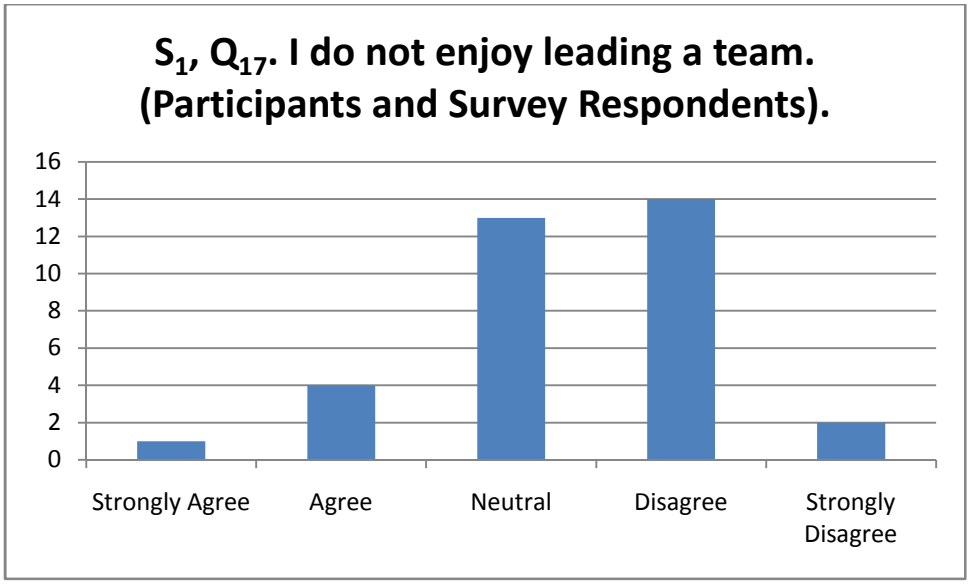


Figure 5.29: *Results of S1, Q17.*
Despite not necessarily being experienced team leaders, sixteen of the surveyed students indicated they enjoyed leading teams.

On S_2, students stated whether they were the leaders of their teams. A significant number of teams did not have leaders.

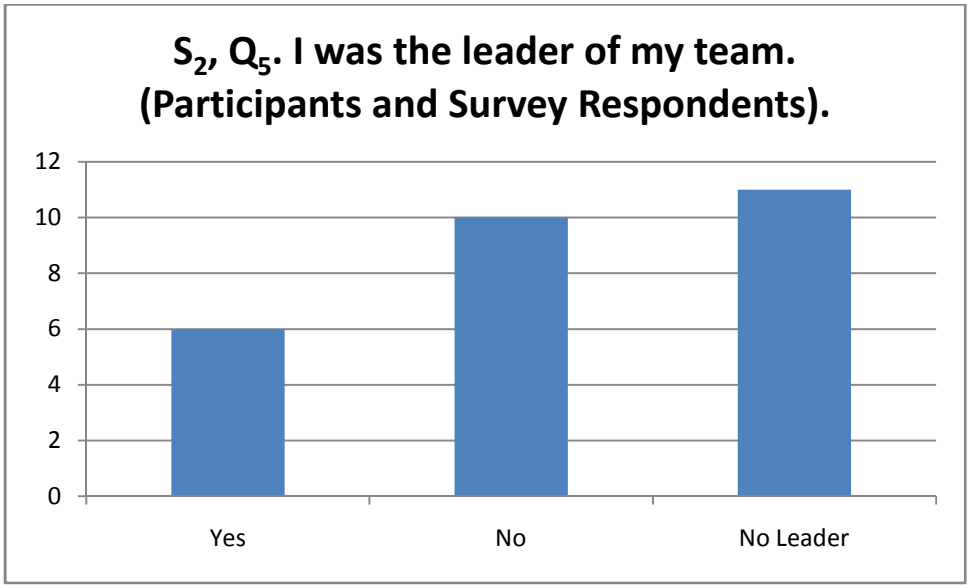


Figure 5.30: *Results for S2, Q5.*
In this class there were 10 teams but only 6 students indicated that they were team leaders. Note that not every single student was surveyed—some team leaders may not have completed S_2.

Whether teams had specific roles (including leaders) was explored in S_2, Q6. For **Q6. I had a specific role within my team**, 6 positive and 19 negative responses were collected. Described roles included:

P_2: *One of many equivalent workers.*

P_9: *made sure we kept on track*

P_{10}: *Not formally, but we each had our strengths*

P_{13}: *Organizer/leader*

P_{18}: *Organizer/much of work*

P_{19}: *My role was never decided, it just happened that way. I was the organizer of the projects.*

P_{23}: *Computer Boy*

5.4.3 Communication

Since communication and dealing with conflict is a critical part of teamwork, this topic was briefly addressed by S_1 and S_2.

Participants stated that they often used email for team coordination. P_4 explained that Google gmail was helpful due to the threaded conversation features. For S_1, Q21 students responded to "**I think the easiest way to communicate with others is**" as shown.

Response	Number of Students
In person	23
Using a computer	6
No preference	6

Table 5.6. *Results for S1, Q21.*
The majority of students indicated that they found communicating in person to be easiest. Some participants indicated in interviews that their entire teams did the majority of the coursework in person.

Note that two students chose both "in person" and "using a computer."

When asked whether they felt comfortable dealing with conflict in a team at the beginning and end of the course, the results were quite similar.

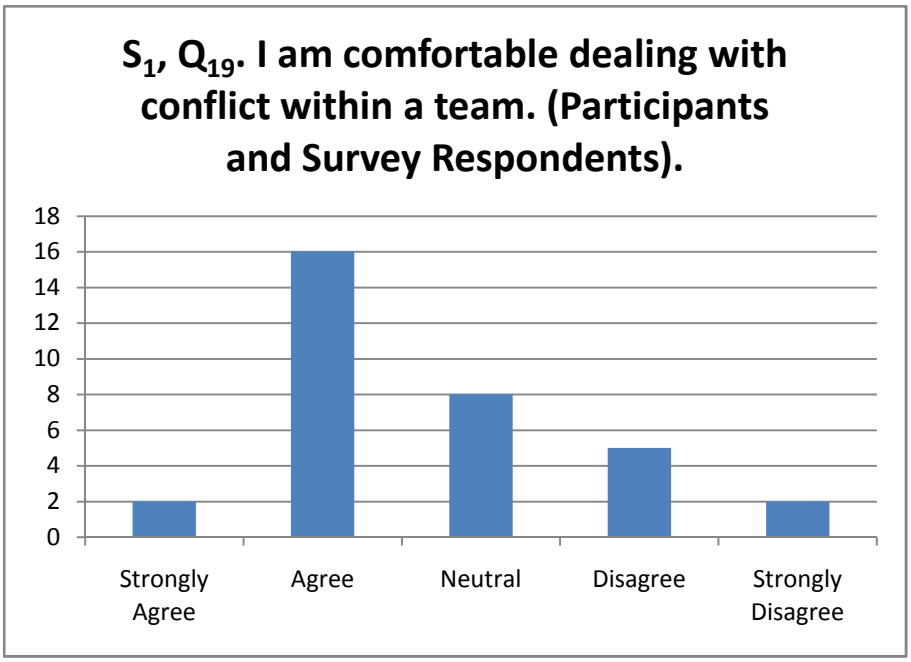


Figure 5.31: *Results for S1, Q19.*

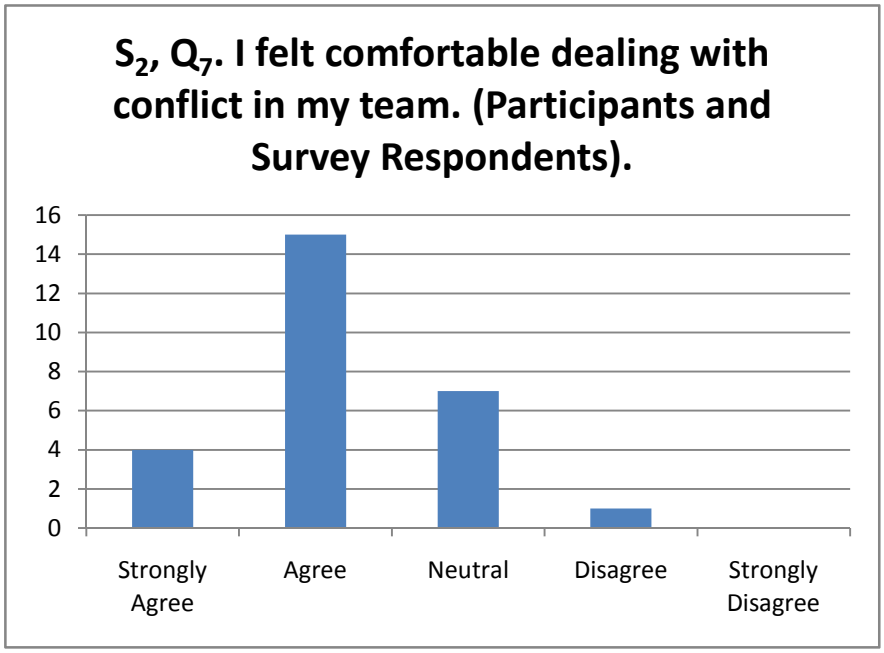


Figure 5.32: *Results for S2, Q7.*
An overall comfort dealing with team conflict both before and after the deployment of the methodology used perhaps suggests that interpersonal student dynamics were not significantly disturbed. Note that the survey respondent and participant groups for these two sets of results are not identical; the comparison of data should be interpreted as an approximation.

Students were also asked whether they had difficulties communicating with other team members. None of the interviewed participants indicated that language was an obstacle for communication, despite a significant number of students not speaking English as their first language.

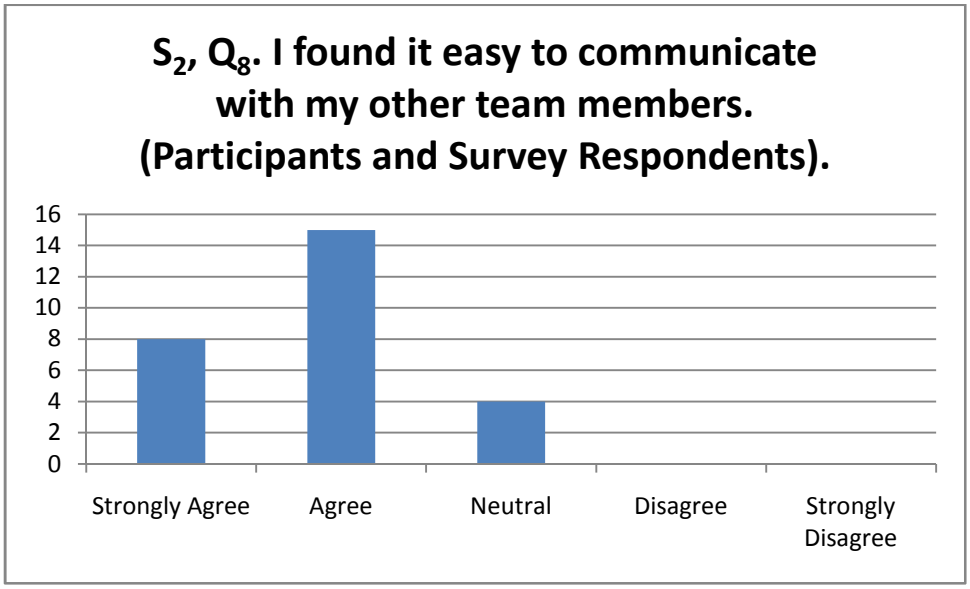


Figure 5.33: *Results for S2, Q8.*
It is perhaps significant that none of the surveyed students indirectly indicated that they had difficulty communicating with other team members.

Students were also asked to state whether they would have preferred to select their own teams and whether the division of labour was perceived as fair.

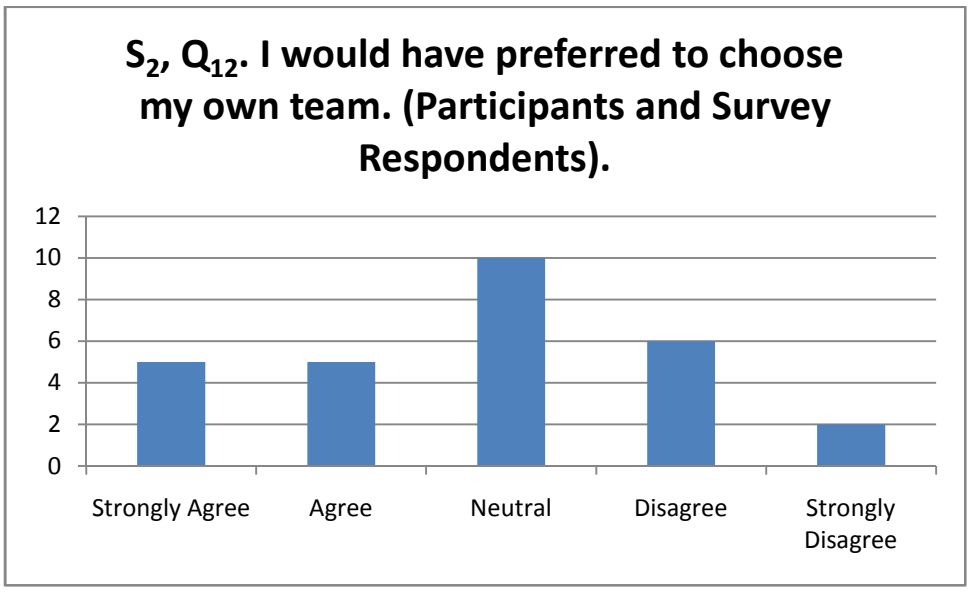


Figure 5.34: *Results of S2, Q12.*

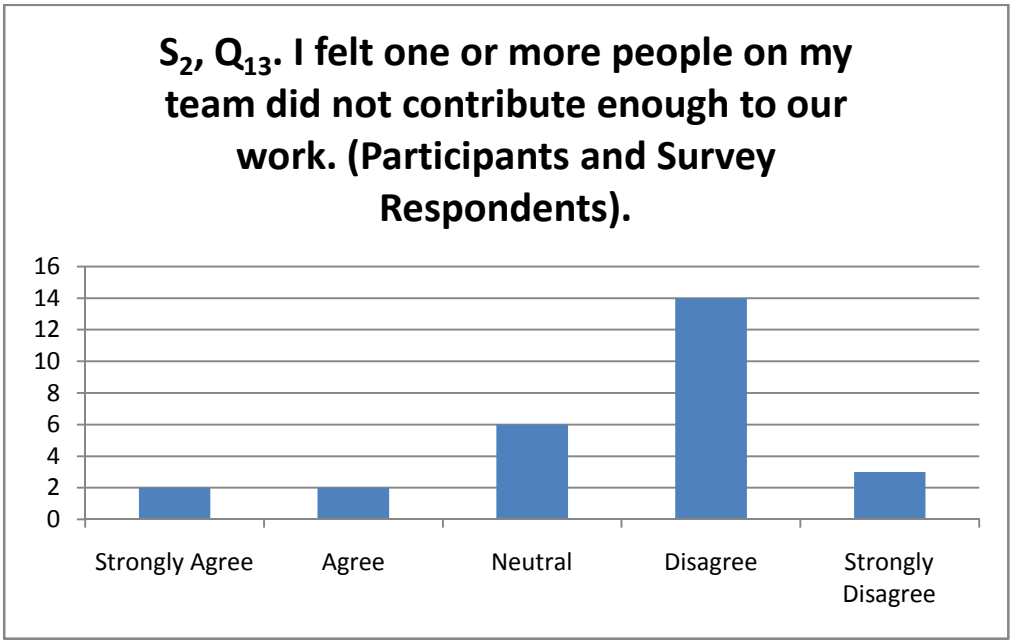


Figure 5.35: *Results of S2, Q13.*

The results of S_2, Q12 (10 students who indicated that they would have preferred to choose their own teams) are countered by the fact that none of the students in the course opted to switch teams when provided with this opportunity to do so by the instructor. Note that two students did not complete the course and it is not clear whether these individuals were considered as non-contributing team members when students were completing S_2, Q13.

