UNIVERSITÉ DE SHERBROOKE

Student Attitudes Towards Cooperative Learning in Education
Attitudes d'étudiants face à l'apprentissage coopératif en éducation

par

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a été évalué par un jury composé des personnes suivantes :

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SUMMARY

Active or participatory learning by the student within a classroom environment has been fairly recently recognized as an effective, efficient, and superior instructional technique yet few teachers in higher education have adopted this pedagogical strategy. This is especially true in Science where teachers primarily lecture to passively seated students while using static visual aids or multimedia projections. Teachers generally teach as they were taught and lecture formats have been the norm. Although student-learning theories as well as student learning styles, abilities, and understanding strategies have changed, traditional teaching techniques have not evolved past the “chalk and talk” instructional strategy. This research looked into student’s perceptions of cooperative learning or team-based active learning in order to gain insight and some understanding as to how students felt about this learning technique. Student’s attitudes were then compared to student grades to determine whether cooperative learning impeded or ameliorated academic performance. The results revealed significant differences measured in all the survey questions pertaining to perception or attitudes. As a result of the cooperative learning activities, respondents indicated more agreement to the survey questions pertaining to the benefits of cooperative learning. The experimental group exposed to cooperative learning thus experienced more positive attitudes and perceptions than the groups exposed only to a lecture-based teaching and learning format. Each of the hypotheses tested demonstrated that students had more positive attitudes towards cooperative learning strategies. Recommendations as to future work were presented in order to gain a greater understanding into both student and teacher attitudes towards the cooperative learning model.

RÉSUMÉ

L'apprentissage actif ou préparatoire par l'étudiant au sein d'une classe a été reconnu assez récemment comme une technique d'enseignement plus efficace. Cependant, peu d'enseignants ont adopté cette stratégie pédagogique pour l'éducation post-secondaire. Ceci est particulièrement le cas dans le domaine des sciences où les enseignants font surtout usage de cours magistraux avec des étudiants passifs tout en utilisant des aides visuelles statiques ou des projections multimédias. Les professeurs enseignent généralement comme on leur a eux-même enseigné et les cours magistraux ont été la norme par le passé. Les techniques traditionnelles d'enseignement n'ont pas évolué au-delà de la craie et du tableau noir et ce même si les théories sur l'apprentissage par les étudiants ont changé, tout comme les styles, les habiletés et les stratégies de compréhension d'apprentissage des étudiants. Cette recherche se penche sur les perceptions des étudiants au sujet de l'apprentissage coopératif ou de l'apprentissage actif par équipe de telle sorte qu'on puisse avoir un aperçu et une certaine compréhension de comment les étudiants se sentent par rapport à ces techniques d'apprentissage. Les attitudes des étudiants ont par la suite été comparées aux notes de ceux-ci pour déterminer si l'apprentissage coopératif avait nui ou au contraire amélioré leurs performances académiques. Les résultats obtenus dans l'étude d'ensemble révèlent des différences significatives dans toutes les questions ayant trait à la perception et aux attitudes. Suite aux activités d'apprentissage coopératif, les répondants ont indiqué un plus grand accord avec les questions de l'étude d'ensemble ayant trait aux bénéfices de l'enseignement coopératif. Le groupe expérimental exposé à l'apprentissage coopératif a ainsi démontré des attitudes et des perceptions plus positives que les groups exposés uniquement à un format d'enseignement et d'apprentissage basé strictement sur des cours magistraux. Chacune des hypothèses testées ont démontré que les étudiants avaient des attitudes plus positives envers les stratégies d'apprentissage coopératif. Des recommandations concernant des travaux supplémentaires ont été présentées pour mieux comprendre les attitudes à la fois de l'étudiant et de l'enseignant envers le modèle d'apprentissage coopératif.

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INTRODUCTION

Teachers in the college environment have often struggled with motivating and actively engaging students in the classroom. Lecture based instruction, with or without computer assisted devices, do not lend themselves to active participation by the student population, even when selected students are called upon to provide comment or questions. Many students either remain passive and unthinking, fall asleep, distracted by their immediate environment, or engaged in irrelevant conversations with neighbors, thus distracting the class and deriving little benefit from their presence. The implementation of multi-media presentations have added to the students passivity as most instructors distribute hardcopies of prepared notes, reduce the lighting, and present more material and content while at a quicker pace (as no or little writing or copying of notes is required). The implementation of technology is thus double-edged: providing efficient content delivery while increasing student passivity. By the end of class, students are often overcome from either the dazzling speed of course content presented or by their boredom-induced stupor.

Many teachers instinctively know, understand, and acknowledge that in actively engaging students, students are less likely to be distracted, disengaged from the content delivery, perform assigned work from other classes, or "space out". However, transforming the classroom into a more cooperative environment is not easy. Most faculty resist the transformation from the "chalk and talk" lecture format to a group activity arrangement because they fear loss of control, content slippage, unease with the format and structure, or have no time to prepare such an activity. Most faculty are unaware that lecture based instruction is only marginally successful in student learning and that student learning modes have evolved over the years due to external and environmental factors.

Students are not any less bright or capable of learning the material as past students but their learning strategies and learning priorities have changed. Students have always learned by actively interacting with their surroundings whether in an educational setting or not. The educational system in Québec has been capitalizing on this interactivity by introducing cooperative learning environments starting in primary school and now extending into secondary school.

Cooperative learning has often been defined as any number of instructional strategies that involve students interacting with one another, however cooperative learning is more structured and teacher centered than many other forms of small-group teaching. It tends to emphasize formal instructional procedures, designed to ensure that students feel a sense of positive interdependence and to focus on individual accountability in course grading, as opposed to undifferentiated grades for all members of a group, regardless of differing individual contributions. Typically, a cooperative environment involves a lecture-less class wherein small groups of three or four students do exercises while the instructor roams the class offering assistance when needed and guides the inquiry. The class-time may include a short lesson but nonetheless requires active student participation. Active learning on the other hand encompasses cooperative learning and can involve or include peer instruction, problem-based learning (PBL), inquiry-based learning, role playing, and team and/or group work inside or outside the classroom.

The goals of a cooperative lesson in the chemistry domain include the clarification of a basic concept or technique that is foundational to chemistry and the reinforcing of an area of particular difficulty. Cooperative activities generally encourage peer interaction within class and out of class peer study groups. One of the main benefits of student-student interaction is in concept formulation through teaching opportunities which results in improved student performance and perseverance.

This paper will first present the relevant literature review encompassing general cooperative learning theory along with its typography, followed by the previous research performed to establish student perceptions of cooperative learning endeavors.

The literature review will be followed by the research methodology including the research instruments used, participant selection, procedures utilized, and hypotheses tested and investigated.

An extensive analysis of the quantitative data by SPSS™ statistical software and the qualitative data by HyperResearch™ analysis software will be then presented in the Data Analysis and Discussion section on student perceptions.

The errors and limitations of the work will then be discussed followed by conclusions reached. A final section outlining research for future work will be presented so that continuing research in this field could be pursued and accomplished.

CHAPTER ONE

REVIEW OF THE LITERATURE

In order to provide a more meaningful, more academic, and more enjoyable learning environment for students, some professors are implementing instructional strategies whereby students actively engage in the educational experience. Professors are increasingly transforming the lecture-based class into one in which active involvement including group work, collaborative, cooperative, and team-based learning are but a few techniques in which students must participate. Although many see these strategies overlap, some educators have distinguished differences. Collaborative learning "refers to a variety of instructional practices that encourage students to work together as they apply course material to answer questions, solve problems, or create a project" (Colbeck, Campbell, & Bjorkland, 2000) whereas cooperative learning is regarded as "a more structured, hence more focused, form of collaborative learning" (Millis & Cottell, 1998). Michaelson, Knight and Fink (2002) have designed team-based learning strategies in which teams are used as a central pedagogical mechanism throughout an entire course and calls for larger groups (from five to seven students) than do other strategies (typically three to five). Also, team-based learning advocates see grading team projects as crucial and they highly recommend peer assessment.

The literature review is divided into two parts representing the various aspects of the research: cooperative learning theory, and student perceptions of cooperative learning.

McKeachie (1988) concluded that at least three elements of teaching make a difference in students' gains in thinking skills: (1) student discussion, (2) explicit emphasis on problem-solving procedures and methods using varied examples, and (3) verbalization of methods and strategies to encourage development of metacognition. He stated, "Student participation, teacher encouragement, and student-to-student interaction positively relate to improved critical thinking. These three activities confirmed other research and theory stressing the importance of active practice, motivation, and feedback in thinking skills as well as other skills. This confirms that discussions, especially in small classes, are superior to lectures in improving thinking and problem solving." (p. 81).

1. COOPERATIVE LEARNING THEORY

Students learn in a variety of ways depending on their learning style (Felder & Silverman, 1988), approaches to learning; deep, surface, and strategic (Ramsden, 1992), levels of intellectual development (Atherton, 2005), as well as how they construct knowledge (Spencer, 1999). The traditional teaching paradigm, lecturing, has its roots in behaviorist or objectivist theory, where information or “truth” is imparted by an expert and only one correct answer is imagined. The alternative cognitive teaching paradigm involves a more constructivist approach, where students performing group work negotiate and develop a shared meaning of knowledge. This cognitive learning cycle involves the inductive or exploratory stage whereby data is collected followed by the deductive stage or application stage.

Three interrelated theoretical perspectives were expressed by Springer et al.

(1999) to describe the "efficacy of small group learning" (p. 24): cognitive elaboration, affective collaboration, and motivation. Cognitive elaboration maintains that new information is best retained when linked to information already present in memory. Team members establish this cognitive association by describing and elaborating on classroom issues typical of group work. Affective collaboration involves the interaction in the form of discussion and dialogue, exchanging of ideas and theories among students enhancing learning for both the listener and the communicator, thus facilitating the learning process. The motivational aspect consists of students valuing the success of the group and necessitates that students view the process as cooperative instead of seeing it as competitive. In this model, individual accountability for learning is paramount (Slavin & Cooper, 1999) as to motivate students to interact and share ideas as opposed to solely sharing correct answers. It is imperative that for students to effectively participate in team learning, they must feel rewarded by success, and that equally important are that their peers excel.

