

Collaboration using Social Networks for Team Projects

Kendall E. Nygard, Lisa Bender, Gursimran Walia,
Jun Kong, Kanwal Gagneja
Department of Computer Science
North Dakota State University
Fargo, USA
{kendall.nygard, lisa.bender, gursimran.walia, jun.kong,
kanwalinder.gagneja}@ndsu.edu

Marvin LeNoue
American English Institute
University of Oregon
Eugene, USA
mnlenu@uoregon.edu

Abstract—The study concerns thirty-one teams who carried out term projects in a Social Implications of Computers course. The work of each team required social and ethical analyses that pertain to a computing or internet related topic. Some of the teams utilized the Ning social networking tool as the primary communication and collaboration vehicle and others used more conventional means. The degree of diversity among team members was measured using survey methods and controlled in forming the teams to establish a quasi-experimental design. Statistical analyses support the hypothesis that the Ning system was helpful in elevating the performance of teams with high diversity.

Keywords—social networking; team projects; diversity

I. INTRODUCTION

Team projects are highly valued components of many courses within most university programs. It is well understood that team projects help individuals to develop soft skills that will be critical in the workplace, such as respectfully and professionally listening, contributing, writing, presenting, brainstorming, discussing, and assisting others. In addition, learning important concepts and perspectives in a topic area new to them is facilitated through working in teams. At North Dakota State University (NDSU), we have introduced team projects into a course entitled Social Implications of Computers. Unlike team projects in a capstone or other computer science course, these projects involve deep exploration of social and ethical issues in a chosen topic area as well as detailed analyses of the ramifications of alternative action choices. Working on team projects of this type is a new experience for most of the students and the maturity of their thinking skills is advanced in important ways.

Social networking systems (SNS), such as Facebook, are wildly popular in today's world. This popularity and the availability of many interaction features in SNS suggest that they could offer new and powerful possibilities for technology-enhanced education. Our study specifically examines the potential for a social media platform called Ning to provide helpful mechanisms for student teams to employ for communicating, cooperating, and collaborating while carrying out a major course project

The members of project teams can vary widely in terms of dimensions such as age, gender, cultural background, intelligence level, motivation, and experience in the working world. Highly diverse teams face special problems in conducting their projects. More specifically, heterogeneity heightens the potential for teams to face difficulties in establishing a leadership structure, mutual respect, open discussion, motivation, and generally getting best efforts from all of the participants. Our study compared the effects of heterogeneous teams with social networking support against the homogeneous teams without social networking support.

The remainder of this paper is organized as follows: Section II provides a general background of social networks in education and discusses problems faced by team members in their class projects. Section III details the design of the experiments that were conducted to investigate the usefulness of social networking systems as a collaboration method for performing the project activities. Section IV presents an analysis of the results from the experiment. Section V gives a summary and the conclusions.

II. BACKGROUND

In the Computer Science and Management Information System programs at NDSU, the course Social Implications of Computers is required for senior level students. A course of this type is often taught within programs that are nationally accredited by the Accreditation Board for Engineering and Technology (ABET). A major team project that develops and examines multiple viewpoints of an ethical issue in computing or the internet is required in the Social Implications course. The project has four deliverables. Because such projects have a long history of being required in the course, guidelines for teams to follow and the grading rubrics for each deliverable are detailed and well-developed. There are typically three people on a team. In many cases, the students on a team do not know each other personally prior to the course, yet they are expected to join forces and work effectively as a team on the course project.

A. Course Projects

Many degree programs in computing education require a substantial development project in which the students work in teams and are fully involved in the analysis, design, and

development of a software product. Typically called capstone projects, there is often sponsorship by a company that provides in-kind mentoring, commitments and support. Capstone projects tend to focus on following the formalisms of project management that have evolved over time. These formalisms include such things as guidelines for developing a charter, building a schedule, managing change, following standards, and producing various technical documents that pertain to requirements, design, testing, etc. Social factors of importance in working within teams, such as negotiating, discussing, and communicating are also important in the management of capstone projects. However, Capstone projects are quite different from the ethics projects that we require in the Social Implications course. In the ethics projects, student teams are charged with identifying and analyzing ethical questions, evaluating their importance, researching and understanding the viewpoints of multiple stakeholders, and carrying out analyses that consider the ramifications of possible courses of action. The types of ethical dimensions that are examined as the pertain to computing systems include: a) Quality of life, b) Use of power and control, c) Risks and Responsibility, d) Property Rights, e) Privacy, f) Equity and Access, and g) Honesty and Deception.