5.4.4 Team Contracts

Team contracts are a part of the standard SCALE-UP methodology but overall were not well received by this particular group of students.

Figure 5.36: *Results of S_2, Q10.*

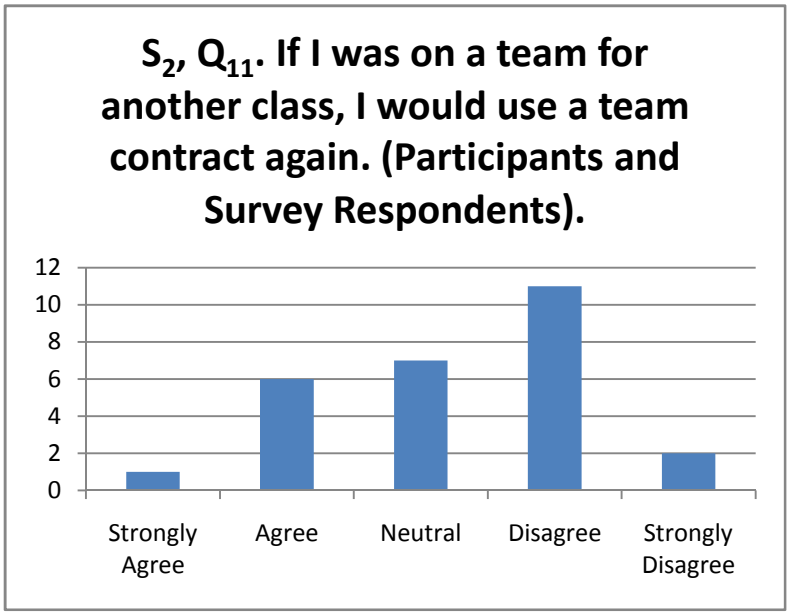


Figure 5.37: *Results of S2, Q11.*

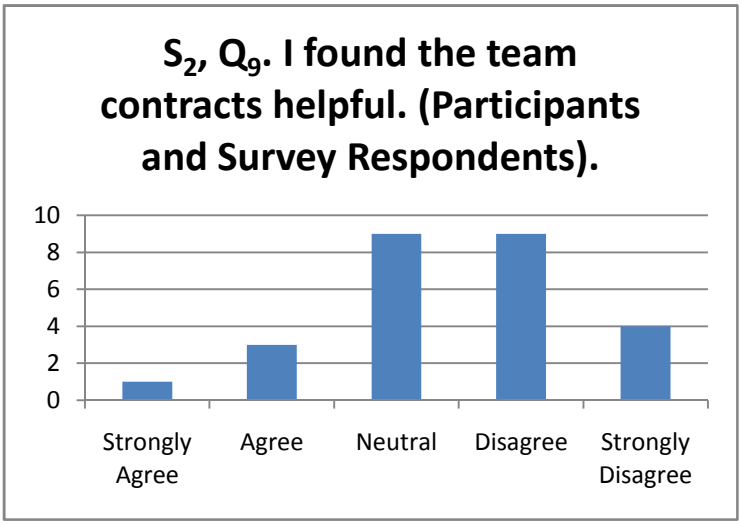


Figure 5.38: *Results of S2, Q9.*

Some of the team contracts were reviewed during interview sessions and varied greatly in specificity of team member responsibilities. Consequently, adherence to the team contract most likely also varied between teams which perhaps accounts for the results of S_2, Q10. The overall negative responses regarding the helpfulness of the team contracts are also dependent on the nature of each team's contract. A more even comparison would be achieved by using identical team contracts for each team. The student contracts developed in this course can be found in Appendix K.

5.4.5 Participant Demographics

On S_1 I gathered demographic information from participants and survey respondents.

Summary: The majority of the students in this course were in either 3rd or 4th year and pursuing Bachelors degrees in Science or Engineering. The majority of the students were enrolled in Computer Science programs and spoke English as their first language, with the remainder speaking Chinese dialects. Note that only one participant spoke Somali and this student did not complete the course.

Academic Year	Number of Students
2nd year	4
3rd year	16
4th year	14
5th year	1
Unknown	2

Table 5.7. *Academic Years of Students.*

Degree	Number of Students
Bachelor of Science	24
Bachelor of Engineering	9
Unknown	2

Table 5.8. *Degrees of Students.*

Program	Number of Students
Computer Engineering	7
Computer Science	21
Physics	2
Biochemistry	1
Electrical Engineering	1

Table 5.9. *Programs of Students.*

First Language	Number of Students
English	20
Mandarin	3
Chinese	5
Somali	1

Table 5.10. *First Languages of Students.*

5.4.6 Database Background

On S_1, background information was gathered from the students in order to contextualize their responses to other questions on both surveys. **One** student had heard of SCALE-UP previously. **Two** students had taken a course with Dr. German before (SENG 265). **One** student had taken CSC370 before at another university. **Five** students had learned about databases before in another course. **Two** students had taken CSC 212 at UVic; the remainder had taken courses at work, home and another university.

Despite most students having little formal training in this area, twenty students indicated that they had hands-on experience with databases. Eighteen survey respondents and participants explained how they had gained this experience. Some data have been removed from these quotations for anonymity reasons.

> $_4$**S$_1$**: *very little from personal projects*
>
> $_5$**S$_1$**: *Being Infrastructure Assistant @ [work location]*
>
> $_7$**S$_1$**: *work term*
>
> $_8$**S$_1$**: *I worked at a coop job and needed to write a program that queried the [type] database at [location].*
>
> $_{10}$**S$_1$**: *I had a bit database experience [sic] in my co-op work term.*
>
> $_{13}$**S1**: *Fiddling in my spare time*
>
> $_{14}$**S1**: *Designing for web applications*
>
> **P$_2$**: *A little work with MS Access on a co-op term*
>
> **P$_9$**: *Worked with Oracles 10s in previous jobs*

P_{12}: *self taught*

P_{13}: *Started MySQL in 1998 by reading a book. Have spent the last 8 years working a lot with databases with small business gov't and large corporations*

P_{15}: *work terms*

P_{16}: *Co-op with Health Canada*

P_{17}: *I have worked (and played) with developing web applications for 5 years. These applications heavily rely on databases.*

P_{18}: *Previous co-op jobs... designing DB's for a customer network. Personal web projects.*

P_{19}: *By myself out of interest. I have only done basic Access and MySQL.*

P_{20}: *Learned in co-op job.*

P_{23}: *Ten years experience as a software developer, majority of that on projects that used databases.*

Students completing S_2 were also asked to indicate whether they were the weakest member of their teams in terms of database experience.

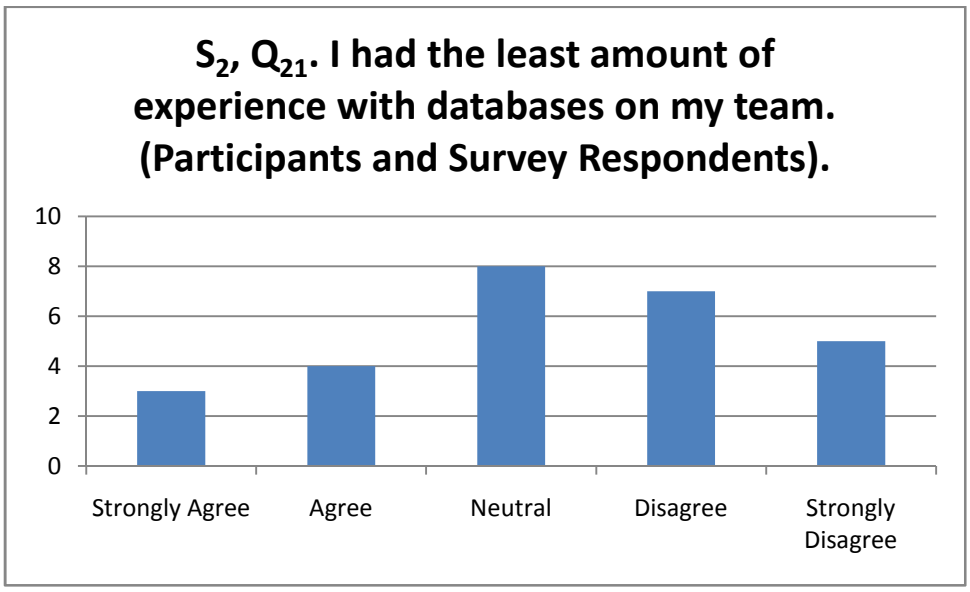


Figure 5.39: *Results of S2, Q21.*
The answer to this question was difficult for students to assess even by the end of the course which perhaps results for the high number of 'Neutral' responses.

Since the answer to this question may be difficult for a student to determine exactly, it is not altogether surprising that eight students chose Neutral.

5.5 Chapter Summary

In this chapter, the data results were explored in relation to the original research questions by answering sub-questions developed during the analysis phase. Additional sets of data were reviewed in order to bring forward interesting aspects of the study which may serve as alternative research topics for future studies of a similar nature.

Chapter 6 Recommendations

6.1 Introduction

In this chapter, I provide recommendations for the use of SCALE-UP for undergraduate database instruction based on the outcomes of this project. Specifically, I describe successful and unsuccessful aspects of the methodology used. I also provide suggestions for concurrent evaluations of SCALE-UP based on my own experiences as primary investigator. Finally, recommendations received directly from students about the course are shown.

6.2 Course Instruction: Successes and Lessons Learned

This section is intended primarily for instructors planning on using SCALE-UP for the first time. It is understood that some observations may only be relevant for Computer Science or database courses.

6.2.1 In-class Activities

Successes

1. Actively provide support to students working on activities.
2. Begin visiting student teams as soon as the activities are handed out in order to get students working right away.

3. Address frequently identified problems immediately to the whole class—i.e. stop the activity session to resume lecturing if needed.
4. Design the exercise so that it can be completed quickly.

Lessons Learned

1. Some of material for this course requires complex knowledge and yet the in-class exercise needs to be done quickly. Developing in-class activities that can be done quickly but still cover the required material can be challenging.
2. Determining the estimated length for each activity can be difficult. Instructors and/or curriculum developers should take into account slower students who will require more time to complete the activity.
3. Allowing students to comment on the solutions of other teams can be difficult and may require infrastructure support.
4. Computers for each team, if not each student, are needed. Full-size whiteboards would be ideally stored in a locked cabinet in the classroom.
5. Lectures and exercises should be created together so that both of these learning aides support each other.
6. Creating and preparing all of the course material (lectures and in-class activities) for the semester in advance will make the transition to this teaching style less stressful for the instructor.
7. However, in contrast to #6, it is not always obvious in advance whether the activities will work and it is sometimes difficult to design them properly.

8. The length of the class dictates the length of the activity. This teaching style is better suited to longer classes.
9. The number of instructors or teaching assistants available to help teams impacts the length of the activities.

6.2.2 Lectures

Successes

1. Remain flexible about student learning and be aware of difficulties students may be having. If many students do not understand a concept, this problem may need to be addressed in a lecture format and may require you to modify the scheduled activities during the class.

Lessons Learned

1. In comparison to a traditional teaching style, instructors are required to "tighten" the lecture and cover enough material that the students will be ready for the activity.

6.2.3 Assignments

Successes

1. Make sure the assignments are too big to be completed by a single person. This requires a careful estimate of student proficiency.
2. Assignments should be designed so that they can be broken down. Students will hopefully be able to create modules and then integrate them.

6.2.4 Team Management

Successes

1. Control the size of the teams. Teams of four were optimal for this course.
2. Control the size of the class.

Lessons Learned

1. It's not easy to create teams that will be stable immediately. Students who drop out of the course will force the instructor to rearrange the teams.

6.2.5 Classroom

Successes

1. Find a classroom that most closely resembles a SCALE-UP classroom in terms of layout and available furniture.

Lessons Learned

1. Have a large whiteboard for each team so that teams are able to see others' work.
2. Have a locked cabinet in the classroom to store materials.
3. It would be ideal if the class could be scheduled in such a way that there was time to rearrange furniture if needed both before and after the class.

6.3 Evaluation Successes and Lessons Learned

In this section I make recommendations for those who seek to evaluate the use of SCALE-UP for a Computer Science or database systems course.

6.3.1 Design Phase

Successes

1. Consult with subject experts (data collection, organizational behavior, educational research, course curriculum, teaching methodology, etc) during the design phase.
2. Apply for ethical approval to cover multiple iterations of your study regardless of whether you initially intend to repeat the study. Apply for the maximum amount of time permitted.
3. Apply for ethical approval early in order to ensure that the application is approved prior to the beginning of participant recruitment and/or data collection.
4. Work closely with the board (or a board representative) that will approve the ethical application.
5. Leave study design as flexible as possible. Include many types of data collection in application.

Lessons Learned

1. Ensure there is no indirect power-over between instructor and primary investigator (to facilitate communication, dynamic adjustments, etc)

6.3.2 Recruitment

Successes

1. Address class as peers, welcome and answer questions, and do not apply pressure.

Lessons Learned

1. Plan for full participation (in terms of time and resources allocated).
2. Have a minimum of two people for the recruitment session. Include assistants in ethical application form (esp. for distribution and collection of forms, etc).

6.3.3 S_1

Successes

1. Ask other researchers to review drafts of your survey.
2. Test-deploy surveys on non-participants to check for completion time, ambiguity of language, etc.

Lessons Learned

1. Provide a lot of opportunity for open-ended feedback (i.e. create a mixed methods survey that reflects the approach of the study).
2. Explore more than two research questions. Abandon a question later if it does not prove to be viable.

3. Check for tone of questions. Some questions may have been viewed as mildly insulting (e.g. whether students have felt left out of teams, etc).

6.3.4 Interviews

Successes

1. Minimize note taking – it's too distracting! Complete notes immediately after interview or tape session.
2. Maintain flexible length of interview time so participants do not feel pressured to stay for longer than they wish.
3. Allow participants alternative method of participation (e.g. email) in order to get more responses.

Lessons Learned

1. Prepare more questions than needed.
2. Leading questions do not seem to work well with Engineering/Computer Science students.
3. Questions requiring creative answers may take longer and/or be off-putting (e.g. million dollar question)

6.3.5 Photography Session

Successes

1. Consent rate was very high.
2. Take as many photos as possible.
3. Use photo waivers.

Lessons Learned

1. Track who does NOT agree—this is simpler if there is a high participation rate.
2. Pass around a class list that students must sign—this is easier than having individual photo waivers, some of which might get misplaced, etc.

6.3.6 Focus Group

Successes

1. Arrange focus group in students' primary building (ECS).
2. Refer to other forms of data collection (surveys, interview notes) in order to make comparisons and have richer feedback.
3. Encourage focus group members to compare opinions.

Lessons Learned

1. Develop a better incentive for attendance. I offered participants donuts and this was not very successful!

2. Schedule focus group earlier in the course so there is no conflict with exam studying.

6.4 Recommendations from Students

Students gave recommendations related to the course on S_2.