Slavin (1996) described four major theoretical perspectives on cooperative learning and achievement: extrinsic motivational, social cohesion, developmental, and cognitive elaboration. From an extrinsic motivational perspective, cooperative learning enhances achievement through the use of reward structures, which create situations where group members attain their personal goals only when the group is successful. From a social cohesion perspective, cooperative learning enhances achievement through the use of teambuilding and group self-evaluation, which create a positive climate such that students care about one another and want each other to succeed. From a developmental perspective, cooperative learning enhances achievement through peer interaction around appropriate tasks where, for example, more capable peers provide stepping stones or scaffolds in the development of other students' thinking. Finally, from a cognitive elaboration perspective, cooperative learning enhances achievement through structured activities in which students elaborate their understanding of the material by explaining it to someone else (as cited in Abrami & Chambers, 1996).

Stepwise discriminant analysis, used by Rassuli & Manzer (2005) to survey student perceptions of success in team learning, resulted in better understanding and communication of simple and complex concepts (cognitive elaboration), better attitudes towards instructor and course along with higher achievement (affective collaboration), and concluded that team work improves team test taking, team learning and team problem solving (motivation).

A meta-analysis of forty six (46) studies between 1929 and 1993 comparing competitive and cooperative strategies indicated that cooperative strategies were superior in their effectiveness on problem solving. This success may be due to the exchange of information and insights among cooperators, the generation of a variety of strategies to solve the problem, increased ability to translate the problem statement into equations, as well as the development of a shared cognitive representation of the problem (Qin, Johnson, & Johnson, 1995).

Numerous correlational studies examining the effectiveness of cooperative learning with that of competitive or individualistic efforts have demonstrated the superior efficacy of group work. Nurrenbern & Robinson (1997) established an extensive bibliography on cooperative learning covering general definitions, cooperative learning in the chemistry classroom and laboratory, chemistry course organization, and assessment. A summary of the studies conducted at the higher education level may be found in Johnson, Johnson, & Smith (1991). A comprehensive review of all studies and meta-analyses of their results is available in Johnson & Johnson (1989). Research by Johnson et al. (1991) revealed that the more students work in cooperative and collaborative learning groups, the better they will understand what they are learning, and the easier it will be to remember what they have just learned. Because these students both learn from others and teach their peers, they feel better about themselves, the class, and their classmates.

Springer et al. (1997) used meta-analysis techniques to determine the efficacy of cooperative learning on student achievement, student attrition and student attitudes. They have identified an ambitious line of future research which addresses questions relating to the impact of cooperative learning on a number of student outcomes, types of students, and disciplinary areas.

Regarding the impact of cooperative learning on specific Science, Mathematics, Engineering Technology (SMET)-disciplinary areas, the college-level research is still relatively new and has yet to be systematically organized. Treisman (1985) in mathematics, Felder & Brent (1994) and Felder (1991) in engineering, Heller & her associates (Heller & Hollabaugh, 1992; Heller, Keith, & Anderson, 1992) in physics, Klionsky (1998) in biology, and Cooper (1995a; Cooper, 1995b) in chemistry have led colleagues within disciplinary groups, demonstrating that small-group work can have a powerful impact on achievement, attrition and attitudes among students, particularly women and minorities.

Bowen (2000) attempted to answer the question "Is cooperative learning more effective than traditional instruction in promoting academic achievement, persistence, and attitudes among undergraduates in science, mathematics, engineering, and technology [SMET] courses?" by conducting a meta-analyses of thirty seven (37) research studies (not all chemistry related) between the years 1980-1996 involving 3500 students. His results show that, on average, using aspects of cooperative learning enhanced chemistry achievement for high school and college students and strongly recommends that chemistry instructors continue incorporating cooperative learning practices into their classes. He also suggests that these results can be used to support efforts at curriculum change that instructors might make in their teaching situations. Surprisingly, when at-risk students in non-science majors (NSM) enrolled in an Introductory Chemistry class were split between a large and small class lecture formats, the large class students out-performed the small class students in academic achievement (Mason & Verdel, 2001). Although both classes had cooperative assignment sets for group work, it was thought that the smaller class had limited access to better achieving students and thus was hindered in the instructional environment.

Cooperative work has resulted in multiple outcomes: (a) higher achievement and greater productivity, (b) more caring, supportive, and committed relationships, and (c) greater psychological health, social competence, and self-esteem. In the process of sharing and communicating their thoughts within the team or group environment, students develop a kind of collective learning synergy that surpasses the sum of their individual efforts (Mutch, 1998). Dougherty (1997) and Hagen (2000) reported that cooperative learning had a positive impact on student retention and student performance in General and Organic Chemistry, respectively. Carpenter & McMillan (2003) also reported beneficial peer instruction, reduced stress levels, and budding friendships in their Organic Chemistry classroom.

Finding that students were underachieving in his chemistry courses, Kogut (1997) attempted a learning team approach that resulted in higher grades, increased participation, and greater individual satisfaction and enjoyment. Paulson (1999) slowly introduced active learning into his university classroom and discovered that not only did the achievement rates of his students increase but students were discussing the content material at a higher level than what was observed with a lecture format. Conversely, Hass (2000), using cooperative laboratory experiments, reported that although there appeared to be no difference in student achievement or performance results, at least this approach did not sacrifice the students' understanding of experimental concepts. This study also demonstrated that students were capable of organizing and directing themselves through a laboratory experience with proper supervision and guidance that led to higher self-esteem and reliance.

Cooperative or active learning can take many forms, the most prevalent being teams being formed within the college classroom with members working collaboratively towards a common objective. Some authors used case studies in a non-science major (NSM) course on introductory chemistry to introduce the scientific method, basic chemistry calculations, and current and relevant controversial topics to increase participation and interest by students (Bennett & Cornely, 2001; Dinan, 2002). However, Jackson & Walters (2000) using role-playing to actively engage students in analytical chemistry, reported higher achievement rates, technical skills, collaborative work, and communication abilities while Gahr (2003) used group-led concept maps in the Organic Chemistry laboratory to promote higher cognitive participation. In order to both introduce and increase cooperative effort amongst students, Henderson & Mirafzal (1999) designed written scenarios involving everyday occurrences along with providing experimental equipment and chemicals and required student groups to perform experiments in the classroom.

Peer tutoring or mentoring, an abridged form of group cooperative learning, was popularized by Mazur (1997) in Physics and by Ellis et al. (2002), and Ellis et al. (2003) in Chemistry through the use of ConcepTests; problems involving conceptual understanding of behaviors and principles. Students pair up to discuss conceptual or algorithmic problems and try to convince each other of the correct solution. Student solutions are then presented to the class and may be tabulated for demonstration ease.

In an effort to satisfy work/employer complaints that graduating students lacked the technical problem solving and critical thinking skills required to work within the workforce, Houghton & Kalivas (2000) transformed the traditional chemistry laboratory experience, complete with laboratory manual and procedural instructions, to a group based endeavor in which students were asked to go into the field and determine the many factors which contribute to the well being of Rainbow Trout. The group had to rely on each other to ensure task completions, had to propose multiple budgets for the testing processes, and had to present findings. A side benefit to this work was the interdisciplinarity created between chemistry, biology, and ecology disciplinary fields. Cooperative activities in higher level instrumental and analytical chemistry courses that present interesting and real-world problems are uncommon but was attempted with greater student interest and achievement (Giancarlo & Slunt, 2004).

Felder (1996) remarked that when cooperative learning instructional strategies were implemented in his course, students grades and positive social interaction increased, deeper and more complex questions were asked, students were preferentially sought after by potential employers, and a greater percentage of them went on to graduate school. Stolzberg (2003) used the cooperative learning method of peer instruction using conceptual understanding tests to determine the student's current knowledge base and determine their misconceptions. As a result of this testing, the pace and depth of the subject matter was adjusted on the basis of class needs and immediate feedback on the level of student understanding was determined. He also observed that student comments about the peer instructional strategy at the end of the semester were nearly 100% positive.

Many researchers have also produced workbooks or sourcebooks from which cooperative learning examples, techniques, and applications are detailed. Abrami et al. (1995), and Johnson et al. (1991) have written excellent pre-collegiate and collegiate resource books focusing on general applications of cooperative learning. Nurrenbern (1995) has published a useful cooperative-learning workbook specifically designed for chemistry teachers, McNeill & Bellamy (1995) an applied workbook describing how cooperative learning can be used in college engineering classes, and Hagelgans et al. (1995) constructed a good workbook designed for college-level mathematics teachers.

Towns et al. (2000) used an action research project incorporating both quantitative and qualitative methods to determine that small-group activities fostered a feeling of community in the classroom. It was this social interaction that led to facilitated learning and increased student achievement and persistence through mutual commitment and mutual goals.

While most studies agree on the many social and academic benefits of cooperative learning environments, *group goals* and *individual accountability* must be present to ensure student achievement (Slavin & Cooper, 1999) at least at the pre-college level. Slavin (1990) further specified that cooperative learning need include equal opportunities for success, team competition, task specialization, and adaptation to individual needs. Nonetheless, Davidson (1985) provided examples where student achievement was not dependent on group goals and individual accountability at the college level in mathematics.

Many techniques have been developed for the implementation of cooperative learning: Learning Together (D.W. Johnson & Johnson, 1984), Jigsaw (Aronson, 1978), Jigsaw II (Slavin, 1988), Group Investigation (Sharan & Sharan, 1987), and others. One well respected technique for the implementation of cooperative learning involved the following 18 steps (D.W. Johnson & Johnson, 1984): 1) clearly specify educational objectives; 2) limit group to no more than six; 3) structure group for heterogeneity relative to sex, ethnicity, and ability; 4) arrange groups in circles to facilitate communication; 5) use instructional materials to promote interdependence among students; 6) assign roles to ensure interdependence; 7) explain the academic past; 8) structure positive goal interdependence; 9) structure individual accountability for learning so that all group members must contribute; 10) structure inter group cooperation; 11) explain criteria for success; 12) specify desired behaviors; 13) monitor students behaviors continuously for problems with the task or with collaborative efforts; 14) provide task assistance; 15) intervene to teach collaborative skills, if necessary; 16) provide closure to lessons with summaries by students and teacher; 17) evaluate the students work; and 18) assess group functioning by ongoing observation during lessons and discussion of the group process once the lesson is completed.