We submit that team functioning has strong analogies with the ethical topics being carried out in projects. This is fundamentally why we require that students adopt and represent multiple viewpoints in their project work. More specifically, the social norms that develop for working in teams are similar to the resolving of ethical dilemmas in the topic of choice. Thus, team projects on ethical topics have the double benefits of students learning to work well in teams, reinforced by deep understanding of ethical issues.

B. *Social Networks in Education*

Social media is a term that applies to networked tools, services, and applications that support webs of interactions among people and with data as well as providing for the creation of online content [1,2]. Examples of social media systems include Wikipedia, MySpace, Facebook, YouTube, Second Life, Flickr, Twitter, and Ning. Social media applications give Internet users the capability to create, contribute, communicate, and collaborate in the online environment without need for specialized programming knowledge. In the spirit of Marshall McLuhan [3], it is understood that social media create communities of people who follow new types of interaction patterns and for whom the pace of their communication lives is altered. Educators are now challenged to create and sustain learning opportunities that leverage these new capabilities.

Ning is a free-form, online platform that allows people to create and host their own social networks. With Ning, users can customize their profile pages, share documents, RSS feeds, comments, photos and videos, chat, post events and post status updates on Twitter and Facebook. Within social media, we find social network systems (SNS) such as Ning, to be particularly useful in creating an open-ended learning environment that provides multiple possibilities for activities and provides students with tools and resources that support problem-solving [4,5].

The use of a SNS as a serious mechanism of education delivery is still in the early stages of development, yet there is evidence of potential in pedagogy [6,7]. Many campuses have committed to Learning Management Systems (LMS), such as Blackboard. However, a LMS tends to focus on content handling and email and is fundamentally teacher/institution centric. When compared with a LMS, social software offers greater interactivity and a distributed web of communication paths. The success of social software is based upon human needs for social interaction and a sense of community [4,8].

Our study is motivated by team problems that we have observed in the past that we hypothesize could be addressed with social networking systems. These include difficulties in students finding times in their schedules to meet regularly in person, situations in which one or more team members emerge as dominant personalities and examples of students who disempowered or disrespected on their team. Diversity on teams amplifies some of these problems.

C. *Diversity*

Diversity within teams can have effects on how teams conduct their work and set and meet their goals [9]. The primary differences among members of our teams are age, gender, ethnicity, and working experience. There is a tendency for people in teams to categorize one another, essentially distinguishing in-group members (those who are similar) from out-group members (those that are dissimilar) [10]. Work by Brewer [11] and van Knippenberg and Schippers [12] reports on investigations of in-group and out-group interactions. Results indicate that in-group members tend to be favored and trusted over out-group members and cooperation among in-group members tends to be better than among people working in widely diverse groups. Results also indicate that as groups become more diverse, there tend to be more misunderstandings due to the lack of a common frame of reference. Thus, in-group (homogeneous) teams tend to function more smoothly than out-group (heterogeneous) teams. Social networking tools act as an interaction buffer which allow users to continue to interact, but in a less direct way. Users can take the time to thoughtfully post content and take more time assessing and reacting to information that is placed in the SNS. In this way, SNS such as Ning can help to neutralize the potentially negative effects that heterogeneous teams can experience due to the lack of a common frame of reference.

Our study is empirical work focused on examining the use of the Ning social networking system on the performance of heterogeneous teams in completing a semester-long project on a topic with significant social/ethical issues. Our results indicate that using the Ning tool for managing the class projects was beneficial.

III. STUDY DESIGN

The study is designed to answer the question of whether the use of the Ning social networking system is helpful in addressing problems faced by heterogeneous teams in conducting projects. The study basically compares the performance of student teams that used Ning with the student teams that did not use Ning.

The experiment utilizes a Non Equivalent Pre-test Post-test Control group quasi-experimental design consisting of a control group (consisting of homogeneous student teams that could meet face-to-face and use traditional communication methods such as emails and attachments) and an experiment group (consisting of heterogeneous student teams that were asked to use the Ning tool) to help coordinate and manage their group projects and to facilitate communication among team members. The details of the study are given below.

A. *Hypotheses*

The following two hypotheses were posed in the study

Hypothesis 1: The *heterogeneous* student teams using the Ning tool produced project quality at least as high as the *homogeneous* student teams that used traditional project coordination methods such as face-to-face meetings, emails, and posted attachments.

Hypothesis 2: Subjects favored the use of the Ning tool for managing the class projects.

B. *Independent and Dependent Variables*

The experiment manipulated the following independent variables:

- **The project management technique.** Subjects either used Ning or used traditional communication and coordination methods for managing their group project activities.
- **The pre-test.** Measures were collected from each subject regarding their age, gender, nationality, background knowledge and skills, personality type, work culture, and their preferences for alternative project coordination methods. The results from the pre-test helped form *homogeneous* teams and *heterogeneous* teams.
- **The training procedures.** Measurements of the perceived usefulness of training procedures for each

student were gathered.