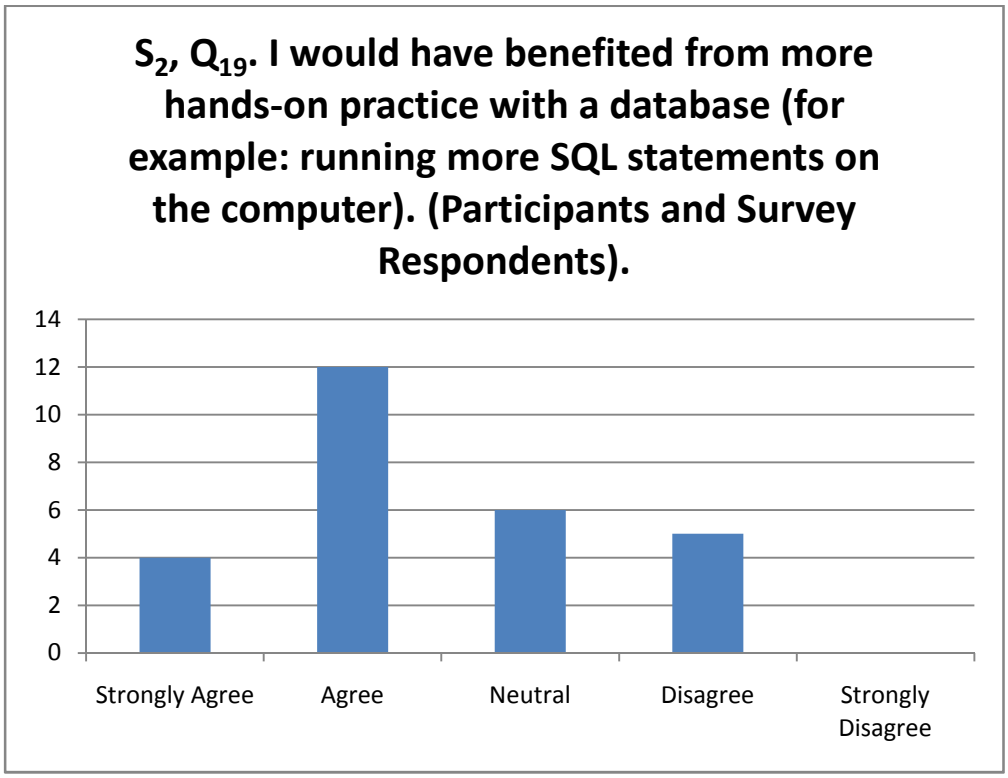


Figure 6.1: *Results of S2, Q19.*
The need for more computers was demonstrated by the response to Q19. If students had laptops within the classroom, the opportunities for more hands-on practice and direct assistance from the instructor would have been greatly improved.

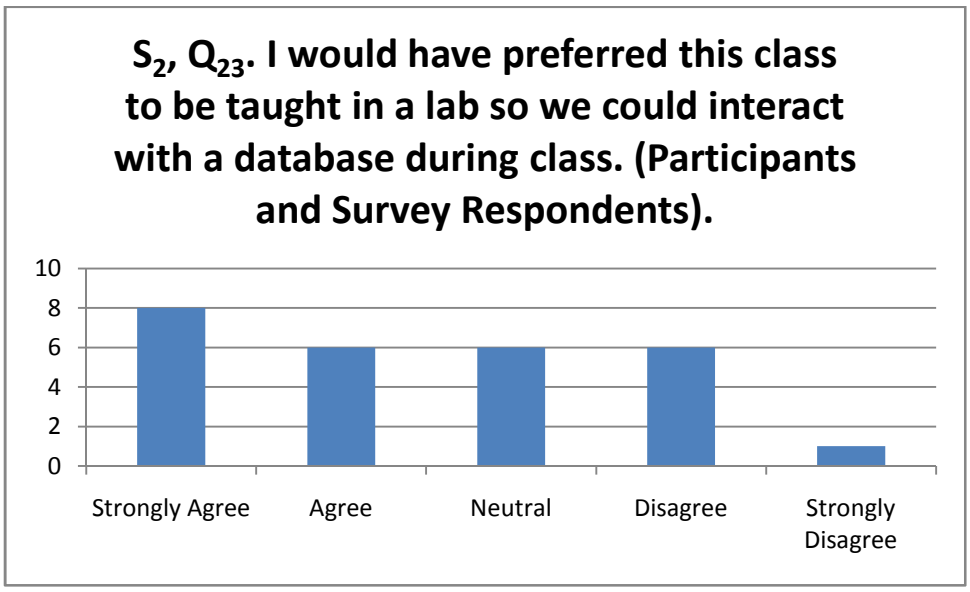


Figure 6.2: Results of S2, Q23.

Perhaps having optional lab time would allow students who wished to have more hands-on practice do so.

Chapter 7 Contributions and Future Work

7.1 Summary of Contributions

This work is intended to be a resource for instructors using SCALE-UP for Computer Science courses and pedagogical researchers interested in evaluating the teaching method's effectiveness for this subject.

The contributions of this work include:

1. The design and implementation of the evaluation,
2. The data collection for such evaluation,
3. An analysis of the collected data.

7.2 Detailed Contributions

This thesis documents the first reported use of a modified version of the SCALE-UP teaching methodology for an undergraduate database systems course. UVic is the only academic institution offering a database course taught using these techniques, one of a few to use SCALE-UP for a Computer Science course, and the only university in Canada currently known to be experimenting with this style of teaching.

Prior to the beginning of the course, the instructor (Dr. Daniel German) adapted the academic material to suit SCALE-UP requirements. In order to evaluate this revised curriculum and change in teaching style, I conducted a pedagogical study. The principal aims of this study were: 1. to ensure that student academic requirements were satisfied, and 2. to explore whether this style of teaching fostered teamwork and collaboration within the classroom.

Overall, the results of the study indicated that these goals were met. As an outcome of this evaluation, it was found that student academic performance was within range compared to previous sections of the course taught by the same instructor. Perhaps more importantly, students reported a largely positive response to the SCALE-UP methods used and its underlying philosophy of collaborative learning.

This study was conducted over a four-month semester. Of a potential forty participants, twenty-six students and one instructor agreed to join the study resulting in a 67.5% participation rate. I employed a variety of data collection techniques, including two written surveys used in a pre/post-test manner. A number of non-participants also agreed to complete written surveys on an anonymous basis, with a total of sixty-one surveys completed by the end of the semester. An estimated 15 hours was spent performing in-class observations, as well as over 10 hours interviewing students and the instructor. The collected data not only addresses the research questions but also provides a basis for the included recommendations and potential avenues for similar projects in the future.

7.2 Future Work

As previously explained, this work details the deployment of a simplified version of the SCALE-UP teaching method for an undergraduate database systems course. Both the results of the project and its evaluation are useful for instructors considering applying SCALE-UP to other courses, particularly those within our discipline. Ongoing research could provide a more extensive exploration of the pedagogical and team collaboration challenges encountered when teaching Computer Science undergraduate courses. Not only does SCALE-UP serve as a vehicle for exploring these challenges, but it also provides a possible method of improving the quality of instruction and learning.

7.2.1 Pedagogical Improvements

Repeated iterations of this project could benefit from:

- *Customized physical and technical infrastructures*

  The support provided by having a suitable classroom and the computing equipment would not only benefit not only the instructor(s) but also the students. Following the standard SCALE-UP setup would also allow for a more even comparison of evaluation results with other SCALE-UP projects.

- *Collaborative curriculum redevelopment*

  Working together with other instructors teaching undergraduate database systems courses would ease the workload for individual instructors and also improve the

quality of the curriculum developed. Activities suited for classes of this subject are highly specific and not easily borrowed from those used in other disciplines.

- *Shared evaluation results between Computer Science and database courses*

Again, collaboration between instructors regarding the results of their SCALE-UP teaching would be helpful and improve the quality of both teaching and evaluations.

7.2.2 Future Studies and Study Improvements

Reiterations of this study would lend greater statistical significance to the research questions originally posed. A study that repeats the original research questions and adds more questions could achieve a comparison between evaluations as well as a richer understanding of the results. In particular, it would be helpful to explore in greater detail the reasons for team (dis)harmony as well as strategies used by students in order to maximize team success.

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Appendix A: Ethical Application and Certificates of Approval

**Note that minor revisions made to the ethical application after the first initial review by the HREB are written in capital letters.*

University of Victoria

Human Research Ethics Board
Application for Ethics Approval for
Human Participant Research

Instructions:

1. Download this application and complete it on your computer. Hand written applications will not be accepted.
2. Use the *Human Research Ethics Board Guidelines* to complete this application: http://www.research.uvic.ca/Forms/
3. Submit one (1) original and three (3) copies of this completed, signed application with all attachments to: Human Research Ethics, Technology Enterprise Facility (TEF), Room 218, University of Victoria, PO Box 1700 STN CSC, Victoria BC V8W 2Y2 Canada
4. If you need assistance, contact the Human Research Ethics Assistant at (250) 472-4545 or ethics@uvic.ca
5. Please note that incomplete applications cannot be processed and will be returned to the applicant.

A. Principal Investigator

If there is more than one Principal Investigator, provide their name(s) and contact information below in Section B, Other Investigator(s) & Research Team.

Last Name: **Wolfe (nee Hargreaves)** First Name: **Elizabeth**

Department/Faculty: **Computer Science** Email: **chabela@uvic.ca**

Phone: **(250) 743-4225** Fax: **(250) 743-4225**

Mailing Address:
(if different from Dept/Faculty)

Title/Position:

☐ Faculty ☐ Undergraduate ☐ Ph.D. Student
☐ Staff ☒ Master's Student ☐ Post-Doctoral

Students: Provide your Supervisor's:

Name: **Dr. Micaela Serra** Email: **mserra@cs.uvic.ca**

Department/Faculty: **Computer Science** Phone: **(250) 472-5769**

Graduate Students: Provide your Graduate Secretary's email address: **gradsec@csc.uvic.ca**

Project Supervisor

Name: Dr. Daniel German **Email: dmg@uvic.ca**

Department/Faculty: Computer Science **Phone: (250) 472-5790**

B. Project Information

Project Title: **Evaluating the SCALE-UP Teaching Methodology for an Undergraduate Database Systems Course (CSC370)**

Anticipated Start Date: **September 1st 2006** Anticipated End Date: **May 1st 2009**

Geographic location(s) of study: **University of Victoria, BC, Canada**

Keywords: 1. **pedagogical evaluation** 2. **collaborative teamwork** 3. **database curriculum development** 4. **large undergraduate classes**

Other Investigator(s) and Research Team:

(*Include co-investigators, students, employees, volunteers, community organizations. The form will expand.)*

Contact Name	Role in Research Project	Institutional Affiliation	Email or Phone
Dr. Daniel German	**designer, participant**	**University of Victoria**	**dmg@uvic.ca**
Mary Sanseverino	**designer, evaluator**	**University of Victoria**	**msanseve@uvic.ca**

C. Agreement and Signatures

Principal Investigator and Student Supervisor affirm that:

- *I have read this application and it is complete and accurate.*
- *The research will be conducted in accordance with the University of Victoria regulations, policies and procedures governing the ethical conduct of research involving human participants.*
- *The conduct of the research will not commence until ethics approval has been granted.*
- *The researcher(s) will seek further HREB review if the research protocol is modified.*
- *Adequate supervision will be provided for students and/or staff.*

Principal Investigator

_____
Signature

_____
Print Name

_____
Date

Student's Supervisor

_____
Signature

_____
Print Name

_____
Date

Student's Supervisor

_____
Signature

_____
Print Name

_____
Date

Chair, Director or Dean

I affirm that adequate research infrastructure is available for the conduct and completion of this research.

_____
Signature

_____

Print Name

_____

Date

D. Project Funding

Have you applied for funding for this project? ☒ Yes ☐ No

If yes, please complete the following:

Source(s) of Project Funding	Project Title used in Funding Application(s)
Learning and Teaching Centre, University of Victoria	**Evaluating the use of tablets and SCALE-UP teaching in CSC370 Database Systems**

E. Level of Risk

The Tri-Council Policy Statement (TCPS) definition of "minimal risk" is as follows:

> *The research can be regarded as within the range of minimal risk if potential participants can reasonably be expected to regard the probability and magnitude of possible harms implied by participation in the research to be no greater than those encountered by the participant in those aspects of his or her everyday life that relate to the research. The designation of minimal or non-minimal risk affects the way the application is reviewed not the substance of the ethical review."*

Based on this definition, do you believe your research qualifies as "minimal risk research" research?

☒ Yes ☐ No

Explain your answer by referring to the level of risk stated in the TCPS definition:

For this study, our participants will be undergraduate students enrolled in a database course (CSC370). Participants will be observed within the classroom setting and may participate in interviews and/or focus groups. Since we are keenly interested in the participants' learning experiences, in no way will we interfere with the regular, day-to-day functioning of classroom activities. We anticipate that our participants will already be familiar with the questions that we will ask them in interviews or focus groups since it is very likely that they will have completed teaching evaluations in the past for other courses. Our questions will be similar to those found in teaching evaluations conducted by the university itself; however, our questions will be more in-depth and will focus specifically on the SCALE-UP teaching method as applied to this course (CSC370).

F. Scholarly Review

What type of scholarly review has this research project undergone?

☐ External Peer Review (e.g. granting agency)

☒ Supervisory Committee or Supervisor—required for all student research projects

☐ None

☒ Other, please explain:

Dr. Daniel German, Mary Sanseverino and Elizabeth Wolfe have performed similar studies for a number of years while working together as members of the GILD research group

(http://gild.cs.uvic.ca/). We intend to perform internal peer reviews of the study's design and implementation, leveraging knowledge gained in previous studies.

G. Other Approvals

Do you need to seek approval from other agencies, community groups, local governments, etc ?

☐ Yes ☒ No

If so, what types of other approval will you need?

☐ School District, Superintendent, Principal, Teacher

☐ VIHA or other regional government authority ***If you are planning to conduct research in a VIHA facility, you must use the Joint UVic/VIHA application form on the ORS website***

☐ Indigenous Community (see item 13)

☐ Other, please explain:

N/A

H. Description of Research Project

1. Purpose and Rationale of Research

Briefly describe in non-technical language:
Please use 150 words or less. The form will expand to the length of your answers.

1a. The research objective(s) and question(s)

The research objective for this project is relatively straightforward: We wish to explore how the SCALE-UP teaching methodology improves undergraduate student learning in an introductory database course (CSC370). Since Dr. German has taught CSC370 five times in the past using traditional teaching methods, we would like to compare the students' and instructor's impressions of SCALE-UP versus their experiences with traditional instruction.

We are very hopeful that SCALE-UP will not only improve database learning but will also serve as an alternative pedagogical example for other courses, including those outside the Computer Science department. In terms of the research itself, we have two primary research questions: 1. Is SCALE-UP an effective, if not superior, method of teaching large undergraduate classes about databases? and 2. Does SCALE-UP encourage and support teamwork and collaboration within the classroom?

1b. The importance and contributions of the research

Databases are used in virtually every industry and sector of society. Typically, databases are maintained by teams of developers and administrators who must work together in a cooperative manner. We feel that it is critical for undergraduate students enrolled in CSC370 to be given rigorous practice with team-based, hands-on database activities while learning database fundamentals. We anticipate that SCALE-UP will support team-based work within the classroom setting. Students often work together as teams during labs and outside the classroom; by supporting teamwork within the classroom during lectures, we hope to improve collaboration and to ensure that every student has a rich and positive experience while working as part of a database team.

SCALE-UP (Student-Centred Activities for Large Enrollment Undergraduate Programs) was developed by Dr. Robert Beichner for undergraduate physics courses at North Carolina State University. Dr. Beichner has confirmed that, as of September 2006, SCALE-UP has yet to be applied to any university-level database courses. SCALE-UP has never been used at the University of Victoria. Subsequently, our research results will be of great interest to the Computer Science department, the University of Victoria, and any other university offering undergraduate database courses.