2. STUDENT PERCEPTIONS

Students' perceptions, attitudes, and behaviors can generally determine whether a particular instructional strategy is successful in the classroom and it is these same attitudes and beliefs that Parr & Townsend (2002) conclude are affected by peer context. Thus if cooperative learning strategies are perceived by some students in the classroom as ineffective, wasteful, or inefficient, these same attitudes may influence others to poison the classroom atmosphere to this instructional technique. It is thus imperative that teachers understand the prevailing student attitudes and perceptions within the classroom in order to better structure and implement cooperative learning strategies and this understanding of student attitudes may enable teachers to persevere with this pedagogical approach if at first unsuccessful.

Student perceptions that cooperative learning in a Business class would result in improvement in understanding of both simple and complex concepts, enhance their critical thinking skills (defined as recognizing, formulating, analyzing, and interpreting business problems), enhance their communication skills (defined as effective presentation of ideas and formulations and the ability to work in groups), were confirmed in a multivariate analysis performed by Yazici (2004). Yazici (2004) also found that students' self-confidence in their ability to define problems and apply knowledge competently were enhanced, and as students shared what they know with peers, their communication and group skills also improved significantly. These same students perceived themselves as independent learners as a result of cooperative learning strategies conducted in class.

Baumberger-Henry (2005) used The Problem-Solving Inventory (Heppner, 1988) to assess whether nursing students who learn using cooperative learning strategies self-perceive or are aware of greater problem-solving capabilities when faced with an issue or predicament as well as used The Clinical Decision Making in Nursing Scale (Jenkins, 1985) to assess how students view themselves as clinical decision makers. Although Baumberger-Henry (2005) did not measure any significant differences of student self-perception in problem solving between cooperative learning classes and straight lecture classes, cooperative learning did not hinder or impede learning. Limitations to the study suggest that had more students and a longer time frame been available, significant differences would be evident.

Hijzen, Boekaerts, & Vedder (2006), in studying 1920 students (mean=18 years, SD=3.6), determined that the student's perception of the quality of cooperative learning was highly dependent on *contextual factors in the classroom* as well as on *goal preferences.* Contextual factors measured included the type of task, the type of evaluation/rewards, teacher instruction behavior, teachers' clarity on rules for cooperative learning, and students' evaluations of the extent that they were taught cooperative learning skills. Also measured were the students' perception of school climate, including their perceptions of the availability of teacher's academic and emotional support, and the availability of peer academic and emotional support. Goal preferences included achievement goals, entertainment goals (e.g., I want to have fun at school), self-determination goals (e.g., I want to determine myself how I do things), working goals (e.g. I want to finish that task), belongingness goals (e.g., I want to make many friends) and social support goals (e.g., I want to provide help to peers).

It is widely assumed that better academically performing students would not be in favor of group work since it was thought that they believe they would not benefit from the experience, would imagine they have less control over their individual grade, did not know how to handle conflict, had time and location constraints, and would rather spend the time in personal study (Buckenmyer, 2000; Monk-Turner & Payne, 2005). In an effort to understand whether these perceptions were accurate amongst high achieving students, Monk-Turner & Payne (2005) surveyed 145 criminal justice majors. Although these students did not see how the group work experienced in class would prepare them for future work nor did they look forward to group projects, most (85%) agreed that the group members contributed equally to any task assigned. Buckenmyer (2000) devised an annotated guide on how teams should be selected and managed in order to minimize both teacher and student objections to collaborative work while Gardner & Korth (1998) proposed a framework for learning to work in teams by making use of motivation, attitudes toward group work, learning preferences (Kolb, 1985), valuing others' styles, and educational activities.

As part of a much wider assessment of constructionist approaches implemented in secondary schools in teaching science in Australia, Hand, Treagust, & Vance (1997) revealed that students had mostly positive perceptions of cooperative learning. Students perceived that their presented ideas had value, were able to engage in more discussion, were involved in more practical work, took less notes, found science more fun, and had greater understanding of the material. Qualitative interviews also resulted in six assertions: 1) students are more mentally active in the learning process, 2) students perceived that they could offer ideas without worrying whether they were right or wrong, 3) students became more meta-cognitive with respect to the processes involved in the construction of science concepts, 4) students became more confident in the "correctness" of their constructions, 5) students became much more confident in their understanding of the science knowledge addressed within the classroom, and 6) students recognized that the locus of control in terms of learning had changed and were comfortable with the added responsibility.

Blignaut & Venter (1998) determined that students in South Africa enrolled in computer science, where 58% had English as a second language, perceived that they developed better communication skills, working in groups increased their understanding of the material, gained on a personal and social level, and that they learned more in a group than by working individually. Most students felt that they learned how teams work and how their contribution provided synergy to the task assigned.

The implementation of cooperative learning strategies requires that the attributional style, achievement history, and self-concept also be considered. Abrami et al. (1992) found that students who perceived themselves to be either incapable of learning, see effort as futile, or have negative self-image, sometimes labeled as learned-helplessness students, learned less in an unsuccessful cooperative learning group as compared to their being in a successful cooperative learning group.

Some students also may prefer to work on their own, especially if they are high achievers, when faced with the option of working with students who do not contribute equally to the group. This failing to contribute to group work is known as "free riding" or "social loafing" among social psychologists (Maranto & Gresham, 1998) to which many students object.

Kouros & Abrami (2006) using the Students' Attitudes Towards Group Environments (SAGE) questionnaire found that high school and junior college students had positive attitudes toward learning with fellow classmates. However, students wanted the freedom to select their group members, and group evaluation and division of task elicited diverse views. This information is critical for educators and small group researchers who are interested in knowing the underlying processes that influence academic achievement and success in cooperative groups.

Attitudinal and perception surveys conducted by Williamson & Rowe (2002) when chemistry lecture based instruction was replaced by cooperative group problem-solving sessions revealed no significant differences in content or achievement measures whereas course retention rates and student satisfaction increased. In this work, two sections of a junior-level quantitative analysis chemistry course, were studied; the treatment section wherein cooperative learning and group problem solving occurred, and the control section where traditional lectures on content, theory, and worked out problems were presented on the front classroom board. Students in the treatment section were presented with analytical problems, were expected to work out solutions, and then present their findings to the class. The class was encouraged to find flaws and patterns in the presenters reasoning. Interestingly, the researcher's found that the control group wished to have more active engagement; discussions, group work, etc., whereas a significant number of students in the treatment group (28%) wished to have at least some traditional lectures.

Although the research is quite clear as to the various benefits (attitudinal, social, academic, etc.) of cooperative learning strategies implemented in education, this instructional technique still remains much of an enigma within higher education. This is especially true in the Sciences where lecture-based instruction is the norm.

This study will consist of an effort to understand and explore why cooperative learning is not more greatly used by teachers, and for that matter, why students do not demand or request this learning environment. By surveying and questioning student and teacher attitudes as indicated in the Methodology section, some common ground for classroom implementation of cooperative strategies may be revealed.

CHAPTER TWO

METHODOLOGY

The purpose of this work was to study student perceptions of group work in an effort to understand either the reticence or enthusiasm for this particular pedagogical instructional strategy. In general, teachers have anecdotal information as to which aspects of small group learning elicit strong student attitudes. There is little research and data that thoroughly explore student attitudes, especially at the college level and in the science program. Therefore, the intent of the SAGE questionnaire was to reliably tap areas of small group learning that include student views and concerns, group dynamics theory, and existing classroom climate inventories and explore how attitudes are related to behavioral and learning outcomes. Finally, this study was designed to highlight problematic areas of small group learning which may lead to general recommendations being made.

This study employed two methodologies to determine student attitudes and perceptions to cooperative learning. The first method involved the use of a standardized and authenticated survey whereas the second method involved interviewing student participants. The former survey methodology prompted the participants to respond with respect to cooperative or group learning to questions concerning their self-image, their relationship to the group, their pre-existing attitudes, and their perceptions of the learning process. Interviews were used to both further explore the above perceptions as well as give an opportunity to the participant to express views, impressions, and attitudes that were not explicitly questioned in the survey. The interviews allowed participants to elaborate on teaching strategy, professor influence, and topic relevance to this instructional strategy.

The SAGE measure developed by Center for the Study of Learning and Performance (CSLP)[1] was quoted as being comprised of items generated from twelve existing classroom climate measures, such as, the Learning Environment Inventory (Fraser, Anderson, & Walberg, 1982); Classroom Environment Scale (Moos & Trickett, 1987); and Classroom Life Instrument (D. W. Johnson, Johnson, & Anderson, 1983).

The SAGE questionnaire consisted of 56 questions including attitude statements (e.g., When I work in a group I am able to share my ideas), perception issues (e.g., I feel working in groups is a waste of time), and background questions (e.g., gender). Students indicated their responses on a five-point Likert scale ranging from *strongly agree* to *strongly disagree* (see Appendix I).

Five students from the experimental class were interviewed as to their perceptions, attitudes, and feelings towards the group work activities. These students were selected based on gender, general academic performance, and enthusiasm to participate in the research effort. These volunteers were not compensated nor remunerated.

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[1] Established in 1988 and based at Concordia University, the CSLP is a research centre consisting of over 50 principal members, research collaborators and/or associates, 16 support staff, and over 40 graduate students. Researchers are from Concordia (Education, Psychology, Applied Linguistics), McGill, Université de Montréal, UQAM, Bishop's, Louisiana State, Johns Hopkins, and McMaster universities, and at Cégép Montmorency and Vanier and Dawson Colleges.

In order to triangulate results, the quantitative data from the survey questionnaires along with the qualitative data from the interview process was compared and contrasted.

1. RESEARCH HYPOTHESES

Cooperative learning strategies, which focus the student in an active and participatory method of group interaction for learning, does not necessarily mean that greater academic achievement, greater enthusiasm (or other attitudinal perceptions), or higher learning occurs. In an effort to understand how cooperative learning strategies can improve the learning process, the following student centered research hypotheses, based on expectations from previous research findings, performed at the college and university level, were formulated:

H1: Students will perceive that cooperative learning improves their understanding of chemistry or chemical methods and concepts. Students will also perceive that cooperative learning enhances their critical-thinking skills (i.e., recognition, formulation, analysis, and interpretation of chemistry or chemical problems, as well as their ability to apply knowledge to any chemistry or chemical problem). This first hypothesis was measured using the following survey questions:

1. When I work in a group, I do better quality work.
2. The material is easier to understand when I work with other students.
3. My group members help explain things that I do not understand.