I. Recruitment

2. Recruitment and Selection of Participants

Attach all relevant recruitment materials in an appendix (i.e. information letter, consent form.

2a. Briefly describe the target population for recruitment.

The target population is an undergraduate class enrolled in CSC370 in January 2007 at the University of Victoria.

2b. Why is this population of interest?

This population is of interest since the participants will be students who are learning about databases specifically using the SCALE-UP methodology.

2c. What is the desired number of participants?

The maximum desired number of participants is forty students.

2d. What are the salient characteristics of the participants (e.g. age, gender, race, ethnicity, class, position, etc.):

There are no salient characteristics about the participants except that they are enrolled in CSC370 in January 2007.

2e. Provide a detailed description of your exact recruitment process. Explain:

i) Who will recruit/contact participants (e.g. researcher, assistant, third party)

The primary investigator, Elizabeth Wolfe, will contact participants.

ii) Describe any relationship between the investigator(s) and participant(s) (e.g. instructor-student, manager-employee). (See question no. 3 if there is a power-over relationship.)

There will be no relationship between the investigator and the participants other than as investigator-participant.

iii) Describe how recruitment will be done (e.g. in person, by telephone, letter, email, advertisement) and from what source(s) will the participants be recruited.

Recruitment will be done in person in the first class of CSC370.

iv) Describe the steps in the recruitment process.

This recruitment process will take place during the first class of CSC370. Prior to introducing the study, Dr. German will take attendance to ensure that no students are missing. (If any student is absent, the recruitment process will be repeated for them at a later date). After taking attendance, Dr. German will leave the room so that he is not present during the recruitment process. The primary investigator (Elizabeth Wolfe) will provide both a verbal and written explanation about the study to the students and identify herself as a primary contact for anyone with questions or concerns. She will explain what is involved in participation and field any questions students may have. She will then hand out consent forms to all of the students. Students who wish to participate in the study will be required to fill out the consent form.

v) Whether the permission of other bodies is required (e.g. school boards).

No.

3. Power-Over

Are you or any of your co-researchers in any way in a position of authority or power over participants? Examples of a "power-over" situation include teachers-students, therapists-clients, supervisors-employees and possibly researcher-relative or researcher-close friend.

☒ Yes ☐ No ☐ Varies

If *yes* or *varies*, describe below:

i) The nature of the relationship.
ii) Why it is necessary to conduct research with participants over whom you have power.
iii) What safeguards (steps) will be taken to minimize inducement, coercion or potential harm.
iv) How the dual-role relationship and the safeguards will be explained to potential participants.

THE PRIMARY INVESTIGATOR IS IN AN INDIRECT POWER-OVER SITUATION WITH THE PARTICIPANTS SINCE HER SUPERVISOR IS THEIR INSTRUCTOR AND A MEMBER OF THE RESEARCH TEAM. HOWEVER, THE PRIMARY INVESTIGATOR is not and will not be involved in evaluating the students participating in the study. THE PARTICIPANTS WILL BE FULLY INFORMED OF THIS RELATIONSHIP IN THE VERBAL EXPLANATION SCRIPT AND THE CONSENT FORM. PARTICIPANTS WILL ALSO BE REASSURED THAT THE PRIMARY INVESTIGATOR WILL NOT BE EVALUATING THEM AND THAT PARTICIPATION IN THE STUDY WILL NOT COMPROMISE THEM IN ANY WAY. THE RESEARCH TEAM WILL TAKE STEPS TO ENSURE THAT PARTICIPANTS DO NOT FEEL PRESSURE TO PARTICIPATE IN THE STUDY FROM OTHER STUDENTS OR DUE TO THE PRIMARY INVESTIGATOR'S RELATIONSHIP TO THE INSTRUCTOR. We will ensure that Dr. German will not be in a power-over situation--he will not have access to any of the data collected during the period of January to May 2007 and, like the other faculty members involved in the study, will only ever have access to completely anonymized data.

J. Data Collection Methods

4. Data Collection

For community-based research, autobiographical or observational research, please see Appendix III of the Guidelines.

4a. Which of the following methods will be used to collect data? *Check all that apply.*

Interviewing participants: ☒ in-person ☐ by telephone ☐ using web-based technology (explain)
Conducting or administering a: ☐ standardized questionnaire or test (one with established reliability and validity) ☒ non-standardized questionnaire or survey (one that is un-tested, adapted or open-ended)
Administering a questionnaire or survey: ☒ In person ☐ by telephone ☐ mail back ☐ email ☐ web-based ☐ Other, describe:
☐ Administering a computerized tasks
☒ Conducting group interviews or discussions (including focus groups)
☒ Observing participants *[In 4b, describe who will be observed and where]*
☐ Recording of participants Using: ☐ audio ☐ video ☒ photos or slides

☒ Analyzing secondary data

☒ Anonymized data (Eligible for *Application for a Waiver from Full Ethical Review*)

☐ Non-anonymized data (Skip to Item 7g, 8, 11-12, 17, and 19-23)

In 4b describe the source of the data, (e.g., institutional, organizational, educational files, personal writings) and explain whether and how consent was obtained from the individuals for use of their data.

☐ Using human tissue (e.g., blood, hair, DNA, gametes)

Ensure that you apply to the Biosafety Committee for the storage and use of biological materials. Also, complete the Human Tissue Form available on the ORS website, have it signed and attach it to your application. If using human tissue only, skip to 7g-8, 11-end.

☐ Other, specify:

4b. Provide a sequential description of the procedures/methods to be used in your research study. List all of the research instruments and assessment tools, and in an appendix provide copies of all instruments. If not yet available, provide drafts or sample items/questions. For multi-method or other complex research, use the following sections in ways best suited to explain your project.

These are the steps we will follow in obtaining consent and gathering data.

1. PRIOR TO THE COURSE COMMENCING, WE WILL OBTAIN CONSENT FROM THE COURSE INSTRUCTOR (DR. DANIEL GERMAN) TO INTERVIEW HIM ABOUT HIS EXPERIENCES USING TRADITIONAL INSTRUCTION, TEACHING DATABASE CURRICULUM, AND FACILITATING TEAMWORK WITHIN THE CLASSROOM. DR. GERMAN WILL SIGN THE CONSENT FORM (CHECKING THE RELEVANT SECTION RE INTERVIEWS) AND WILL THEN BE INTERVIEWED FOR APPROXIMATELY ONE HOUR. DR. GERMAN WILL ALSO BE INTERVIEWED AFTER THE COURSE HAS COMPLETED FOR A SIMILAR LENGTH OF TIME.

2. IN THE FIRST FEW CLASSES OF JANUARY 2007, STUDENT participants will be recruited and consent forms signed. The consent form/information sheet provides students with the option of indicating which activities they wish to participate in. (Please refer to consent form attached).

3. Participating students will complete the Pre-SCALE-UP assessment at the end of the first class. (Please see assessment draft attached).

4. Participants will be observed in 12 or 13 one hour classes one time per week for the duration of the course. (Total hours of observation within the classroom for the entire study will not exceed 13 hours).

PARTICIPATING STUDENTS WILL BE IDENTIFIED BASED ON THEIR SEATING ARRANGEMENTS AND/OR NAMETAGS ON THEIR DESKS. STUDENTS WILL SIT TOGETHER IN NUMBERED TEAMS WITH EACH INDIVIDUAL TEAM POSITION ALSO IDENTIFIED EITHER BY LETTER OR NUMBER. (THIS ARRANGEMENT IS A NECESSARY PART OF THE COURSE ORGANIZATION AND WILL NOT BE SET UP EXPRESSLY FOR THE STUDY. FOR EXAMPLE, A STUDENT COULD BELONG TO TEAM '3' AND HOLD POSITION 'A'--THEREFORE THE STUDENT WOULD BE REFERRED TO AS '3A'.)

ALL STUDENTS WILL ALSO HAVE NAMETAGS ON THEIR DESKS IN FRONT OF THEM. AGAIN, THE USE OF NAMETAGS IS PART OF THE SCALE-UP METHODOLOGY. STUDENTS WHO ARE PARTICIPATING IN THE STUDY WILL BE EASILY IDENTIFIED BY THEIR NAMETAGS.

OBSERVATIONS ABOUT PARTICIPANTS WILL BE WRITTEN USING EITHER THEIR INITIALS OR TEAM POSITION. TEAMS THAT INCLUDE STUDENTS WHO DO NOT WISH TO PARTICIPATE WILL NOT HAVE OBSERVATIONS MADE IN REFERENCE TO THOSE PARTICULAR STUDENTS.

FOR EXAMPLE, IF TEAM 1 IS EXPERIENCING DIFFICULTIES WITH A TEAM MEMBER WHO IS NOT A PARTICIPANT, THE OBSERVATION WILL NOT IDENTIFY THAT STUDENT OR THAT STUDENT'S ROLE BUT INSTEAD REPRESENT THE PHENOMENON IN A MORE GENERAL WAY, SUCH AS: "TEAM 1 EXPERIENCED DIFFICULTIES WITH ONE OF ITS TEAM MEMBERS."

5. Partway through the course, 2 or 3 participants will be interviewed for one hour (at the most) sessions each.

6. At the end of the course, a maximum of 8 students will participate in a one hour focus group to discuss their experiences with SCALE-UP.

7. At the end of the course, participants will complete the Post-SCALE-UP Assessment (Please see assessment draft attached).

8. At various points during the course, participants who have provided consent will also allow their course notes to be photocopied immediately after class and allow their assignments to be reviewed by the primary investigator.

9. The final data collection method will be a brief photography session held at the end of the course during one of the last classes. Photographs will be taken of the students in teams within the classroom setting. Students will be allowed to view all of the photographs taken and will sign waivers if they agree to the photographs being used. Photographs which do not receive full waivers from all subjects will be deleted (we will be using a digital camera).

4c. Where will participation take place? (e.g., UVic classroom, coffee shop, elementary school)

Participation will take place in the CSC370 classroom and other UVic classrooms set up for interviews and focus groups.

4d. How much time will be required of participants?

Students who consent to: being observed during lectures, filling out surveys and providing copies of their course notes will not required to provide any additional time to the study. Attendance will be mandatory for all lectures. Any interviews and focus groups will not last longer than one hour. We will perform 2 interview sessions: partway through the course and after the course has finished. Students who participate in the interviews will contribute 2 hours of their time (maximum) to the study. Focus groups will be held after the course has finished--students will participate for 1 hour.

K. Possible Inconveniences, Benefits, Risks and Harms to Participants

5. Benefits

Identify any potential or known benefits associated with participation and explain below.
Keep in mind that the anticipated benefits should outweigh any potential risks.

☒ To the participant ☒ To society ☒ To state of knowledge

To the participant: By performing assessments of the students and student teams as soon as the course begins and throughout the semester, we will be able to ensure that the course curriculum meets the students' needs. With the information collected we will be able to make ad hoc adjustments to the activities planned and emphasis on particular curriculum sections. We anticipate that this will improve the quality of the course delivery and instruction.

To society: Since we intend to improve the quality of database learning, we anticipate that students with a solid understanding of database fundamentals will subsequently create and maintain superior databases. The ubiquitous nature of databases in our society makes this objective very worthwhile.

To state of knowledge: Undergraduate database courses are offered all over the world and our results will potentially be of great interest to instructors who wish to improve course instruction. Furthermore, applying

a relatively new teaching methodology to a different discipline is of interest to researchers involved in computer science education research as well as to researchers passionate about curriculum development and pedagogical techniques.

6. Inconveniences

Identify and describe any known or potential inconveniences to participants:
Consider all potential inconveniences, including time devoted to the research.

Any potential inconveniences to the participants will be negligible.

7. Estimate of Risks

Could this study involve the following? Please answer each question by putting an **X** in the appropriate boxes:

7a. Could a participant feel demeaned or embarrassed during their participation in the research?

☒Very unlikely ☐Possibly ☐Likely

7b. Could a participant feel fatigued or stressed due to the research?

☒Very unlikely ☐Possibly ☐Likely

7c. Could a participant experience any other emotional or psychological discomfort as a consequence of participation?

☒Very unlikely ☐Possibly ☐Likely

7d. Is there any social risk, possible stigmatization, loss of status, privacy and/or reputation?

☒Very unlikely ☐Possibly ☐Likely

7e. Are there any physical risks?

☒Very unlikely ☐Possibly ☐Likely

7f. Could a participant experience any economic risk? (e.g. job security, job loss)

☒Very unlikely ☐Possibly ☐Likely

7g. Do you see any chance that participants may be harmed in any other way? (e.g. risk to community)

☒Very unlikely ☐Possibly ☐Likely

8. Possible Risks

If you indicated in Item 7 (a) to (f) that any risks are *possible* or *likely*, please explain below:

8a. What are the risks?

N/A

8b. What will you do to try to minimize or prevent the risks?

N/A

8c. How will you respond if the risk of harm occurs? (e.g. what is your plan?)

N/A

9. Deception

Will participants be fully informed of everything that will be required of them prior to the start of the research session?

☒ Yes ☐ No *(If no, complete the Request to Use Deception form on the Office of Research Services website.)*

L. Compensation

10. Compensation

Is there any compensation for participating in the research? (e.g. gifts, money, social advantage, bonus points)

☐ Yes ☒ No

If yes, explain the nature of the compensation and why you consider it to be necessary:
Also consider if the amount of compensation could be considered to be a form of inducement.

N/A

M. Free and Informed Consent

The following questions address the competence of participants to give consent, the process used in your research to obtain consent, ongoing consent, and the participants' right to withdraw. Consult Appendix V of the Guidelines for further information.

11. Participant's Capacity (Competence) to Provide Free and Informed Consent

Identify your prospective participants: *(Check all that apply.)*

☒ Competent adults

☐ Non-competent adults:

- ☐ Consent of family/authorized representative will be obtained
- ☐ Assent of the participant will be obtained

☐ Competent Children

Minimal Risk Research

☐ Children under 13: consent of parent/guardian will be obtained, and child consent will be obtained

☐ Youth 13 to 18: consent of youth will be obtained, and parental consent is required due to institutional requirements (e.g. school districts)

☐ Youth 13 to 16: consent of youth will be obtained, parents will be informed

☐ Youth 13 to 16: consent of youth will be obtained, parents will *NOT* be informed

☐ Youth 17 to 18: consent of youth will be obtained, parents will not be informed

☐ Other, explain:

Above Minimal Risk Research

☐ Parent or guardian consent will be obtained and child/youth assent/consent will be obtained

☐ Other, explain:

☐ Non-competent Children:

- ☐ Consent of parent/guardian
- ☐ Assent of the child/youth will be obtained

☐ A protected or vulnerable population (e.g., inmates, patients).

12. **Means of Obtaining Consent**: (*Check all that apply and attach copies of all consent materials.)*

☒ Initial verbal explanation and signed Consent Form. (*Attach consent script(s) and consent form(s).)*

☒ Letter of information and signed Consent Form. (*Attach information letter(s) and consent form(s).)*

☐ Letter of information and verbal consent. (*Attach information letter(s). Explain below why written consent is not appropriate and how verbal consent will be documented.*)

☐ Implied consent (*E.g. anonymous, mail back or web-based survey. Attach information letter.)*

☐ Other means. (*Explain below and provide justification.)*

☐ Consent will not be obtained. (*Explain below)*

Explain consent procedure if "verbal consent," "other" or "consent will not be obtained":

N/A

13. Indigenous Community Approval

Indigenous community approval may be required when the research involves Indigenous people from a community (whether residing in urban or reserve areas), the cultural knowledge and/or resources of Indigenous people, or where individuals speak on behalf of an Indigenous nation.

13a. Does your research specifically involve or include in the study's population sample individuals from an Indigenous community?

☐ Yes ☒ No

13b. Will a particular Indigenous community or communities be a central focus of the research?

☐ Yes ☒ No

13c. If you answered "yes" to questions a) or b), have you sought approval from an Indigenous community or communities for this study?

☐ Yes ☒ No

13d. If you answered "yes" to question c), briefly list the people you have contacted and describe the approval process that you have or will follow:

N/A

13e. If you answered "no" to questions c), briefly justify your decision not to seek Indigenous community approval:

N/A

14. Informed Consent

Describe the exact steps you will follow in the process of obtaining informed consent.

In order to obtain informed consent, the principle investigator will provide a written and verbal explanation to potential participants before the data collection process begins. The

principle investigator will also provide potential participants with a sufficient amount of time to ask questions before signing the consent form. Contact information for all of the researchers will be provided in the consent form/information sheet. Participants will be allowed to take a copy of the consent form/information sheet with them. The primary investigator will make it very clear to all potential participants that they will be free to withdraw from the study at any time without explanation or fear of negative consequences and that data pertaining to them will be deleted or destroyed. IF PARTICIPANTS DO NOT WISH TO SIGN THE CONSENT FORM IMMEDIATELY AND WISH TO THINK FURTHER ABOUT WHETHER THEY WISH TO PARTICIPATE IN THE STUDY, THEY WILL BE FREE TO TAKE BOTH COPIES OF THE CONSENT FORM WITH THEM AND LEAVE A SIGNED COPY OF THE FORM IN A LOCKED ASSIGNMENT BOX IN ECS WHICH ONLY THE PRINCIPAL INVESTIGATOR WILL BE ABLE TO ACCESS. PARTICIPANTS WILL BE FREE TO JOIN THE STUDY AT ANY TIME BEFORE THE END OF THE COURSE—THERE WILL BE NO TIME CONSTRAINT SET TO JOIN THE STUDY.

15. Ongoing Consent

Ongoing consent is required for research that occurs over multiple occasions and/or multiple research activities and/ or extended periods of time (i.e., more than one point of contact, including second interviews, review of transcripts, etc.)

15a. Will your research occur over multiple occasions or an extended period of time?

☒ Yes ☐ No

15b. If yes, describe how you will obtain ongoing consent:

At the beginning of each activity, participants will be asked to provide ongoing consent by initialing beside the description of the activity on their consent forms. The exception to this policy is the direct observations which will mostly capture general information about team performance within the classroom versus specific information about individual participants.

16. Participant's Right to Withdraw

Free and informed consent requires that participants have the right to withdraw at any time without consequence or explanation.

Describe what participants will be told about their right to withdraw from the research at any time. If compensation is involved, explain what participants will be told about compensation if they withdraw.

The consent form/information sheet includes the following: "If you choose, you can withdraw from the study at any time by telling the observer your wishes. The observation of your work will stop and you can review any notes or material that relates to you. You can ask for those materials to be removed, and you will be given all copies. You can also allow the material to stay with the study."

17. What will happen to the person's data if s/he withdraws part way through the study?

☐ It will not be used in the analysis.

☐ It is logistically impossible to remove individual participant data.

☒ It will be used in the analysis if the participant agrees to this. Describe how this agreement will be obtained*:*

Upon withdrawing from the study, a participant's data will be deleted or destroyed.

HOWEVER, A PARTICIPANT MAY ALSO PERMIT THEIR DATA TO STAY WITH STUDY. AGREEMENT FOR THIS ARRANGEMENT WILL BE OBTAINED INITIALLY VERBALLY FROM THE PARTICIPANT AND THEN ALSO IN WRITING, REFERRING SPECIFICALLY TO THE DATA SET THAT THE PARTICIPANT HAS REVIEWED, HAS HAD TIME TO CONSIDER, AND AGREED TO. SINCE THIS IS LIKELY TO BE AN UNCOMMON OCCURRENCE, THE WRITTEN AGREEMENT WILL BE DRAFTED ON AN INDIVIDUAL BASIS AND IN CONSULTATION WITH THE ETHICS BOARD.

N. Anonymity and Confidentiality

18. Anonymity

Anonymity means that no one, including the principal investigator, is able to associate responses or other data with individual participants.

18a. Will the participants be anonymous?

☐ Yes ☒ No

19. Confidentiality

Confidentiality means the protection of the person's identity (anonymity) and the protection, access, control and security of his or her data and personal information during the recruitment, data collection, reporting of findings, dissemination of data (if relevant) and after the study is completed (e.g., storage).

19a. Will the confidentiality of the participants and their data be protected?

☐ No

☐ Yes, completely

☒ Yes, with limits (*Check relevant boxes below.)*

- ☒ Limits due to the nature of group activities (e.g. focus groups) the researcher can not guarantee confidentiality
- ☐ Limits due to context: The nature or size of the sample from which participants are drawn makes it possible to identify individual participants (e.g. school principals in a small town)
- ☐ Limits due to selection: The procedures for recruiting or selecting participants may compromise the confidentiality of participants (e.g. participants are identified or referred to the study by a person outside the research team)
- ☐ Limits due to legal requirements for reporting
- ☐ Other

19b. If confidentiality will be protected, describe the procedures to be used to ensure the anonymity of participants and for preserving the confidentiality of their data.

In all cases, except for the focus group and the photography session held at the end of the semester, the confidentiality of the participants will be protected by the primary investigator. THE PRIMARY INVESTIGATOR WILL TAKE THE FOLLOWING MEASURES TO PROTECT THE CONFIDENTIALITY OF THE PARTICIPANTS: (1) THE CONSENT FORMS, ANY HANDWRITTEN OBSERVATION NOTES, PHOTOCOPIES OF STUDENT NOTES AND ANY OTHER SORT OF DATA RECORDED ON PAPER WILL BE STORED IN A LOCKED CABINET IN THE PRIMARY INVESTIGATOR'S OFFICE IN THE ECS BUILDING. ONLY THE PRIMARY INVESTIGATOR WILL HAVE ACCESS TO THIS CABINET AND (2) ANY ELECTRONIC DATA WILL BE STORED ON THE PRIMARY INVESTIGATOR'S PERSONAL LAPTOP WHICH IS KEPT AT HER HOME AND IS NOT NETWORKED TO ANY OTHER COMPUTERS. AFTER DATA COLLECTION IS

COMPLETE, THE PRIMARY INVESTIGATOR WILL REMOVE ANY IDENTIFYING DETAILS IN ORDER TO BE ABLE TO PRESENT A 'CLEAN' VERSION OF THE DATA TO THE REST OF THE RESEARCH TEAM.

19c. If there are limits to confidentiality due to the methods (e.g. group interview), sample size or legal requirements (e.g., reporting child abuse) so that you cannot guarantee confidentiality, explain what the limits are and how you will address them with the participants:

We will establish at the beginning of focus group that the session is confidential.

19d. If confidentiality will not be protected, explain why. If you are asking the participants to waive their right to confidentiality (you plan to identify them with their data), explain what steps will be taken to respect their privacy, if any.

Participants who agree to be photographed in their project teams in the classroom will sign photo waivers. Participants will have the opportunity to review the photographs taken before signing the waivers and if photos are not released, we will delete them from the digital camera.

O. Use and Disposal of Data

20. Use(s) of Data

20a. What use(s) will be made of the data?

The collected data will be used primarily to assess the effectiveness of the SCALE-UP teaching methodology for undergraduate database courses. With our results, we will be able to refine our teaching practices and make improvements for upcoming years.

20b. Will your research data be analyzed, now or in future, by yourself for purposes other than this research project?

☐ Yes ☒ No ☐ Possibly

20c. If yes or possibly, how will you obtain consent for future data analysis from the participants?

N/A

20d. Will your research data be analyzed, now or in future, by other persons for purposes other than explained in this application?

☐ Yes ☒ No ☐ Possibly

20e. If yes or possibly, by whom and how will you obtain consent from the participants for future data analysis by other researchers?

N/A

21. Commercial Purposes

21a. Do you anticipate that this research will be used for a commercial purpose?

☐ Yes ☒ No

21b. If yes, explain how the data will be used for a commercial purpose:

N/A

22. Maintenance and Disposal of Data

Describe your plans for preserving, protecting and destroying all the types of data you collect (e.g. paper records, audio or visual recordings, electronic recordings) after the research is completed:

22a. means of storing data (e.g., a locked filing cabinet, password protected computer files):

Data will be stored in a locked filing cabinet in the primary investigator's office in the ECS building or on the primary investigator's password protected personal laptop.

22b. location of storing data:

The locked filing cabinet is kept in the primary investigator's office in the ECS building on UVic campus. The primary investigator's laptop computer is kept at her home and is not networked to other computers.

22c. duration of data storage:

The data will be stored until the end of the study.

22d. methods of destroying data:

The data will be destroyed by shredding all paper copies and deleting files from the primary investigator's personal computer.

23. Dissemination

How do you anticipate disseminating the research results? (*Check all that apply)*

- ☒ Directly to participants
- ☒ Thesis/Dissertation/Class presentation
- ☒ Presentations at scholarly meetings
- ☒ Published article, chapter or book
- ☒ Internet
- ☒ Media (e.g. newspaper, radio, TV)
- ☐ Other, explain:

P. Researchers

24. Conflict of Interest

24a. Are you or any of the research team members in a perceived, actual or potential conflict of interest in regard to this research project (e.g. in relation to participants, partners in research, private interests in companies or other entities)?

☐ Yes ☒ No

24b. If yes, please provide details of the conflict and how you will manage it:

N/A

25. Researcher(s) Qualifications

In light of your research methods, the nature of the research and the characteristics of the participants, what special training or qualifications do you and/or your research team have or need to acquire?

Every member of the research team has participated in similar research activities to those that will be undertaken during this study while working on Gild projects, such as: drafting information and consent forms, designing and assessing evaluation methods, performing data collection and analysing results of pedagogical evaluations. Mary Sanseverino has done two other technology-related pedagogical studies (in addition to her work with Gild) and is the Associate Director of UVic's Learning and Teaching Centre where her focus is on instructional technology development.

26. Risk to Researcher(s)

26a. Does this research study pose any risks to the researchers, assistants and data collectors?

This research does not pose any risks to the researchers, assistants or data collectors.

26b. If there are any risks, explain the nature of the risks, how they will be minimized, and how they will be responded to if they occur.

N/A

Q. Further or Special Questions

27. Multiple Site Research

27a. Does this project involve collection of data at multiple sites within Canada?

☐ Yes ☒ No

27b. Does this project require the approval of other sites, bodies or organizations (e.g., other ethics board(s), school board, etc.)?

☐ Yes ☒ No

27c. If you responded Yes to 27a. or 27b above, list the sites, bodies or organizations:

N/A

28. International Research

28a. Will this study be conducted in a country other than Canada?

☐ Yes ☒ No

28b. If yes, describe how the laws, customs and regulations of the host country will be addressed:

N/A

29. Other Information

If there is anything else you would like to inform the HREB about this study, provide the details below:

N/A

30. Attachments*

As applicable, attach the following documents (check those that are appended):

☒ Recruitment materials, e.g., script(s), letter(s)

☒ Consent form template or the Consent form checklist

☒ Copies of all other research instruments, including standardized instruments, questionnaires, sample interview questions and/or focus group questions (if large, attach sample questions)

☐ Approval from external organizations (or proof of having made a request for permission)

☐ Permission to gain access to confidential documents or materials

☐ Request to Use Deception form

☐ Human Tissues form

☐ Other, please describe:

*Ensure that all applicable attachments are included with all copies of your application. Incomplete applications cannot be processed and will be returned to the applicant.

Appendix B: Consent and Information Form

Learning and Teaching Issues in CSC370 (Database Systems)

You are being invited to participate in a study entitled “Evaluating the SCALE-UP Teaching Methodology for an Undergraduate Database Systems Course (CSC370)”.This study explores how to provide students with a solid foundation in database fundamentals while encouraging students to work together in teams during class lectures.

We are interested in your participation since you will be learning about databases and participating in activities specifically designed to help you learn to solve database problems. The study is being conducted by Elizabeth Wolfe and Mary Sanseverino. Elizabeth Wolfe is a graduate student and Mary Sanseverino is a faculty member, both in the Computer Science department at the University of Victoria (UVic). You may contact either of them if you have further questions. Elizabeth Wolfe can be reached by email at chabela@uvic.ca; Mary Sanseverino can be reached by phone at (250) 472-5792 or by email at msanseve@cs.uvic.ca. Please note that your instructor, Dr. Daniel German, has participated in the initial design of this study from September until December 2006. DR. GERMAN IS ALSO ELIZABETH WOLFE’S SUPERVISOR BUT THE RESEARCH TEAM HAS TAKEN MEASURES TO ENSURE THAT PARTICIPANTS DO NOT FEEL PRESSURE TO PARTICIPATE IN THE STUDY. DR. GERMAN WILL NOT HAVE ACCESS TO ANY OF THE STUDY’S DATA UNTIL FINAL GRADES HAVE BEEN SUBMITTED FOR THIS COURSE (CSC370).He will not be involved in the study IN ANY WAY from January until May 2007 since he will also be a participant IN THE STUDY. Neither of the faculty members involved will have access to **any** of the data collected until May 2007 and, with the exception of photographs, will only ever see completely anonymous results.

This research is being funded and supported by a LTC Grant. The LTC (Learning and Teaching Centre) promotes teaching improvement at UVic.

Learning about databases, especially in a hands-on fashion, can be difficult in large undergraduate classes. It is particularly important to learn how to develop database solutions with other people. Database concepts can be difficult to understand and learning to master them usually requires a lot of practice with concrete examples. The purpose of this research project is to look at how we can design hands-on activities and support teamwork within the classroom. We are taking teaching methods used in other disciplines and adapting them to this course. Specifically, we are using the SCALE-UP teaching methodology which supports this style of teaching and learning. More information about SCALE-UP is available here: http://www.ncsu.edu/PER/scaleup.html

This study is important because it will have benefits for teachers, researchers and developers interested in improving the teaching of database concepts. It will also benefit students taking database courses in the future. To date, database, computer science and software engineering concepts have never been taught using SCALE-UP techniques. Our study would be breaking new ground and the results will be of interest to UVic and the larger computer science and software engineering community.

We are very interested in having you participate in this study. We are asking your permission to observe you in the classroom during lectures. Your participation is completely voluntary. No names or other methods of identifying you in reports will be used. The observations will be used only to describe what, in general, goes on when you are working together in teams and learning about database concepts.

There are no known or anticipated risks to you by participating in this research.

This study will consist of 1 one hour observation per week during class lectures. Additionally, there will be 2 one-hour interviews conducted at the middle and end of the term (2 hours in total). Questionnaires may also be conducted. You may decline to answer any question posed to you during interviews or questionnaires.

Allowing a researcher to observe your work is completely voluntary on your part. The observations will be used only to describe what, in general, goes on when you interact with your other team members while solving database problems. In order to make the process as comfortable as possible, only trained researchers will be undertaking the observation. These researchers are neutral third parties and are not responsible for any evaluation of your work.

In terms of protecting your anonymity, information gathered from the observation process will only ever be reported as an aggregate description. No names are gathered or used. At no time will anyone be able to identify any of the participants by use of any written reported material. We may ask to photograph students within the classroom setting; however, we will only take photographs after we have written consent from everyone who will be in the photograph. If you choose, you can withdraw from the study at any time by telling the observer your wishes. The observation of your work will stop and you can review any notes or material that relates to you. You can ask for those materials to be removed, and you will be given all copies. You can also allow the material to stay with the study. The observations made will not be shared with the lab instructor or the course instructor and will not impact your mark in this course in any way.