4. My group members like to help me learn the material.

5. I also learn when I teach the material to my group members.

6. I learn more information, when I work with other students.

H2: Students will perceive that cooperative learning enhances communication of chemistry or chemical concepts and team-building skills. The second hypothesis, H2 was measured by the student sharing of opinions and ideas, as reflected in the following questions:

1. When I work in a group, I am able to share my ideas.

2. I find it hard to express my thoughts, when I work in a group.

3. When I work in a group, there are opportunities to express your opinions.

4. Everyone's ideas are needed if we are going to be successful.

H3: Students are likely to perceive the learning experience as positive, enjoyable, and sociable as a result of cooperative learning. This third hypothesis, H3, was reflected in the following questions:

1. I enjoy the material more when I work with other students.

2. I become friends with my group members.

3. My group members do not care about my feelings.

4. I get to know my group members well.

H4: Student perceptions concerning other student's perceptions of them, changed as a result of cooperative learning exposure. This self-perception was studied using the following questions:

1. My group members make me feel that I am not as smart as they are.
2. My group members do not care about my feelings.
3. My group members do not like me.
4. My group members do not respect my opinions.

This research measured student attitudes towards cooperative learning experiences or perceptions using a survey previously developed by the Center for the Study of Learning and Performance (CSLP). This survey was modified, with permission, both to reflect the Cégép experience as well as to increase question clarity and meaning.

2. PARTICIPANTS

There were three student participant groups in this study. These groups were identified as the "murray-control" group, the "murray-experimental" group, and the "tom" group. Each participant group was studied separately in that they are given separate SAGE questionnaire surveys. Only the murray-experimental group students participated in the interview process.

Students chosen for this study were enrolled in a second-term General Chemistry (202-NYA) class, the second chemistry course as pre-requisite course in the pre-university two-year College science program. Entry into this course required successful high school completion, a minimum of 70% in the prerequisite high school chemistry (Chemistry 534), as well as successful completion of the Chemistry of Solutions (202-NYB) course. This particular course was offered in the first term of second year (or the third term) as these students are considered off-profile or off-sequence, i.e. they were not expected to finish their collegial studies within the prescribed two year period. These students would have been off-profile for a number of reasons; they failed the first chemistry course (202-NYB) in the first term, and repeated this course (202-NYB) in the second term, or they failed this course (202-NYA) in term two and had to repeat in the current term three, or they did not have the pre-requisite course to enter the science program and had to complete a high-school equivalent course first. These students may also have elected to take a biology course instead of the second chemistry course in the second term thereby not following their cohort, although this route is generally rare.

The "murray-experimental" group consisted of thirty-one students and was exposed to cooperative learning activities in every class. Students were asked to form three to four person groups in the first class attended in the course. Most groups chose students who were in their immediate vicinity and not necessarily their friends. These groups remained unchanged for the duration of the term, mostly due to their effectiveness in controlling the activity along with no major complaints or objections arising to the group participants. Students who were left out of the group formation process were assigned to already established groups. This group met from 10:00-11:30 every Monday and Wednesday morning.

The "murray-control" group consisted of thirty-four students and served as a control group where no cooperative learning strategies were implemented.

Nonetheless, to avoid having the Hawthorne effect in the research test class, i.e. better performance or perceptions differently due to change alone and not attributed to any particular strategy, the control class format was also changed from a lecture format to one that was slightly more visual and discussion based. This class was given printed notes from which to follow each class and worksheets to perform follow-up study. This group met from 8:30-10:00 every Monday and Wednesday morning.

A third student group, “tom”, consisted of forty-one students and served as a second control group. This group/class was taught by another professor who used PowerPoint slide presentation with additional notes written on the blackboard (50/50). No printed notes were distributed prior to class however annotated PowerPoint slides with class notes were made available on-line after each class. This group met from 1:00-2:30 every Monday and Thursday afternoon. The intent of surveying this class was to determine if this “control” group had similar attitudes to the “murray-control” group, and if not, the professor effect due to the lead researcher implicated directly as professor may be eliminated or minimized.

Students ranged in age from 17 to 20+ years. The students were of various race (not studied), and were “regular” streamed as opposed to honors’ students. The students were not randomly selected but were chosen for convenience as the lead researcher had two sections of the same course. One section was designated for study with cooperative learning strategies and the second would serve as the control. Students in either class enrolled not knowing the instructional strategy that would be used. The classes consisted of approximately 50% female students and 50% male students.

This work was quasi-experimental because participating groups or classes were not completely randomized. Participants were chosen for convenience as they had already been registered in the courses due to their exit requirements for degree completion. In addition, these groups were taught at different times of the day, had different student profiles (due to their off-sequence nature), and may have had different skills, experiences, academic background and general chemistry preparedness.

3. PROCEDURE

Students were periodically exposed to a short lecture not exceeding fifteen minutes or presented with tabular or graphical data representing chemical or physical property changes for some variable or function, chemical postulates or theorems. Students then gathered into cooperative learning self-selected "teams" of three or four (see student selection preferences in Kouros & Abrami, 2006), where they were presented with both conceptual and/or algorithmic questions regarding what was just presented. The team all inputted into the final team report, activity sheet, or assignment with each team member needing to be well-versed in the solutions as they were called upon to represent the team if asked a question. The students were then presented with a conceptual problem in chemistry that intended to examine both students understanding of related past chemical concepts as well as questions investigating new content material just presented in the course. Conceptual questions were either chosen from various ConcepTest banks[2], selected from the Chemistry

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[2] www.jce.divched.org/JCEDLib/ QBank/collection/ConcepTests/ and/or http://galileo.harvard.edu/

course textbook[3] or developed in-house.

4. INSTRUMENT

The survey instrument, the Student Attitudes toward Group Environments (SAGE), developed by CLSP, although modified, was used for this study. All student groups received a description and explanation of the research effort and its importance in understanding student attitudes towards cooperative learning. Students were then asked to sign a coded/numbered consent form. Students were then asked to code their response sheet with the number code on the consent but not indicate their identity. Each name and survey questionnaire was thus only linked through an alphanumeric code so that the researcher did not know which questionnaire belonged to a particular student or teacher. The name and code key was securely stored separately. The reason for this two-fold system was to ensure confidentiality but not anonymity. If for any reason a particular respondent wished to have his/her survey removed from the study at some later date, this key code would allow this to occur. In addition, if a participant's answers were especially interesting, then the key code would allow for potential follow-up interviews where the identity of the respondent could be revealed, if allowed.

Survey completion required approximately thirty (30) minutes. Students were free to refuse or discontinue participation at any time as well as skip any questions with which they felt uncomfortable. All data collection was conducted in accordance

[3] Silberberg, M.S. (2006). The molecular nature of matter and change. 4th Ed. McGraw-Hill.

to ethical standards established by the Université de Sherbrooke's Master Teacher Program committee in conjunction with the John Abbott College Innovation Research & Development (IR&D) Committee.

The SAGE survey was administered in the Fall 2006 to students twice; prior to any chemistry classroom exposure to cooperative learning (pre cooperative learning) and then again at the end of term (post cooperative learning) to determine their attitudes, perceptions, and impressions of cooperative learning strategies and techniques that were employed in the classroom. The SAGE survey questionnaires remained unchanged for both pre and post data collection. Students were required to respond to the survey questions using the SCANTRON® data sheets. The main advantage to this technique was that the respondent data was tabulated automatically through a data retrieval system. A copy of the survey questions can be found in Appendix I.

Five (5) students were also interviewed concerning their perceptions and attitudes towards cooperative learning or group work before and after cooperative activities occur. The interview questions were semi-structured so that student responses could be compared and contrasted yet not be confined to strict question and answer criteria. These questions can be found in Appendix II.

The principal analytical tool for survey analysis was the SPSS® v.12 statistical software package. Fifty-nine (59) variables with one hundred and eighty-five (185) responses were studied in the SAGE survey analysis.

The data analysis consisted of significance testing (t-test and ANOVA), cross-tabulations, , and other descriptive measures (mean, median, standard deviation) to substantiate or refute the hypotheses tested in addition to gaining insight into the work.

Student perceptions within and between groups were contrasted and compared, and student's prior and post cooperative learning was compared to determine whether attitudinal changes to cooperative learning strategies had occurred.

Student's previous general high school averages, high school chemistry grades, and final 202-NYA course grades provided by John Abbott College from the MELS[4] in accordance with the consent form permission granted, were contrasted with cooperative learning perceptions and group equity composition. It is important to note the John Abbott College only allowed anonymous data to be distributed despite student consent for complete individual reporting. This anonymity did not allow this data to be coded to individual student survey responses and thus no direct data analysis could be conducted between individual prior academic performance and student perceptions.

Participant data was removed from the study if more than 20% of the survey questions remained unanswered, if it was obvious that the participant misunderstood the question, or if it was clear that there was inappropriate or unreliable responding.

Interviews were conducted by a professor from another department so that students would be at ease criticizing the cooperative learning approach, the lead researcher teaching style, or any other aspect of the class experience. These interviews were taped and only given to the lead researcher once final grades had been submitted. It would also be extremely unlikely that the lead researcher would encounter the interviewee again since this course was the final general chemistry in the science program. This process ensured that the student's final grade would not be biased or compromised by their interview comments in case their voice revealed their identity. Voice recognition software, Dragon Naturally Speaking Preferred Version 9® Voice and Speech Recognition, was used to convert any verbal interview comments to transcribed digital text. This qualitative data was then entered and coded into the HyperResearch® statistical software package for data analysis.

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[4] Ministère de l'Education, du Sport, et du Loisirs

CHAPTER THREE

DATA ANALYSIS AND DISCUSSION

To determine whether the three group/classes studied were equivalent in terms of incoming academic abilities, two student high school performance measures were compared and contrasted: high school overall average and high school Chemistry 534. In addition, the student's final 202-NYA average grade for the three study classes was also examined for differences. The distribution of grade averages is shown with the high school average, the top curve, the high school Chemistry 534 the middle curve, and the final NYA grade the bottom curve.