All information disclosed to researchers in this project is confidential. All data will be kept secure and protected at all times. Primary data, including observation notes, and audio/visual recordings, will be kept in a locked file cabinet in the ECS office of Elizabeth Wolfe, the principal investigator. All transcription of the primary data to aggregate data will be undertaken by researchers that have signed a confidentiality agreement. They will not disclose any information about any data gathered. Study data will be kept for three years. At the end of this time, the study data will be destroyed. The transcribed computer data files will be deleted.

All participants will be able to examine the dissemination of the study results via the research project website. Results from this study will be published in computer science and software engineering journals, presented at scholarly meetings, and may form part of theses and dissertations.

In addition to being able to contact the researchers at the above phone numbers, you may verify the ethical approval of this study, or raise any concerns you might have, by contacting the Associate Vice-President, Research at UVic: (250-472-4545) or ethics@uvic.ca.

Please contact Elizabeth Wolfe or Mary Sanseverino if you have any further questions. You may also speak to your course instructor, Dr. Daniel German, if you have concerns in person or by email at dmg@uvic.ca.

Since we will be gathering data in a number of different ways, we are allowing you the opportunity to indicate how you would like to participate in the study. If you would like to be in the study, please initial **all** of the options that apply to you and then sign the form at the bottom. If you do not wish to participate in the study, please do not write anything on this form. Please note that you can choose **multiple options** from the consent choices described below.

Initial: ____ Yes, I consent to being observed during class.

Initial: ____ Yes, I agree to complete brief written surveys about my learning experiences.

Initial: ____ Yes, I agree to participate in one-hour interviews about my learning experiences.

Initial: ____ Yes, I agree to participate in a one-hour focus group about my learning experiences. I also agree to maintain the confidentiality of the other focus group members.

Initial: ____ Yes, I agree to my course notes being photocopied.

Initial: ____ Yes, I agree to my course assignments being read by the principal investigator.

Your signature below indicates that you understand the above conditions of participation in this study and that you have had the opportunity to have your questions answered by the researchers.

_____	_____	_____
Name of Participant	*Signature*	*Date*

A copy of this consent will be left with you, and a copy will be taken by the researcher. IF YOU NEED MORE TIME TO DECIDE WHETHER YOU WOULD LIKE TO PARTICIPATE IN THE STUDY, YOU CAN LEAVE A SIGNED COPY OF THIS FORM IN ECS BOX {NUMBER} ON THE {NUMBER} FLOOR.

Appendix C: Pre-SCALE-UP Assessment (S_1)

PRE-SCALE-UP ASSESSMENT **Student Number:** _____

Section A.
In this section, we would like to find out more about your academic background.

1. Please indicate your year, degree, and major. (e.g.: 3rd year, B.Sc., Computer Science).

   Year:_____ Degree:_____ Major:_____

2. What is your first language?

   □ English Other: _____

3. What is your gender? □ Male □ Female

4. Before taking this class, had you ever heard of the SCALE-UP teaching method?

   □ No □ Yes

5. Have you ever taken a course with Dr. Daniel German before? If yes, which course(s)?

   □ No □ Yes Class(es): _____

6. Have you ever taken CSC370 before?

   □ No □ Yes

7. (a) Have you learned about databases before in another course?

   □ No □ Yes Course name(s):_____

   (b) If yes, where did you take this course?

   □ at work □ at home □ UVic Other: _____

8. Do you have hands-on experience with databases?

   □ No □ Yes

   If you answered yes, please explain how you gained this experience:

_____
_____

9. Do you know anyone in this class? (i.e. classmates, friends, etc). If yes, please estimate how many people you know.

   □ No □ Yes Estimated # of people: _____

10. Have you ever worked with anyone in this class before on a school assignment or lab?

□ No □ Yes Estimated # of people: _____

Section B.

*In this section we would like to learn about **your past experiences** working with other students while at university.*

11. Have you ever worked on assignments or activities with one or more people (i.e. in pairs or in teams)

(a) during classes?

□ No □ Yes

(b) during labs?

□ No □ Yes

(c) outside the classroom?

□ No □ Yes

12. When working in a team, I have usually been the leader of my group.

□ Yes □ No

13. When working with a team, I have sometimes felt left out/not included in the group.

□ Strongly agree □ Agree □ Neutral □ Disagree □ Strongly disagree

Section C.

*In this section, we would like to explore **your personal opinion** about working in teams based on your own experiences.*

14. I personally enjoy working in teams.

□ Strongly agree □ Agree □ Neutral □ Disagree □ Strongly disagree

15. I find it easy to learn the academic material when working in teams.

□ Strongly agree □ Agree □ Neutral □ Disagree □ Strongly disagree

16. I think it is easier to work in teams than working alone.

□ Yes □ No □ Neutral

Please explain your answer (for either 'Yes' or 'No'):

_____

17. I do not enjoy leading a team.

□ Strongly agree □ Agree □ Neutral □ Disagree □ Strongly disagree

18. I like to have a specific role within my team.

□ Strongly agree □ Agree □ Neutral □ Disagree □ Strongly disagree

19. I am comfortable dealing with conflict within a team.

□ Strongly agree □ Agree □ Neutral □ Disagree □ Strongly disagree

20. I like solving complex problems together with other students.

□ Strongly agree □ Agree □ Neutral □ Disagree □ Strongly disagree

21. I think the easiest way to communicate with others is:

□ in person □ using a computer □ no preference

Section D.
In this section, we would like to find out what you think about working in teams ***in general****.*

22. In general, I think it is easy to learn academic material when working in teams.

□ Strongly agree □ Agree □ Neutral □ Disagree □ Strongly disagree

23. In general, I think teamwork is an effective way to get work done.

□ Strongly agree □ Agree □ Neutral □ Disagree □ Strongly disagree

24. In general, I do not think that working in a team is a valuable learning experience.

□ Strongly agree □ Agree □ Neutral □ Disagree □ Strongly disagree

25. I think it is important for Computer Science/Engineering students to develop strong team skills.

□ Strongly agree □ Agree □ Neutral □ Disagree □ Strongly disagree

Appendix D: Post-SCALE-UP Assessment (S_2)

POST-SCALE-UP ASSESSMENT **Student Number: _____**

Section A. Please tell us about your experiences working with your team.

1. I enjoyed working in a team for this course.

□ Strongly agree □ Agree □ Neutral □ Disagree □ Strongly disagree

2. The team for this course was the best team I have ever worked with.

□ Strongly agree □ Agree □ Neutral □ Disagree □ Strongly disagree

3. I would not work with this team again.

□ Strongly agree □ Agree □ Neutral □ Disagree □ Strongly disagree

4. I found it easy to learn the academic material when working with my team.

□ Strongly agree □ Agree □ Neutral □ Disagree □ Strongly disagree

5. I was the leader of my team.

□ Yes □ No □ Our team did not have a leader

6. I had a specific role within my team.

□ Yes □ No

If yes, please describe this role: _____

7. I felt comfortable dealing with conflict in my team.

□ Strongly agree □ Agree □ Neutral □ Disagree □ Strongly disagree

8. I found it easy to communicate with my other team members.

□ Strongly agree □ Agree □ Neutral □ Disagree □ Strongly disagree

9. I found the team contracts helpful.

□ Strongly agree □ Agree □ Neutral □ Disagree □ Strongly disagree

10. In my team we followed our team contract.

□ Strongly agree □ Agree □ Neutral □ Disagree □ Strongly disagree

11. If I was on a team for another class, I would use a team contract again.

□ Strongly agree □ Agree □ Neutral □ Disagree □ Strongly disagree

12. I would have preferred to choose my own team.

□ Strongly agree □ Agree □ Neutral □ Disagree □ Strongly disagree

13. I felt that one or more people on my team did not contribute enough to our work.

□ Strongly agree □ Agree □ Neutral □ Disagree □ Strongly disagree

14. Sometimes I felt left out/not included in my team.

□ Strongly agree □ Agree □ Neutral □ Disagree □ Strongly disagree

15. My team skills improved while working with this team.

□ Strongly agree □ Agree □ Neutral □ Disagree □ Strongly disagree

Section B. Please tell us about your experiences learning about databases.

16. I found the following database concepts challenging:

□ The Relational Model

□ Functional Dependencies

□ Relational Algebra

□ SQL

□ Transaction Management

□ Security

□ Storage

17. I feel confident that I could build and/or maintain a database in the workplace.

□ Strongly agree □ Agree □ Neutral □ Disagree □ Strongly disagree

18. I had difficulty writing SQL statements on the midterm exam.

□ Strongly agree □ Agree □ Neutral □ Disagree □ Strongly disagree

19. I would have benefited from more hands-on practice with a database (for example: running more SQL statements on the computer).

□ Strongly agree □ Agree □ Neutral □ Disagree □ Strongly disagree

20. The in-class activities helped me understand database concepts.

□ Strongly agree □ Agree □ Neutral □ Disagree □ Strongly disagree

21. I had the least amount of experience with databases on my team.

□ Strongly agree □ Agree □ Neutral □ Disagree □ Strongly disagree

22. I was able to help other members of my team learn about databases.

□ Strongly agree □ Agree □ Neutral □ Disagree □ Strongly disagree

23. I would have preferred this class to be taught in a lab so we could interact with a database during class.

□ Strongly agree □ Agree □ Neutral □ Disagree □ Strongly disagree

Section C. Please provide us with feedback about this course.

24. Please rate the assignments from most difficult (1) to easiest (5).

____ Assignment 1
____ Assignment 2
____ Assignment 3
____ Assignment 4
____ Assignment 5

25. I felt that the assignments were too long.

□ Strongly agree □ Agree □ Neutral □ Disagree □ Strongly disagree

26. If I could change the course, I would improve the:

- □ Course notes
- □ Textbook
- □ Lecture format
- □ In-class activities
- □ Assignments
- □ Exams
- □ Other: _____

27. My learning style is: (check all that apply)

- □ listening to lectures
- □ reading the textbook
- □ doing assignments
- □ doing in-class exercises
- □ reading the online notes
- □ hands-on practice with the database
- □ Other: _____

28. I would recommend this course to another student.

□ Strongly agree □ Agree □ Neutral □ Disagree □ Strongly disagree

Additional comments:

_____

_____

Appendix E: Course Goals for the SCALE-UP Curriculum (Database Systems)

These course goals have been adapted from a list developed by the original SCALE-UP research team. Find below the measurable learning objectives that we would like students to achieve during one course of SCALE-UP introductory database systems.

I. Students should develop a good functional understanding of database systems. They should be able to:

A. Design and implement a relational database
B. Interpret and create SQL queries
C. Understand how a relational database management system computes a query
D. Use a DBMS in a multi-user environment
E. Normalize a relational database.

II. Students should begin to develop expert-like problem solving skills. They should be able to:

A. Design a database that satisfies the data requirements of an organization
B. Solve common data retrieval problems using SQL
C. Optimize queries to improve their execution time
D. Optimize a database (using normalization)
E. Interpret ER diagrams and SQL queries.

III. Students should develop laboratory skills. They should be able to:

A. Interact with a Database Management System in order to create a database, submit queries, and improve their performance
B. Explain how a DBMS stores a database
C. Explain how a DBMS executes a given query
D. Explain the relationship between relational calculus and algebra AND relational database management systems and SQL.

IV. Students should develop technology skills. They should be able to:

A. Solve typical data problems using a relational database
B. Interact with a relational database management system to create and modify a database and to submit queries
C. Write programs that interact with a relational database.

V. Students should improve their communication, interpersonal, and questioning skills. They should be able to:

A. Express understanding in written and oral forms by explaining their reasoning to peers
B. Demonstrate their knowledge and understanding of database concepts in written assignments
C. Discuss experimental observations and findings
D. Present a well-reasoned argument supported by observations and physical evidence
E. Evaluate oral arguments, both their own and those espoused by others
F. Function well in a group
G. Evaluate the functioning of their group
H. Solve database problems together in a group.

VI. Students should retain and/or develop cognitive attitudes and beliefs (expectations) that are favorable for learning database concepts with deep understanding. They should:

A. Believe that understanding database concepts means understanding the underlying concepts and principles
B. See relational databases as a coherent framework of ideas that can be used to understand how data can be stored and processed in order to solve data related problems
C. See what they are learning in the classroom as useful and strongly connected to the real world
D. Be cognizant of the scientific process/approach and how to apply it
E. Indicate a willingness to continue learning about relational databases and its applications
F. See themselves as part of a classroom community of learners.

Appendix F: Samples of In-Class Activities

Commentary:

Each class lasted for 50 minutes. Typically the instructor would provide a 20 minute lecture followed by an in-class activity. While students worked together with their teams in the classroom, the instructor would visit each team in turn, providing assistance if necessary. Instructions for the in-class activity sheets were given verbally in order to encourage students to attend class.

Activity 1

A database schema consists of the following 4 relations:
Product(maker, model, type)
Desktop(model, speed, ram, hd, rd, price)
Laptop(model, speed, ram, hd, screen, price)
Printer(model, color, type, price)

Questions:

1. What Desktop models have a speed of at least 1000?
2. Which makers produce laptops with a hard disk of at least 1 gigabyte?
3. Find the model number and price of all products (of any type) made by manufacturer B.
4. Find the model numbers of all color laser printers.
5. Find the makers that sell Laptops but not Desktops.
6. Find those hard-disk sizes that occur in two or more Desktops.
7. Find those pairs of PC models that have both the same speed and RAM. A pair should be listed once.

Activity 2

Table Studio, owner Janeway.

Janeway executes:

GRANT SELECT, INSERT ON Studio TO kirk, picard WITH GRANT OPTION;

Picart then executes:

GRANT SELECT, INSERT ON Studio TO sisko;

Kirk then executes:

GRANT SELECT TO Studio TO Sisko;

Sisko then executes:

GRANT INSERT TO Studio TO Spock;

Part 1. Draw the grant diagram.