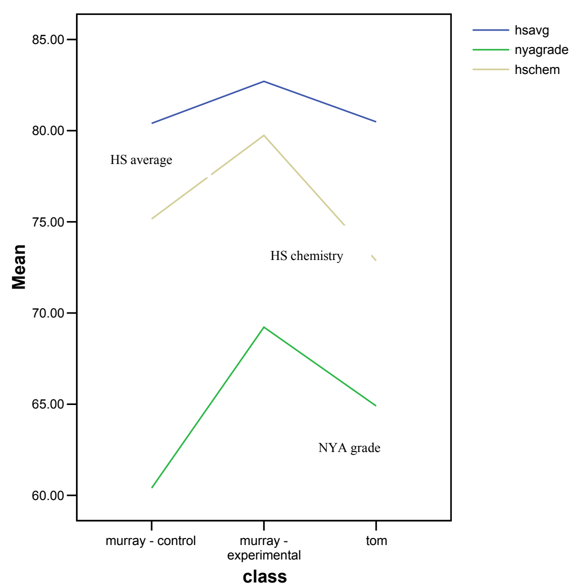

Figure 1: Distribution of Grade Averages

There was no significant difference between incoming high school averages between the three groups or any significant difference between the incoming high school Chemistry 534 pre-requisite averages for the murray-control and murray-experimental groups. However, there was a significant difference (sig.=0.006) between the tom and murray-experimental group for high school Chemistry 534 pre-requisite; 80% for experimental versus. 71% for tom. Thus it was difficult to compare the experimental group to the "tom" group since the experimental group's prior performance in high school Chemistry was so much stronger than the external control (tom) group. Nonetheless, even within these two groups, the general high school averages were not significantly different and thus one could argue that due to their overall academic performance, these two groups were not very different at all.

To ensure that all study groups generally had the same general incoming attitudes and perceptions, the three classes were surveyed during the first week of class prior to the research commencement. Thus, the pre-test results of the three classes were analyzed to determine if there were significant differences in their attitudes. There were no significant differences in attitudes between the "tom" group and either the murray-experimental or the murray-control groups. Of the fifty-six (56) perception or attitudinal questions, significant differences were observed only for the following attitudes/perceptions between the murray-experimental and the murray-control:

1. I become friends with my group members (control agreed more).
2. I do not think a group grade is fair (experimental agreed more).
3. I let other students do most of the work (control agreed more).

4. My marks improve when I work with other students (control agreed more).

It is important to note that all students may have been exposed to cooperative learning activities and environments while in high school or even while in other courses in Cégép (Humanities, English, physical education, or science) before the term began. These students may already have well developed and entrenched opinions on group work based on prior experiences. Or, the students, knowing to which group they belonged before the survey began (an error that will not be repeated in future work) may have been trying to send a subtle message that they want to be treated fairly. For example, the experimental group may have wanted it known that they want to be evaluated individually and that they felt a group grade would be unfair (#2).

For the external control group, "tom", there were no significant differences between the pre and post surveyed group in any of the attitudes or perceptions queried. This was not unusual since no instructional strategy involving cooperative learning activities was instituted in this control class. However, there were three cases (5%) of significant differences or changes in the attitude or perception when the pre and post survey results were analyzed for the murray-control group. This group did not experience any major or consistent cooperative learning activities within the course and thus few measurable changes in attitudes or perceptions occurred. Nonetheless, significant changes occurred in three cases where more agreement was observed.

1. I have to work with students who are not as smart as I am.
2. My work is better organized when I'm in a group.
3. Some group members forget to do the work.

These changes in attitude may have occurred as a result of external exposure to group work from the few cooperative learning activities that were done in this class like class discussions, or from some other external factor.

It is not surprising that the analysis of the pre and post responses of both the murray-control and the tom classes, where no or little cooperative learning occurred, revealed little significant changes in attitudes. In addition, the fact that in general both groups responded similarly revealed that the lead researcher had little effect in biasing the student responses. This result also indicated that the students' attitudes changed little over the course of the term by being exposed to group activities in the College as a whole, if in fact they had occurred.

When the post murray-control and the murray-experimental groups were compared, significant differences were observed in most of the attitude or perception queries (about 90%). In general, there was more agreement in the experimental group except in cases where the question was posed in the negative, and then there was stronger disagreement. Examples of both cases are listed below:

1. When I work in a group, I do better quality work (more agreement in the post group).
2. The material is easier to understand, when I work with other students (more agreement in the post group).
3. I like to help my group members learn the material (more agreement in the post group).
4. My group members do not respect my opinions (stronger disagreement in the post group).

5. I get to know my group members well (more agreement in the post group).
6. When I work with other students, we spend too much time talking about other things (stronger disagreement in the post group).

These responses generally changed the students' more negative attitude towards cooperative learning to one that was more favorable. Examples where no significant differences were observed for the following attitudes/perceptions are listed below:

1. When I work in a group, I want to be with my friends (most agreed).
2. The work takes longer to complete when I work with other people (most disagreed).
3. I let other students do most of the work (most strongly disagreed).
4. When I work in a group, I am able to share my ideas (most agreed).
5. My group members make me feel as though I am not as smart as them (most disagreed).
6. I find it hard to express my ideas when I'm in a group (most disagreed).
7. I do not care if my group members get good grades (most disagreed).
8. When I work in a group, I get the grade I deserve (slightly disagreed or neutral).
9. It takes less time to complete the assignment when I work in a group (most agreed).

Some of the above perceptions were independent of the group learning instructional strategy, e.g. wanting to be with friends (#1), or admitting to freeloading (#3) which actually may have occurred in a non-cooperative learning environment. Items #2 and #9 and items #4 and #6 were really the same questions stated different ways. These and others like these were used to ensure the reliability of responses by the respondent.

1. HYPOTHESES ANALYSES

Each of the research hypotheses posed earlier is discussed in the following sections with consideration of the quantitative results obtained from the surveys distributed as well as with respect to comments made during the interview process. Although more than one person may have expressed similar attitudes during the interview, only the most relevant and most eloquent were selected for inclusion in this work. Student comments are indented and indicated in quotation marks.

Students perceived that cooperative learning improved their understanding of chemistry or chemical methods and concepts (H1). Their perceptions shifted from somewhat disagreeing with comprehension ease within a group, to very positive perceptions (see Figure 2 below). This shift was partly due to the students being able to access immediate aid from group members. Students also perceived that cooperative learning enhanced their critical-thinking skills (i.e., recognition, formulation, analysis, and interpretation of chemistry or chemical problems), as well as their ability to apply knowledge to any chemistry or chemical problem.

One student commented:

> “what happens again for chemistry versus physics, which onto a certain number of problems in class, because the teacher has just so much time in class, but in chemistry, depending on how fast you are answering the questions, you can go on to more complicated ones right away. And then if you don't understand or get

stuck you could ask the teacher or ask your group members."

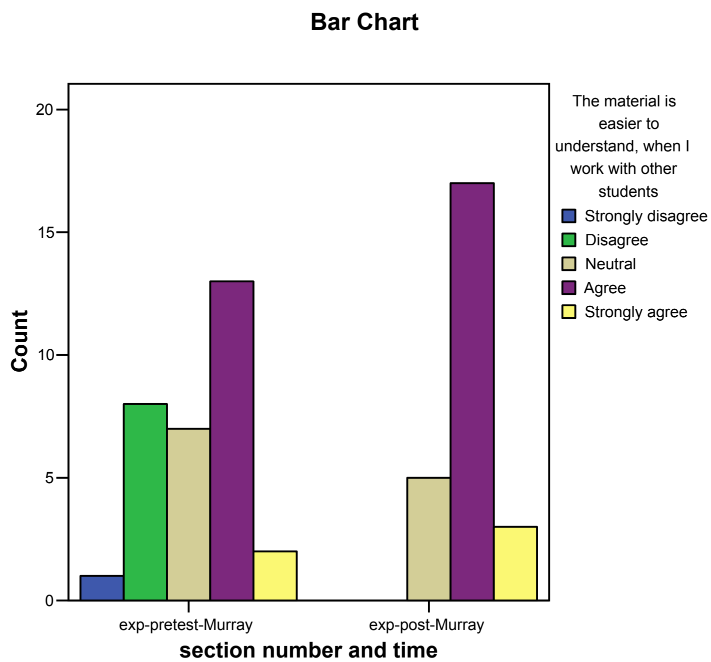

Figure 2: Ease of Understanding

Students also found that cooperative learning helped them learn more material/content, and enabled them to perform higher quality work. Initial perceptions were that the group experience may hinder progress and reduce the quality of the work required, reflected in somewhat negative perceptions of group work quality in Figure 3. However, in practice, peer instruction within their group enabled group members to correct, modify, or refine answers to assigned exercises. Group members were then able to advance to subsequent exercises that demanded greater conceptual or algorithmic solutions. Perceptions thus shifted to a much more positive attitude towards group involvement.

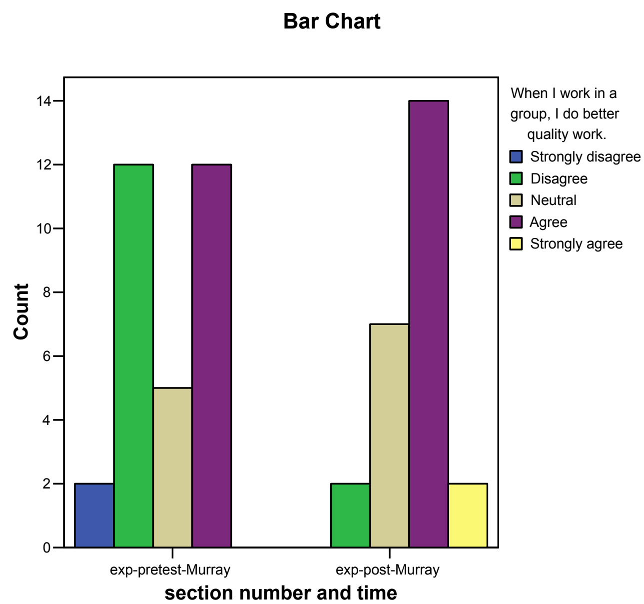

Figure 3: Work Quality

One student commented that because of the more interactive style of cooperative learning, more content can be absorbed during a lecture period, and this perception is also reflected in Figure 4 below. This absorption of information also results in greater understanding of the material.