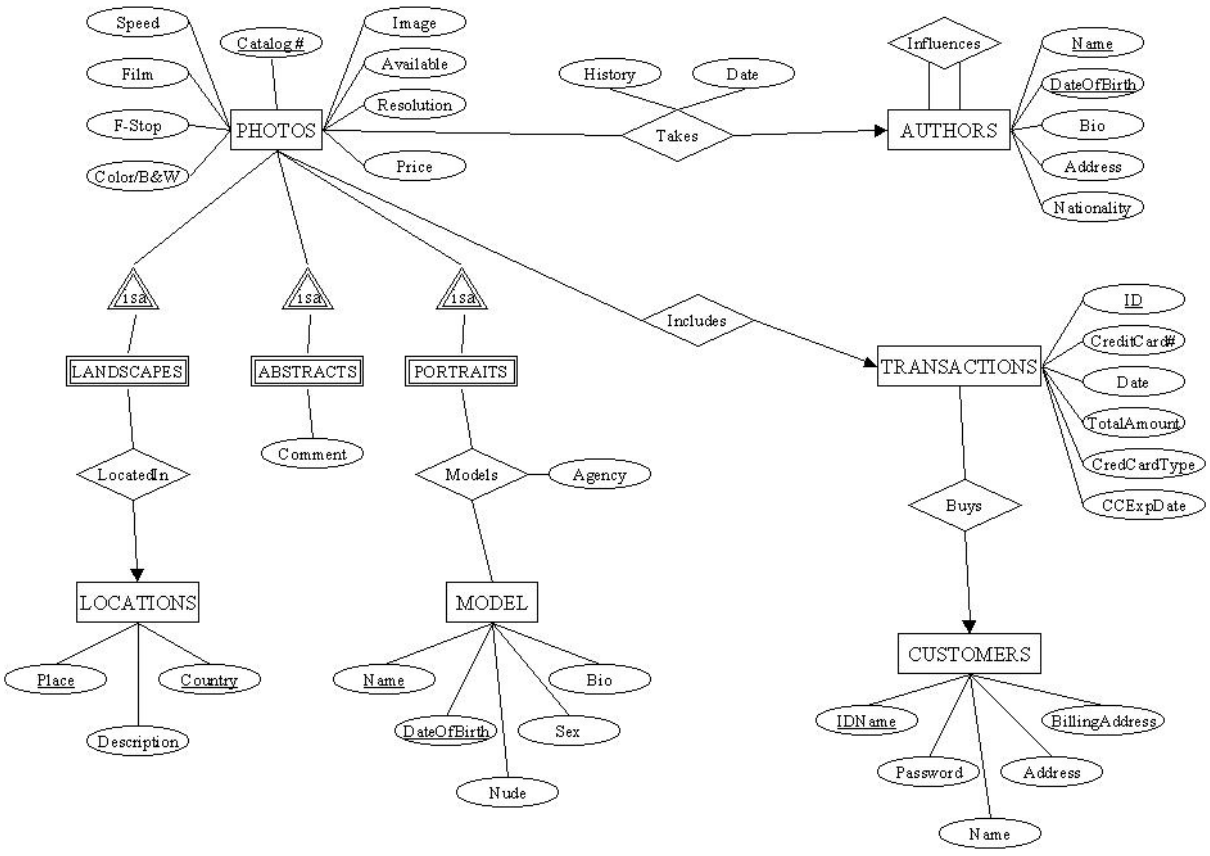
Part 2. What happens when we execute:

1. REVOKE GRANT on Studio FROM Kirk cascade;

Activity 3

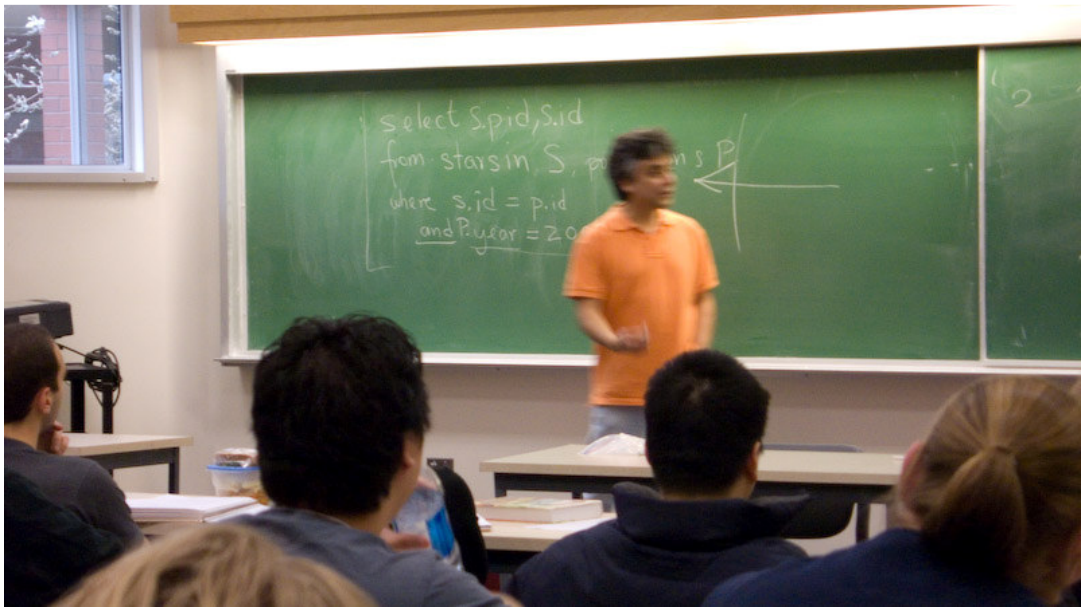
Give an ER Diagram for a DB recoding info about teams, players and their fans, including:

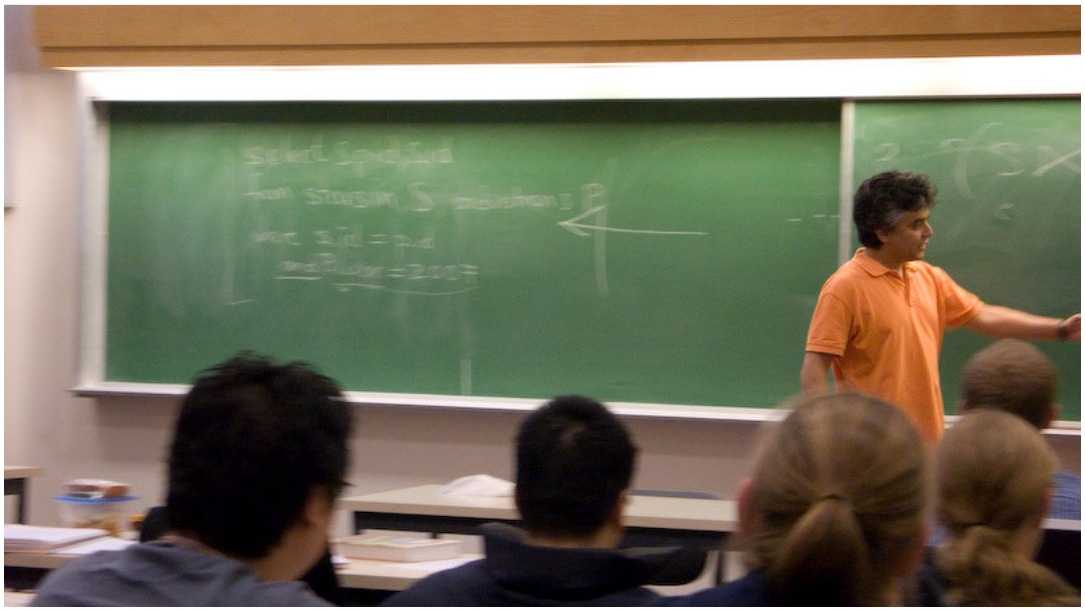
- For each team, its names, players, team captain
- For each player, his/her name
- For each fan, his/her name, favorite team, favorite players, and favorite color

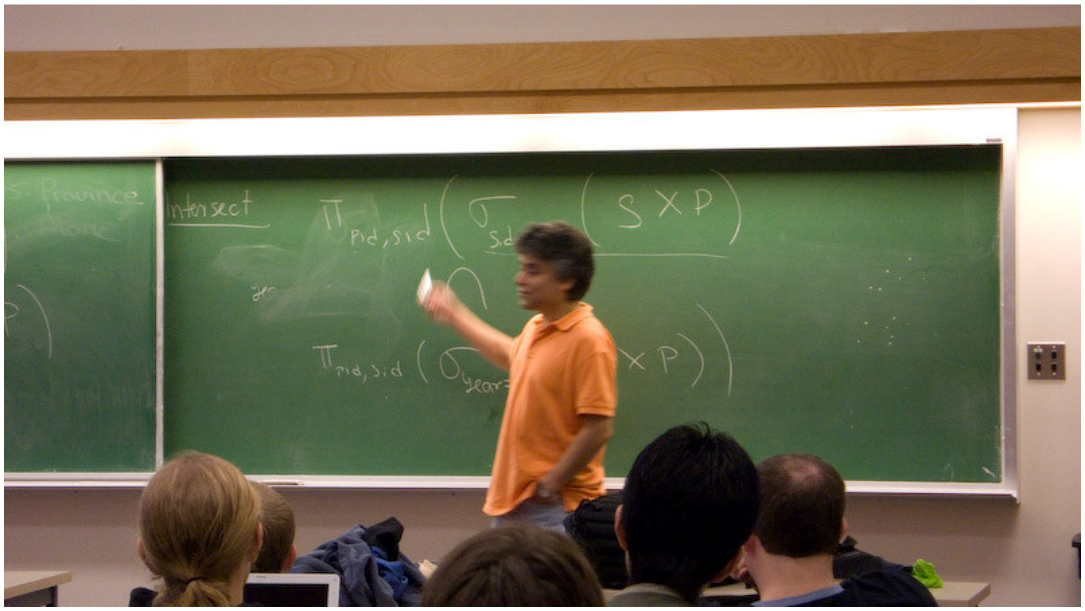


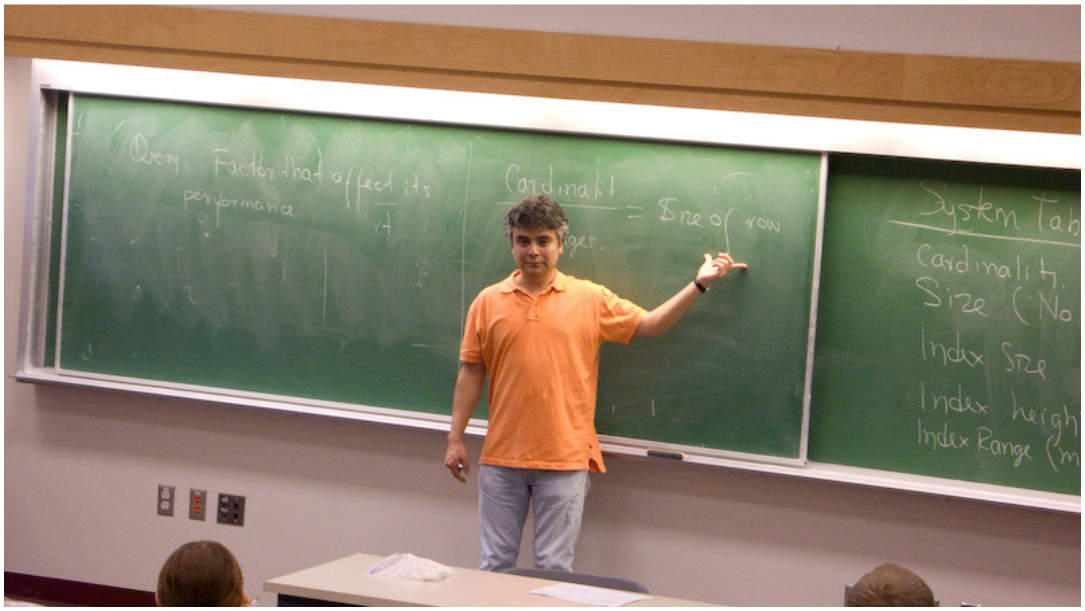
Appendix G: Photographs

These photographs were taken on April 16th 2007 and are shown in chronological order.









Appendix H: CSC370 Course Description

UVic

Department of **Computer Science**

CSC 370: Database Systems

Term

Spring 2007

Course Website

http://turingmachine.org/databases

Instructor

Daniel German
Email: dmg at cs.uvic.ca
Office: ECS 560
Phone Number: 472-5790
Office Hours: Tuesday 14:00-16:00 and on request.

Lecture Schedule

(F01) TWF 10:30 - 11:30 a.m. DSB C112

Textbooks

Required: Database Systems: The Complete Book
Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer D. Widom
Prentice Hall, 1st Edition, 200
ISBN: 0130319953

Course Objectives

The objective of the course is to present an introduction to database management systems (DBMS), with an emphasis on how to organize, maintain and retrieve--efficiently, and effectively--information from a DBMS. The course will focus in 4 main areas:

1. Database design: how can we describe the world in terms of data?
2. Data analysis: how can we answer questions about the world in terms of questions on such data?
3. Concurrency and robustness: how does the DBMS allow multiple users to query and modify the same data? What happens when there is a system failure?
4. Efficiency and scalability: how does the DMBS store large amounts of data and process them efficiently?

Assignments

In this course there will be 5 assignments. Each assignment is worth 5% for a total of 25%. A provisional schedule appears below.

Assignment Schedule

Assignment	Weight	Assigned Date	Due Date
1	5%	January 3	January 11
2	5%	January 11	January 23
3	5%	January 23	February 6
4	5%	February 16	March 13
5	5%	March 13	March 27

Exams

There will two in-class exams: The first exam is worth 30% and will take place **Wed., Feb 14**.

The final exam is worth 30% and will take place **Wed., April 4**.
You must **pass BOTH exams** in order to **pass the course**.

Grading

Coursework	Weight (out of 100%)
Assignments	25%
In class activities	15%
First in class Exam	30%
Second in class Exam	30%

Final Grades are obtained by converting the numerical scores using the conversion table below. Dividing lines between letter grades may be adjusted by a maximum of 3% to account for natural breaks in the numeric scores.

F	D	C	C+	B-	B	B+	A-	A	A+
0-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90-100

Posting Of Grades

Term marks, provisional final grades and final grades will be posted by student number. NO NAME WILL APPEAR. These postings are for your information and for your validation of the data entry. If you do not wish your term marks and grades to be publicly posted in this manner, please notify the course instructor by e-mail no later than Jan 5, 2007.

Course Policies And Guidelines

Late Assignments There will be NO deferral or concession given for tests or assignments that are not completed on the date they are due or scheduled unless an appropriate medical excuse is provided. The mark for any exam not written or assignment not submitted and for which no official medical excuse is provided is zero . The medical excuse should be dated within the week of the exam or assignment deadline and should be handed in within two weeks of the exam or assignment deadline. The medical excuse should provide sufficient information to establish that the student was not able to write the exam due to his/her medical conditions. Student will also be required to give written consent for information about their medical condition to be disclosed to the instructor . When a medical excuse is provided for an in-class exam the final grade will be calculated 60% from the grade in the other exam, 25% from the assignments, and 15% from the in-class activities. When a medical excuse is provided for any assignment, the rest of the assignments will be worth 20% of the final mark.

Attendance: Attendance is mandatory.

Coursework Mark Appeals: All marks must be appealed within 7 days of the mark being posted.

Plagiarism: Submitted work may be checked using plagiarism detection software. Cheating, plagiarism and other forms of academic fraud are taken very seriously by both the University and the Department. You should consult http://web.uvic.ca/calendar2006/FACS/UnIn/UARe/PoAcI.html for the UVIc policy on academic integrity. Note that the university policy includes the statement that "A largely or fully plagiarized assignment should result in a grade of F for the course".

The Faculty of Engineering Standards for Professional Behaviour is at http://www.engr.uvic.ca/policy/professional-behaviour.html

The department guidelines concerning fraud are at http://www.csc.uvic.ca/courses/policies/fraud.html

Department Policies: A list of department policies regarding all courses may be found at http://www.csc.uvic.ca/courses/policies/index.html

This course aims to provide equal opportunities and access for all students to enjoy the benefits and privileges of the class and its curriculum and to meet the syllabus requirements. Reasonable and appropriate accommodation will be made available to students with documented disabilities (physical, mental, learning) in order to give them the opportunity to successfully meet the essential requirements of the course. The accommodation will not alter academic standards or learning outcomes, although the student may be allowed to demonstrate knowledge and skills in a different way. It is not necessary for you to reveal your disability and/or confidential medical information to the course instructor. If you believe that you may require accommodation, the course instructor can provide you with information about confidential resources on campus that can assist you in arranging for appropriate accommodation. Alternatively, you may want to contact the Resource Centre for Students with a Disability located in the Campus Services Building.

The University of Victoria is committed to promoting, providing, and protecting a positive, and supportive and safe learning and working environment for all its members.