> "I find I remember it more in chemistry, than I have a physics class, where it's just a lecture class I find I understand chemistry more."

Nearly 30% initially believed that cooperative learning would be impeded when working in a group, however, after the experience, none (0%) maintained the same perception.

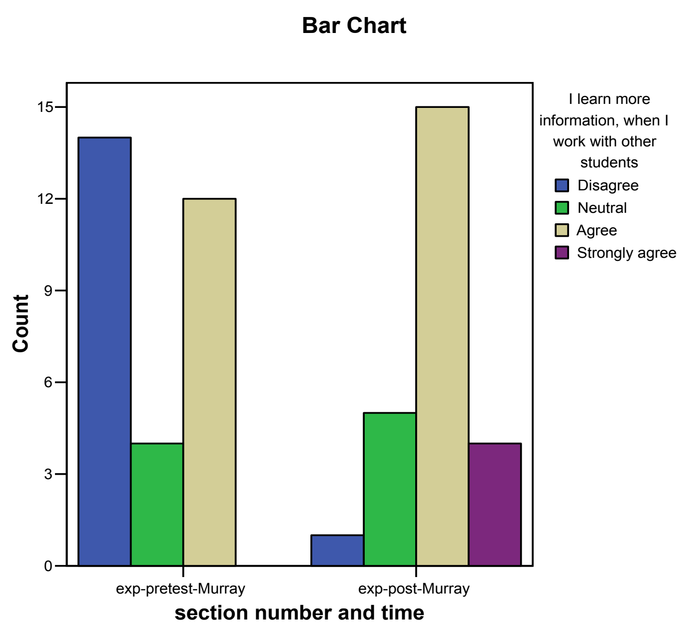

Figure 4: Information Improvement

Students indicated how talking about the course content and sharing ideas enabled them to improve their understanding of the concepts being addressed. Part of this learning improvement relies on the teacher being available to correct misconceptions, lead group members towards a correct response, or to ultimately explain the concept being tested.

> "It's clearer I think, because you get a glimpse of what you're supposed to understand even if in most of the time, I don't understand, but then, we talk about it and we sit there and reflect and see how this question works and then the teacher helps us and asks questions. He tries to understand our responses and he corrects it and everything is clear after."

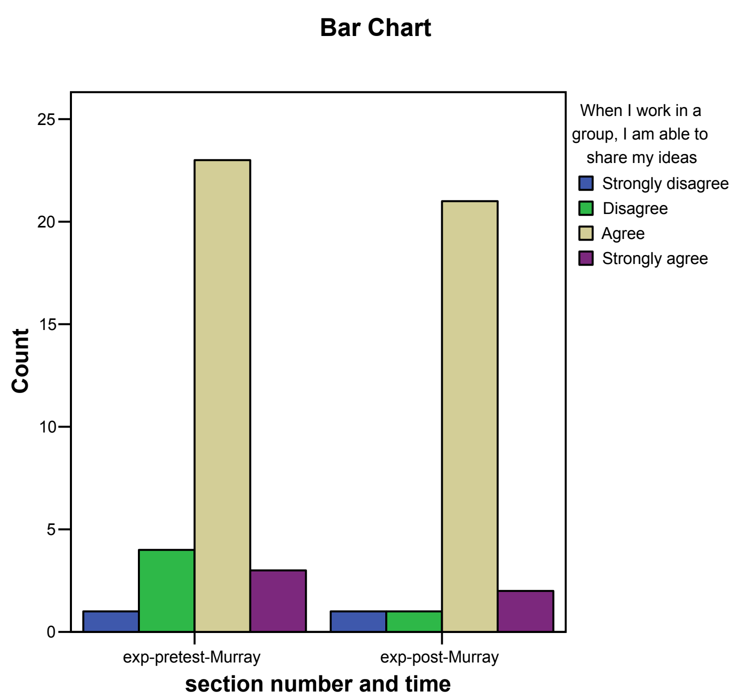

Figure 5: Idea Sharing

Perceptions of communication effectiveness as a result of cooperative learning or group activities, H2, were not always consistent. For example, when asked if cooperative learning enhanced the sharing of ideas, no significant difference in opinion was obvious (see Figure 5). This was an unusual result as students were encouraged to express themselves, and work cooperatively to solve either conceptual or algorithmic problems. However, when asked if there were opportunities to express opinions, which is essentially the same question with minor nuances, there was a definite shift in perception to one which was more positive (see Figure 6).

> "When in group work, I talk the ideas around and I'm more comfortable asking questions"

Initially, students were not as convinced that they could share their ideas or views, as they felt they may be overpowered by more vocal participants, or that they would be too intimidated to express their views effectively. However, this perception shifted to a more positive attitude by the end of the cooperative learning experiment.

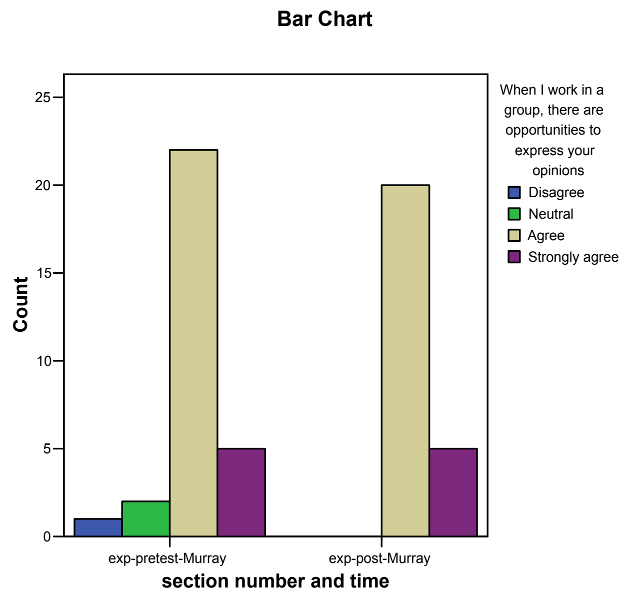

Figure 6: Expressing Opinions

A closer examination of the responses that resulted in significant differences between pre and post queries in the murray-experimental group revealed a shift from a more negative perception to one which is more positive (H3). For example, before experiencing cooperative learning activities in this class, 45% of respondents disagreed (61% including neutral responses) with the statement “when I work in a group, I do better quality work”, thus believing that the quality of the work would suffer if performed in a group environment. No students strongly agreed with the statement. When students were re-questioned concerning their attitude after experiencing group work, only 6.5% of the respondents still believed that they were somehow dragged down by the group.

Similarly, student's attitudes and perceptions fundamentally changed to believing that cooperative learning strategies improve their grades (Figure 7). This result may be due to the fact that the murray-experimental class performed relatively well on class quizzes and class tests. Once must remember that a significant portion of the class had experienced failure in previous Chemistry courses so that relative success in this course may have been attributed to this instructional strategy, and not some other factor such as previous exposure, better study skills, more focus, etc.

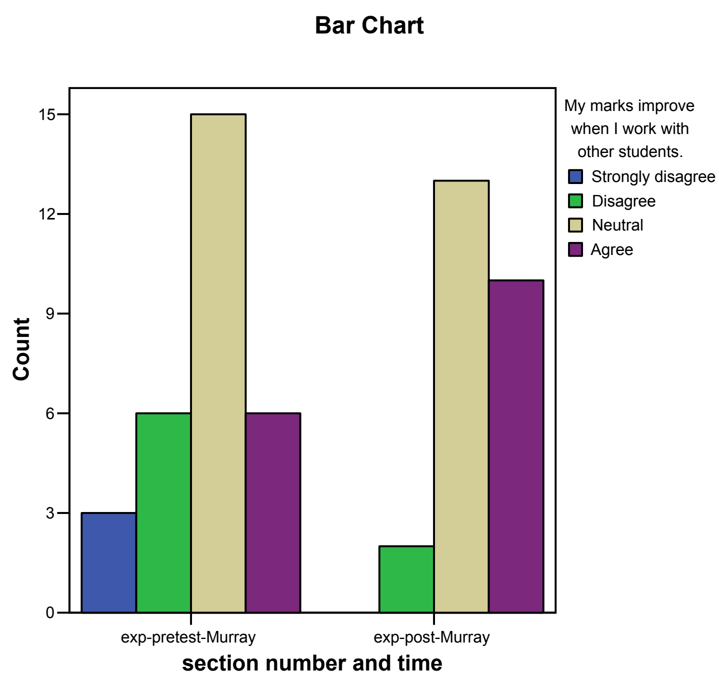

Figure 7: Mark Improvement

Student attitudes shifted to increased enjoyment of learning once they were exposed to a cooperative learning environment. Figure 8 shows a shift in attitude from 32% believing the experience would be negative, to 3% still maintaining that view after the experience. Most of the students interviewed mentioned, on numerous occasions, how they enjoyed the cooperative learning experience.

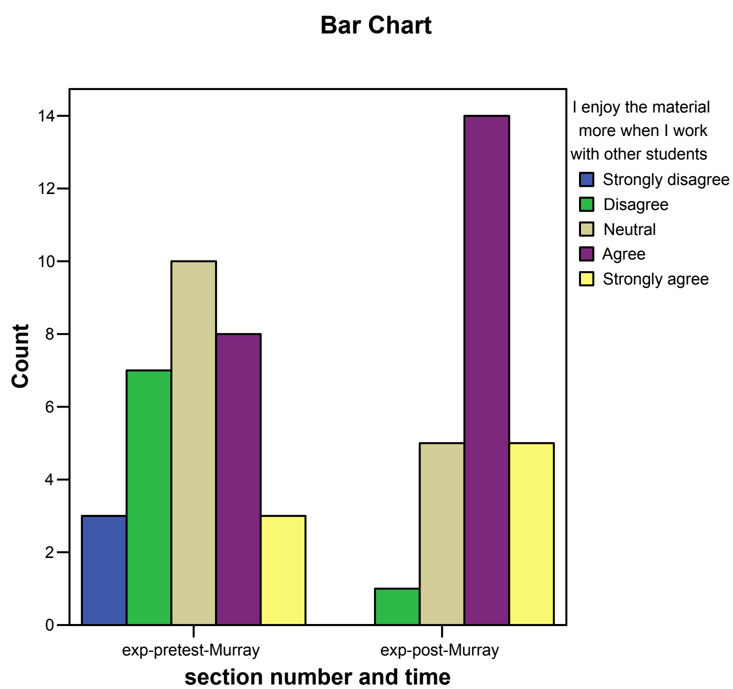

Figure 8: Course Content Enjoyment

One student commented:

"Did you enjoy the class experience? Yes I did.

> So if you're finding it interesting and good, what was the most enjoyable part? Of this type of learning that is. Is there a particular part you enjoyed more than others?
>
> Well, it's fun I have to say.
>
> Yes, compared to last semester, the class I dropped it. It's not even a simple class; I can't really even compare it. It's so different.
> I think it's nice because when you have the group activities, you could sit down and try the problems and try to understand it first and then go back and explain it so it's nice to kind of think about it instead of just throwing information at you and you don't have any thinking time. So that's what I like about it.
>
> Cooperative learning, I like it.
>
> I do look forward to the class, and it's not like…I don't dread the class. I don't and will not consider skipping it unless I have to. I need a really good reason. Yes I do enjoy the class. It doesn't bother me to go to it.
>
> In terms of chemistry right now in Murray's class. My mark is as good as it's ever been in chemistry, and for some reason it's really working for me and I really enjoyed it."

Students also seem to enjoy the teaching or explaining aspect of cooperative learning where they are asked to help their peers understand the material (Figure 9).

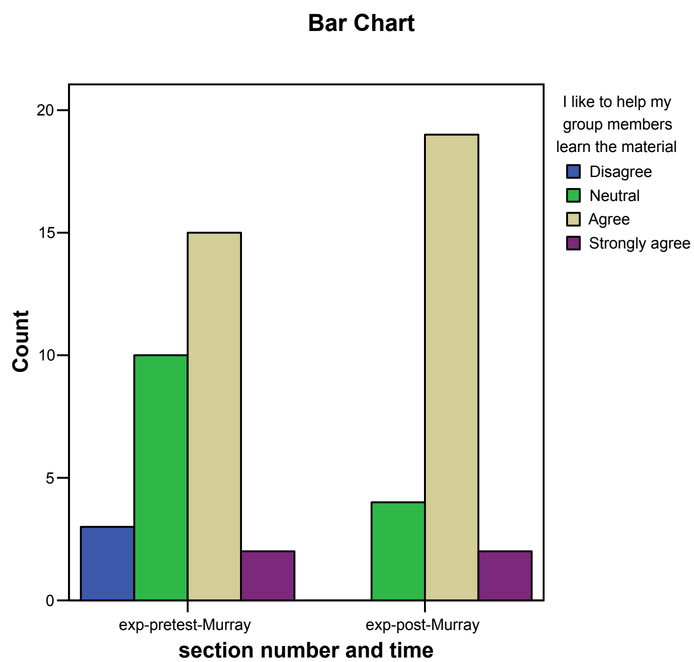

Figure 9: Helping Peers

Students also found that cooperative learning or group activities enabled them to be more engaged with the material, more alert in class, and interact in such a way that the material became more meaningful (Figure 10). Student engagement was reflected on positive attitudes related to teaching the material to peers, expressing ideas and opinions, and contributing to the group effort. This engagement also allowed students to be conscious of the tasks and of the content to be learned.

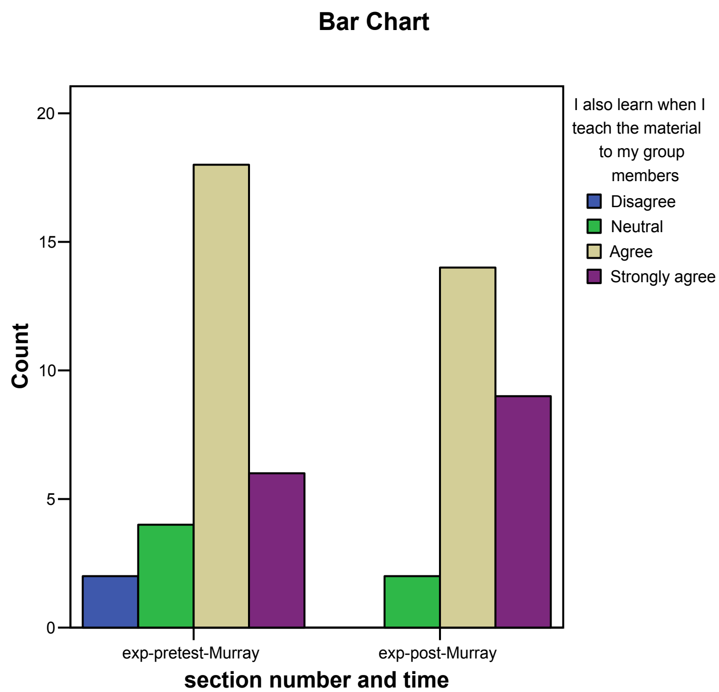

Figure 10: Peer Learning

One student expressed the following view when asked about how the interactive or engagement aspect of cooperative learning influenced his learning:

> "Yes I do. It's relaxing, and I'm taking biology and physics right now and I'm not engaged. I fall asleep a lot in biology at my 8:30 class, and I'm always sleeping. In Chemistry there are no worries. When I show up, I know I'm a little bit tired that day, but I do stay awake because I'm learning with my friends because it's a lot more interactive. Yes, it keeps me involved.

As I said, it's nice to get a feel for the problems and try to figure them out for yourself. He gives you that chance before he gives you the answers, to try to get answers by yourself. And then when you get the right answer, you can put your hand up later. It's a good thing to try to think and to reason by yourself instead of just reading a book and getting an answer without any thought. You kind of get that understanding what's going on, kind of get the background of the course in which you can study to what you actually know. Or what caused this and stuff."

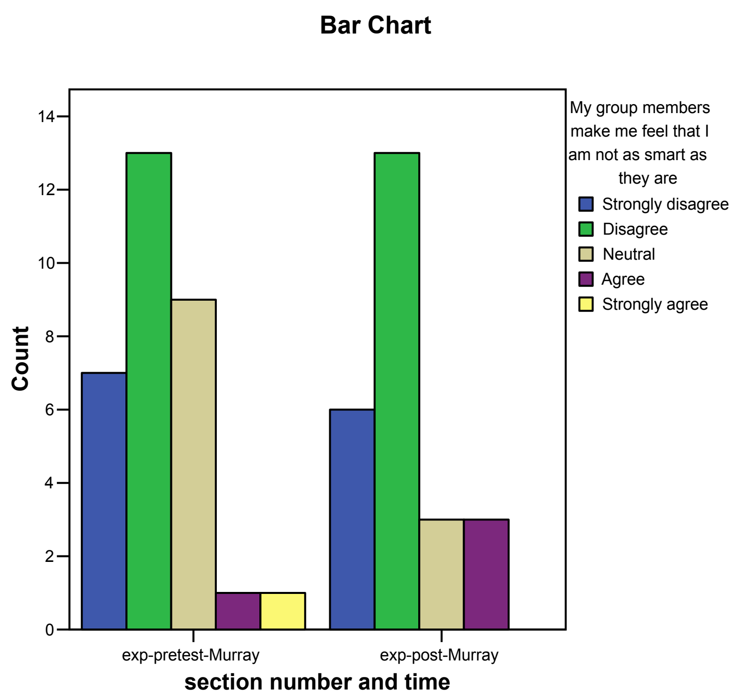

Figure 10: Intelligence Perception

Students' perceptions on how their peers perceive their contribution (H4) also shifted towards a more positive attitude in part possibly due to the non-competitive nature of the structured activities and the individual group composition. In the pre-cooperative learning experience, 64% of the students disagreed with the statement "My group members make me feel that I am not as smart as they are", while 76% after the experience (see Figure 10).

In addition, 63.4% of the student's disagreed when asked to respond to "My group members do not care about my feelings" in the pre-cooperative learning group; this percentage increased to 84.0% after the cooperative learning experience indicating a positive shift in self-perception.

2. ACADEMIC PERFORMANCE

Although no statistical differences existed between the control and experimental classes with respect to incoming general High School average (sig=0.281) and incoming High School chemistry (sig=0.102), a 10.5% increase in final exam grade (53.7 versus 64.2%) and a 7.4% increase in the final course mark (60.3 versus 67.7%) was observed. The final exam is team graded to ensure equity between sections and eliminate bias and the differences between the two classes is indicative of the effectiveness of cooperative learning as an instructional strategy. Nonetheless no statistical differences were observed between the control and experimental classes with respect to either the final exam mark or the final course mark (sig=0.080), although a larger sample size may have resulted in significant differences.

3. ERRORS AND LIMITATIONS

One major limitation to this work involved the definition of cooperative learning or group work. Students had varying understanding of this term, and thus a more open and vague definition was used in order to encompass all understanding: an instructional strategy in which students work actively and purposefully together in small groups to enhance both their own and their teammates' learning.

Another limitation of this research was the adequacy of the achievement data. The achievement data used in this study included the student final grades in their high school chemistry (534), high school average, and final 202-NYB final exam grade. Psychometric properties of the achievement data were not known, since the laboratory tests, unit tests and assignments had been teacher made and various teachers not only had different marking schemes but different marking criteria. No standardized achievement test was used to eliminate teacher bias, although two control groups involving different teachers served to minimize this bias.

There may have been inherent errors, both response set and faking, which may have occurred as a result of this survey. Response set errors included the participants always answering the same way (e.g. circling the “Strongly Agree” selection) despite the question in order to facilitate survey completion. A second error may have occurred by participants answering a certain way because it was what was desirable by their peers (social desirability). In addition, participants may have sensed the researcher’s personal bias to the questions posed, and selected responses in order to please the teacher (faking error).

The major shortcomings in this study were the small sample size and limited responses. A larger sample size would not only have been more representative of the student population but may have also allowed for greater significance testing for cross tabulations.

CHAPTER FOUR

CONCLUSIONS

An analysis of class academic equity revealed that all three classes studied, murray-experimental, murray-control, and tom, were equivalent in terms of incoming student abilities. Student perceptions in the two control groups, murray-control, and tom, showed little significant differences in perceptions, indicating that the lead researcher influence was minimal.