Appendix I: Database Background Quiz

CSC 370. Spring 2007. Quiz Number 1

Student Name:_____ Student Id:_____

1. What is schema?

2. What is the meaning of the following relational algebra expression? *Employees x Salaries*

3. What do the following queries compute:

```
(a) select count(*) from students;
```

```
(b) select name, salary from employees natural join salaries where eid =
3005;
```

4. You are told by your manager that the following query runs too slowly, and you are expected to make it run faster. What would you do?

```
select name from employees where eid = 3005;
```

5. In databases, what is a transaction?

Appendix J: Sample Team Contracts

The following sample team contracts were provided by Dr. Beichner. Online versions are available here: http://www4.ncsu.edu/~beichner/examples/Contracts/index.html. (Accessed: April 2nd 2008).

Informal

Group Contract

We agree to:

1) attend regularly scheduled meetings.
2) be on time for meetings.
3) give notice in case of absence.
4) respond promptly to messages.
5) look over group work before meetings.
6) attend class.
7) get notes to absent group members.
8) rotate positions evenly.
9) be responsible for individual assignment.
10) schedule weekly meetings

Typical

We agree to:
1. come to class
2. Make sure that when we miss class that we contact the others in our group.
3. That we will work assignments collaboratively
4. Switch roles per assignment
5. show up to meetings
6. complete asignments before group meetings
7. assist others having trouble with the assignments.

This group contract is binding upon all who sign it and is subject to change with prior approval of all members of the group.

Fancy

Group Contract
Group 10A

Definition of group and statement of objectives
Group 10A shall be comprised of and organized by [redacted] (a.k.a. "[redacted]"). It will be the aim of said group to successfully complete PY208-011 with the maximum of grade performance and to ensure the understanding all tenets, facts, and errata connected with the study of the PY208 curriculum for all group members. To this end, the following terms and conditions will be obeyed.

Terms and Conditions
Group members shall make every effort to:

A. Attendance
   a. Attend all class meetings.
   b. Attend any out-of-class meetings agreed upon unanimously.
   c. Inform other group members prior to any absence, if possible.
   d. Actively seek any information missed in the event of an absence.
   e. Aid any group member in recovering from an absence.

B. Completion of tasks
   a. Complete all work assigned in a timely manner.
   b. Put sufficient effort and planning into any such work.
   c. Seek aid in a timely manner if the work cannot be completed.

C. Use of time and resources
   a. Remain dedicated to the task at hand.
   b. Be active in any problem solving processes.
   c. Avoid using laptops for any purpose other than completing assignments or otherwise advancing understanding of the PY208 curriculum. This includes, but is not limited to:
      i. Playing games.
      ii. Viewing unrelated web pages.
      iii. Checking email unrelated to physics.
      iv. Pursuing conversations online.
      v. The display of any images or documents that may be in violation of the NCSU Acceptable Use policy.

D. Shared responsibility
   a. Correspond with other group members regarding any concern or problem.
   b. Ensure other group members have a complete understanding of the subject matter.
   c. Indicate to other group members if something is unclear.
   d. Ensure that in no case will a single group member complete all necessary work or abstain completely from a project.
   e. Come to a consensus regarding the solution to a problem.
      i. Disagreements will be dealt with by a reasoned argument.
      ii. If a solution cannot be agreed upon, the solution to be presented will be voted upon.

Acceptance
Each of the below signed group members agrees to abide by the terms and conditions outlined herein. Breach of this contract will result in a verbal warning the first and second offence. Third offence violation will result in dismissal from the group.

Signature _____ Date _____

Signature _____ Date _____

Signature _____ Date _____

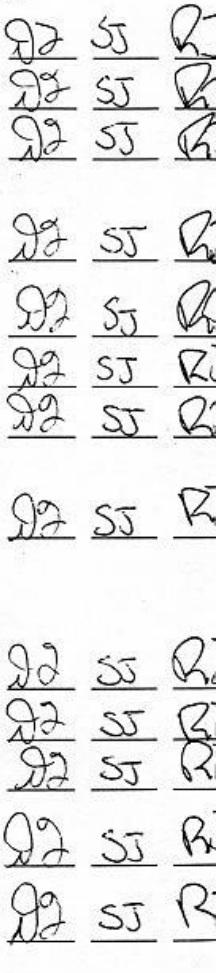
Very Fancy

GROUP A1

Group Contract

Instructions: Please initial all clauses of this contract you are committed to following. An initial implies that you are committing yourself to abide by the clause next to it.

A. I agree to come to class on a regular basis.
B. In the result that I am unable to attend class, I will make it my personal responsibility to get any and all notes from my group.
C. Under any and all circumstances, I will get what work I am allotted to do, done and turned in on time.
D. If I am sick and unable to make it to class on the date a group assignment is due, I will call my group members to make other arrangements to get my work turned in on time.
E. The time and place of group meetings shall be agreed upon unanimously within our group.
F. I will be in attendance and prompt for each and every group meeting.
G. Should an emergency arise that prevents me from attending a group meeting, I will notify my fellow group members immediately.
H. I will do my share of the group work, there will never be an occasion where one group member does all of the work nor will there be a time when a group member does none of the work.
I. Each member will agree on the answer for each group problem before it is turned in. In circumstances where agreement is not automatic, each member shall explain how they arrived at their particular solution until a correct solution is clear. If no agreement can be reached, a vote will be taken on which result to submit.
J. I will do everything in my capabilities to help my fellow group members understand each and every concept and problem.
K. If I do not understand a concept or a solution, I will not hesitate to ask my fellow group members for help.
L. I will communicate with my fellow group members about any concerns I have with our group work.
M. I will be an active member of this group in all aspects. I will not take answers as fact, but instead confirm final results by working the problem myself and attempting to get the same solution.



I certify that I have thoroughly read this contract and that I will abide by it. I am signing this contract at my own free will, and have initialed each of the above statements because I agree with it, and am willing to adhere to each clause. I understand that breach of contract will result in verbal reprimand on the first two instances, followed by immediate dismissal on the third instance. This contract is subject to be amended pending a unanimous vote within the group. By signing below I certify that I am bound, by contract, to

Appendix K: Student Team Contracts

Identifying information has been removed from these contracts in order to protect student anonymity.

Group Contract

1. Goals

The undersigned members of _____ agree upon the following shared goals for the CSC370 course:

a. learn to effectively use a database and a Database Management System
b. understand the internal workings of database systems
c. explore the practical applications of database systems
d. complete the course with a high grade score

2. Expectations and Policies

In the interest of meeting these goals, the group agree to:

a. meet at least once a week for collaboration
b. attend all meetings as scheduled by the group
c. wholly participate in all group discussions
d. contribute equal effort in all assignments and projects
e. meet all group set deadlines
f. allow a chance for other members to edit all work done
g. create documentation of work done as an ongoing process

3. Acceptance

Each of the members signed below agrees to abide by the Expectations and Policies declared in this document. A member found to be in breach of contract will be given a verbal warning, and may be dismissed from the group after three (3) separate instances if deemed appropriate by the other members.

Name	Signature	Date
Name	Signature	Date
Name	Signature	Date

Date Drafted:
January 9, 2007

Team Signatures

Group Contract:

Group Composition and Objectives

named will consist of
The following terms and conditions will be met by all group members in order to complete CSC 370:

Terms and Conditions

1. With regards to attendance, all group members will make every effort to do the following:
   a) attend all lectures and out-of-class meetings,
   b) inform group members of an absence ahead of time, and
   c) contact group members following an absence to obtain any crucial information missed.
2. Regarding the distribution and completion of work, all members of the group shall
   a) complete some portion of work on every project and that the amount of work completed by each member of the group will be similar, and
   b) complete assigned work within a reasonable time frame agreed upon by the group.

In the case of any disagreement with the contract, a majority vote will be taken to determine if a particular point will be upheld.

Changes to this contract may take place following a unanimous vote.

Signed,

Name	Signature
Name	Signature
Name	Signature
Name	Signature

Computer Science 370 - Group Contract

Group name:

Members:

-
-
-
-

Note: Group number is

Mission Statement

's primary objective for the CSC370 course is to meet and surpass the academic requirements set for all assignments and projects. A close, but secondary, objective is to work well as a team and not rely on any one member to do the majority of the work. Emphasis on teamwork and communication have been laid out by the professor and will strive to excel at both.

Expectations

As a team, there is the general and fundamental expectation that everyone does their 'fair share' of work.

is made up of four members with varied academic backgrounds. For resulting grades, members are hoping to achieve marks in the range of B to A+ for the course (and assignments).

Communication and Procedures

The primary method of communication outside of class time will be via email to arrange meetings and coordinate project work. All emails have been distributed to the members.

The policy for arranging group meetings will be such that the intention is to meet at a time and place that is accessible for all members (a minimum of 3, if possible).

Regular/recurring meetings will not be scheduled. Meetings will be scheduled as need be (to be determined by project work load). It may be the case that regular assignments will make weekly scheduled meeting more practical. If so, a time and place will be found that suits the schedules of all group members.

Roles

At this time, no roles have been set for individual group mates. Roles may be assigned at a later time. Initially, in

Summary

In conclusion, all members of have contributed to the creation of this document and agree to the details above. Amendments can be made and do not necessarily require that another contract be drafted and signed.

Signing below signifies that the group member has read and agrees to the contents of this contract.

Date: Wednesday, January 10th, 2007

January 7, 2007

Re: Team Contract

Team contract

This contract establishes an understanding of the responsibilities and aspirations of with respect the formation of csc370 project team Each team member has contributed uniquely to each section of this contract. Each participant must read and accept the terms outlined in the five sections of this contract: team intellectual expectations, team learning methodology, team goals and ambitions, team intrapersonal expectations, team attributes, team work ethics.

Team intellectual expectations

I have practical database experience from the work I have done in the web development field. However, I feel that an overview of the fundamental design principals, and a more detailed look at database optimization would benefit me greatly.

At the conclusion of this course I expect to have a detailed understanding of how databases work. I also expect to learn how to interact with databases.

I would like to learn how a program interacts with a database system, how to use a database effectively and how to implement operations in a database using sql.

I have joined the course with an expectation that I develop some degree of competency with database systems. I expect that upon the completion of this course I will be able to quickly adapt to a new database in the work environment.

Team learning methodology

I learn well when general theories are discussed and explained with the help of examples. I think an open discussion of a topic helps me understand it the best. I'm not a fan of mathematical proofs.

I learn best by going through examples and working on assignments.

I learn best by doing. I would like to write some sql programs in this course if at all possible

I have many different learning styles depending on the structure of the subject to be learned. Computer oriented courses are learned most easily through hands on experience.

Team individual goals and ambitions

I hope to better understand indices, normalization, and other optimization techniques. I am also looking forward to trying the new way that this course is taught, working together in a teams.

I plan on leaving this course with a strong knowledge of databases. I would like to have a grade of A- or better.

My goals for this course are to learn how to apply and create an effective database system.

I would like to come out of this course with an A- and am prepared to do the work necessary to achieve this. I want to come out of this course with a competent understanding of databases.

Team intrapersonal expectations

Since I have not had many courses that focus on team collaboration, I am looking forward to the opportunity to share ideas and discuss the course material. I hope we can share the work load in a way that allows each of us to learn what we want, and have a chance to work on something we find personally interesting. I also feel that it is important to make sure we are able to communicate the assignment break-down effectively.

I expect communication between all members of this team to be strong and effective. The team should answer each other's questions and work together to make sure assignments are completed fully and accurately.

I hope that my team communicates with each other effectively and that we can all learn as much as possible about database systems. I hope that my team understands that I work part-time and will not be able to attend class from time to time. This, however, should not impact our course work as I will be in contact with my team members via email and also in class.

I look forward to working as a team and hope that all members share the same positive view. I feel that team work will reduce the load of the course and will facilitate learning through discussion. I want to let everyone know that I am there for them if they are having problems with assignments or if overall school work load is too high. I urge no team member to take on more than they can handle. I believe that open communication is key to the success of the group.

Team attributes

I have a few years of practical SQL experience, mostly with web development. I enjoy programming in PHP, and C, but have also used Java, C++ and Ruby.

I have experience working with databases, and I expect this to be of great assistance in this course.

I can offer my full cooperation and involvement with our team and offer my complete dedication to our group assignments.

I am an energetic team member with extensive experience in various programming languages. My preferred languages are Python and Java however I am fully competent in Perl and C. Once I decide to accomplish something I do so focused and quickly with good results. I however am not organized and have problems keeping a schedule. I may need to be reminded of project deadlines repeatedly.

Team work ethics

If a topic interests me, I work on it non-stop. Otherwise, I usually leave it to the last minute, but still get it done. Communicating by email is fine, but if something needs to be communicated in person, I will be able to make the trip.

I believe that the group should examine and discuss assignments together, before members independently work on equal portions. While group members are working independently they should communicate via email to ask questions or make comments. Any questions should be asked to all group members and should be answered as fully as possible to assure that each member has a full understanding of the material being covered. After individual work is completed, the members should regroup to review each other's work and compile a final draft of the assignment.

When doing assignments, I prefer to communicate via email as much as possible so that we can work independently as well as coordinate together as a group without having to setup meetings all the time.

For any given task, I prefer to modularize a task and work independently on each module. The solutions for each module should be read and approved by at least 1 other team member in the group.

I. **Mission:** To achieve a workable knowledge of DB systems and SQL such that we are competent to apply for Co-Op jobs. Achieve each individual's grade goals ranging from A's to 'just need the credit'.

**Personal Notes:*

II. **Expectations:** Equal participation of all teammate's and equal work-load for equal credit. Aim to achieve high marks. Have a high quality piece of work produced on-time by all due dates. Communicate clearly with the group concerning all group matters.

**Personal Notes:*

III. **Policies:** Every group member is expected to be at the weekly meeting (13:30 Tuesdays) If you have a legitimate reason to miss a meeting please make prior arrangements with the group. If you miss any group activities/work the onus is on you to make up any time/info. Any group member who repeatedly (as unanimously decided by the group) is guilty of not 'towing the line' will be asked to leave the group.

**Personal Notes:*

IV. **Project Plan:** All projects are to be dealt with in an organized manner. 1) Meeting to examine problem. 2) Project broken into work units. 3) Work assigned and completed. 4) Group audit and integration of all work 5) Final polish and group approval for submission.

**Personal Notes:*

Signatures:

1.

CSC 370 Database Systems Spring 2007

TEAM CONTRACT

Definition of Group and Statement of Objective
Members of includes: It will be the aim of to successfully complete CSC 370 with the result of maximizing the return on the effort expended throughout the course in terms of grades and learning outcomes.

Terms and Conditions
All group members shall make maximum effort to:

- Attend all lecture sessions
- Attend all scheduled team meeting sessions
- **Contribute positive work towards the assigned problems**
- **Complete all assigned work on time**

Acceptance
By signing below each group member will adhere to terms and conditions outlined above. Breach of this contract will result in maximum of two verbal warnings for first two violations. Third violation will result in dismissal from the group.

Signature	**Date**
Signature	**Date**
Signature	**Date**
Signature	Date

Team Contract

Team Name:

I. Mission Statement and/or Goals: The shared goals of the team are to…

To get A+'s for all.

II. Expectations: Include the team's expectations with regard to issues such as attendance at meetings, level of participation, communication, productivity, etc.

Attend all meetings and contribute equally to assignments.

III. Policies and Procedures: Include team policies and procedures governing such things as attendance, preparation, timeliness and quality of work, etc.

Check email daily and be prepared to respond quickly to meeting dates. Complete work on time with a high level of quality, deserving of an A+.

IV. Roles (optional): If appropriate for the nature of your team assignments, develop and assign the task and process roles that are necessary for top team performance.

As assigned based on ability.

Team

Team Contract

1. The shared goals of the team are to learn to work as a team, to improve communication skills and to complete every assignment.

2. Every team member should try to attend every meeting, share ideas, and participate to the best of his ability.

3. Each team member should prepare before each meeting and be on time for each meeting.