The SAGE survey enabled the researcher to quantitatively determine shifts in student attitudes and perceptions of cooperative learning instructional strategies. The pre and post murray-experimental group results revealed significant differences measured in all the survey perception queries, all with more agreement in the post group, and all reflecting a trend towards more positive attitudes with respect to cooperative or group learning. Each of the hypotheses tested demonstrated more positive attitudes towards cooperative learning.

The qualitative analysis of the five student interviews conducted for the murray-experimental class revealed that student's felt that cooperative learning activities were an effective and efficient method of learning course material. Students perceived that they were more engaged with the material, remembered the material better and longer, required less time for independent study, and were better prepared for tests and exams. Students also enjoyed the social aspect of the group environment in that they were able to communicate ideas and opinions, help explain difficult or confusing concepts to peers, and aid non-active or shy students in their integration in the course.

The SAGE questionnaire has several potential uses as: (a) a diagnostic measure to help identify areas in which students have strong positive and negative attitudes; (b) a guide for implementing small group learning strategies effectively; (c) a pre-post attitude measure in which attitude change can be measured; (d) an evaluation tool to assess the effectiveness of the cooperative approach; and (e) a predictive measure in which academic and behavioural outcomes can be identified.

The interview questions enabled the researcher to more fully explore students' attitudes towards cooperative learning whether they were with prior experience, group mechanics and/or dynamics, or determining deeper or more meaningful expression of student perceptions. For example, many students refined their views of the "enjoyment" survey question. Rather than defining "enjoyment" as having fun, many students indicated that the enjoyment aspect was closely associated with peer inclusion and peer respect. Some students also expressed reservations concerning the cooperative learning model: too much peer interaction and teaching, increased self-reliance and self-motivation required, distracting off-task activities by group members, etc. Nonetheless, despite many of these detracting activities, all student interviewees felt that the cooperative learning model should be more rigorously and more consistently applied in Science classrooms.

The interview questions also allowed the researcher to delve into how group dynamics encourage students to learn the course content more effectively. Student interviewees commented on how their increased engagement both with the material and within a non-threatening group environment enabled them to reflect on their learning and understanding, explore issues and problems more fully with peers, and resolve outstanding concerns and confusion.

Future work will explore more fully student attitudes towards cooperative learning with respect to academic performance, attitudes within complex or inequitable group arrangements, and perceptions regarding outside classroom group assignments. Additional research will be conducted on science teacher attitudes towards cooperative learning, and some effort will be made in correlating teacher and student attitudes. Future work will also include multiple regression analysis to determine predominant factors in cooperative learning approaches to student perceptions.

APPENDIX I

SAGE: STUDENT ATTITUDES TOWARD GROUP ENVIRONMENTS

SAGE: Student Attitudes toward Group Environments

This questionnaire is part of a study being conducted by Murray Bronet in the pursuit of a Master's degree in Education. This questionnaire was developed by the Centre for the Study of Learning and Performance at Concordia University in Montreal, Québec, Canada. The purpose of this study is to assess student attitudes toward small group learning. I want to find out how you think, feel and behave when working with other students to learn.

The results from this research will be used to predict how student attitudes toward small group work influence student learning and motivation. Also, I expect information from this study will help teachers make small group learning a more productive and enjoyable experience.

Please be informed:

- This is **not a test**; there are no right or wrong answers.

- Your answers will be kept **confidential**.

- Your teacher will not see your individual responses to any of the questions.

- Your answers will **not affect your grades** in any way.

- You are free to discontinue at any time.

Please answer the items as honestly as possible. Your cooperation in completing this questionnaire is greatly appreciated. Thank you for your support.

Directions:

This questionnaire asks about your attitudes toward small group learning in this classroom.

Use your experiences from this class to answer these statements.

Instructions:

1. Please use an **HB** pencil.

2. Place your answers directly on this questionnaire.

3. Fill in only one answer per question (i.e., do not circle two answers).

4. Do not leave answers blank (if you are uncertain make your best guess).

5. If you change your answer, make sure that you erase your previous answer completely.

Whenever there is a statement about group members, other students, etc., think of the students who have been in your group *in this class.* If you have been in several groups in this class, base your answers on the group that you *were in most recently.*

For each of the statements, circle the answer that most closely corresponds to how you think and feel about the statement.

Response Scale:

a) Strongly Disagree

b) Disagree

c) Undecided

d) Agree

e) Strongly Agree

If you *strongly disagree* with the statement, circle **a**; if you *disagree* with the statement, circle **b**; if you *can not decide*, or feel in between, choose **c**; if you *agree* with the statement, circle **d;** and if you *strongly agree* with the statement, circle **e**.

1. When I work in a group, I do better quality work.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

2. When I work in a group, I end up doing most of the work.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

3.When I work with other students, I am able to work at my own pace.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

4. When I work in a group, I want to be with my friends.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

5. The work takes longer to complete when I work with other students.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

6. My group members do not respect my opinions.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

7. I enjoy the material more when I work with other students.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

8. My group members help explain things that I do not understand.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

9. I become friends with my group members.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

10. When I work in a group, I am able to share my ideas.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

11. My group members make me feel that I am not as smart as they are.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

12. The material is easier to understand, when I work with other students.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

13. My work is better organized, when I am in a group.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

14. My group members like to help me learn the material.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

15. My group members get a good grade even if they do not do much work.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

16. The workload is usually less when I work with other students.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

17. I feel I am part of what is going on in the group.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

18. One student usually makes the decisions in the group.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

19. Our job is not done until everyone has finished the assignment.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

20. I find it hard to express my thoughts, when I work in a group.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

21. I do not think a group grade is fair.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

22. I try to make sure my group members learn the material.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

23. My grade depends on how much we all learn.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

24. It is difficult to get together outside of class.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

25. I learn to work with students who are different from me.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

26. My group members do not care about my feelings.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

27. I do not like the students I am assigned to work with.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

28. I let the other students do most of the work.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

29. I get to know my group members well.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

30. I feel working in groups is a waste of time.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

31. When I work in a group, I get the grade I deserve.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

32. My group members do not like me.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

33. I have to work with students who are not as smart as I am.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

34. When I work in a group, there are opportunities to express your opinions.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

35. When I work with other students, the work is divided equally.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

36. We can not complete the assignment unless everyone contributes.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

37. My marks improve when I work with other students.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

38. I help my group members with what I am good at.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

39.My group members compete to see who does better work.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

40. The material is more interesting when I work with other students.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

41. When I work in a group, my work habits improve.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

42. I like to help my group members learn the material.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

43. Some group members forget to do the work.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

44. I do not care if my group members get good grades.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

45. It is important to me that my group gets the work done on time.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

46. I am forced to work with students I do not like.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

47. I learn more information, when I work with other students.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

48. It takes less time to complete the assignment, when I work with others.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

49. I also learn when I teach the material to my group members.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

50. I become frustrated when my group members do not understand the material.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

51. When I work in a group, I get the grade I deserve.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

52. Everyone's ideas are needed if we are going to be successful.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

53. When I work with other students, we spend too much time talking about other things.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

54. I prefer to choose the students I work with.

a) Strongly Disagree **b)** Disagree **c)** Undecided **d)** Agree **e)** Strongly Agree

55. Your sex.

a) Male

b) Female

56. Subject you learn in this class.

a) Languages (English, French, etc.)

b) Mathematics and Science

c) Social Studies (History, Geography, etc.)

APPENDIX II

STUDENT INTERVIEW QUESTIONS

Sample Student Interview Questions

Can you describe in your words, what cooperative learning is?

Can you recall ever doing this or something similar to this in high school or elsewhere in the College in your programs?

Did you enjoy that class experience? Remember what detail or aspect you like the most?

Do you find any negative aspects to cooperative learning?

Do you feel you learn more or less with this form of cooperative learning?

Do you feel you understood the things you were learning better?

If you prefer peer teaching over instructor teaching, especially based on the lecture model, could you describe how you reached these conclusions?

What do you think about the social aspect involved when you're working in a group?

Do you find it sometimes distracting or difficult to focus because someone in the group may want to go off-topic or be unfocused?

Did you choose your group, or did the teacher choose them for you? Who made the group up?

Do you think anyone including yourself is getting a free ride? Students performing less work by doing cooperative learning activities?

Has it ever happened that you had to engage students more to get involved? That they didn't seem to be totally involved at enough that they didn't see that they were getting a free ride on the other hand, if you had to encourage them to participate more?

If you yourself were shy person, do you think this learning technique would be better, more beneficial to you if you were shy?

Do you think cooperative learning work in the classroom prepared you for the quiz, assignments and the tests in this course?

Do you think you better remember the material?

Try to think of the differences between a traditional lecture class and a cooperative learning course. Was this an efficient way of learning the material?

Do you think corporate learning deepened your understanding of the material? This deepening would enable you to tackle more complex and more conceptual problems that might not have been covered in detail in class?

Do you think you had to spend more time on independent study as a result of cooperative learning in class?

Do you think every class should follow the cooperative learning model?

Which topics of the ones seen in class, like atomic theory, periodicity, Ionic bonding etc. do you think would be useful to work with projects?

If you had a choice and you let to make you could make the decision, what would you prefer thinking of this class would you prefer, a class that was 100% cooperative learning style 50-50 or any other combination?

In your opinion do you think others generally like cooperative learning? Or do you think you like it more than them? Do you know the average thoughts of the class on this topic?

APPENDIX III

STUDENT CONSENT FORM

Student Attitudes Towards Cooperative Learning

Note that all data collected for the purpose of this research will be kept in the strictest confidence and all identifying material will be removed before any results are made public.

Section A

I ____(print name) give permission for the data gathered in this survey to be used for the purpose of conducting research into the factors affecting the perception and attitudes of cooperative learning strategies. I understand that complete confidentiality will be maintained throughout the process of the research and afterwards.

______________________________ (signature) ____________________ (date)

Section B

I ____(print name) give permission for John Abbott College to provide the researcher (Murray Bronet) with the available MEQ and John Abbott College background statistics and marks requested in order to complete the research into factors affecting the perception and attitudes of cooperative learning strategies.. I understand that complete confidentiality will be maintained throughout the process of the research and afterwards.

______________________________ (signature) ____________________ (date)

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