The following dependent variables were measured:

- **Team performance.** These measures include the team grades on the final project report and the final project in-class presentation.

C. *Participating Subjects*

Ninety-two graduate and undergraduate students enrolled in the Social Implications of Computing course at North Dakota State University participated in this study. The ninety-two subjects were divided into thirty-one teams (thirty teams had three students each and one team had four students). The course required that the student work collaboratively on a major project involving a multi-vocal response to an ethical issue related to the world of computer technologies.

D. *Artifacts*

Each of the thirty-one teams produced a project proposal document for a computer-related topic with ethical issues as shown in Table I. The key concept was that each individual in the group was required to adopt a distinct viewpoint that corresponded to a stakeholder. Rather than writing as a single voice trying to answer the ethical question posed in the proposal, the group members represented diverse views on their topic. The consequences of alternative actions were traced through and evaluated with regard to their impact on other stakeholders. One goal of having the students working together as a team was to help them to *understand* the perspectives other than their own, to respect those perspectives, and enrich and mature their own viewpoints through appreciation of others. The students met throughout the semester on their approved topics and subsequently produced an interim status report, final oral presentation and final report.

E. *Experimental Procedure*

To evaluate the hypotheses posed in Section III.A, the study was contained a control group and an experiment group. Figure

TABLE I. TEAMS AND TOPIC TITLES

Team Number	Homogeneous Teams	Heterogeneous Teams
1	Children on the Internet	Use of Computers and Web by Restaurants
2	Computers in Professional Sports	Deep Packet Inspection
3	Global Economy	Devices to Assist People with Disabilities
4	Copyrights in Music and Movies	Identity Theft
5	Technological Responses to Terrorism	Alternate Realities / Virtual Worlds
6	Web in Schools	Computing and Network Access in Kenya
7	Ethical Issues in Airline Security	World After 20 Years
8	Technology in Sports	Computers in Law Enforcement
9	Spam	Free Software and Open Source Software
10	Deep Packet Inspection	Spam
11	Privacy on the Web	Information Welfare
12	Addiction to Video Games	Unmanned Air Vehicles
13	Digital Distraction	Violence in Video Games
14	Facebook – Pros and Cons	Privacy for Organizations and Businesses
15	Music and Video Copyright	Distance Learning
16	X	Copyright Ethics in the Age of Technology

1 provides an overview of the procedure followed and Table II shows the timeline.

The details of the experiment steps are given below.

1) **Step1(Pre-Test):** A fifteen item pre-study questionnaire administered at the beginning of the semester collected information regarding each subject’s age, gender, nationality, background knowledge and skills, personality type, work culture, and their preference of project coordination methods.

TABLE II. PROJECT DELIVERABLES AND TIMELINE

Project Deliverable	Project Proposal	Interim Report	Final Report	Project Presentation
Timeline (2010)	March 10	April 9	May 7	April 28 – May 7

The result from the pre-test was used to develop homogeneous teams and heterogeneous teams in Step 2.

2) **Step 2 (Forming Homogeneous and Heterogeneous Teams):** The process used for forming student teams is as follows:

a) **Assigning point values:** Each item in the questionnaire was assigned point values for each of the responses associated with the question, assigning each item approximately equal weight towards determination of a total score for each student.

b) **Ranking of Scores:** The total scores for all students were ranked and sorted in descending order.

c) **Categorizing Student Teams:** Two categories of student teams were created: *homogeneous* teams (with very similar characteristics) and *heterogeneous* teams (with diverse characteristics). Since the ideal team size is three, the student responses were divided into tertiles (i.e., groups of high, middle, and lower scores). Students were ranked from highest to lowest within each tertile. For example, in a class of ninety students, the top thirty scores represent the upper tertile, scores thirty-one to sixty the middle tertile, and scores sixty-one to ninety the lower tertile. Teams were assigned by matching ranks across the tertiles. The thirty-one teams were further divided into sixteen heterogeneous teams and fifteen homogeneous teams. The *heterogeneous* teams were generated by randomly selecting subjects from each tertile to form sixteen groups. The remaining students were sorted by standardized score and formed into *homogeneous teams* of students by gathering groups of three as they occurred on the list. Students who are adjacent on the list are of high similarity as scored by our diversity measure.

d) **Assigning treatments:** The *heterogeneous* teams were asked to use the Ning private social networking system (Ning) to help coordinate and manage their project and to facilitate communication among team members, whereas the *homogeneous* teams were asked to not use Ning, but rather use the more conventional project coordination methods, such as email and face-to-face meetings.

3) **Training:** Basic training was provided to each group. The *heterogeneous* teams were given hands-on training on

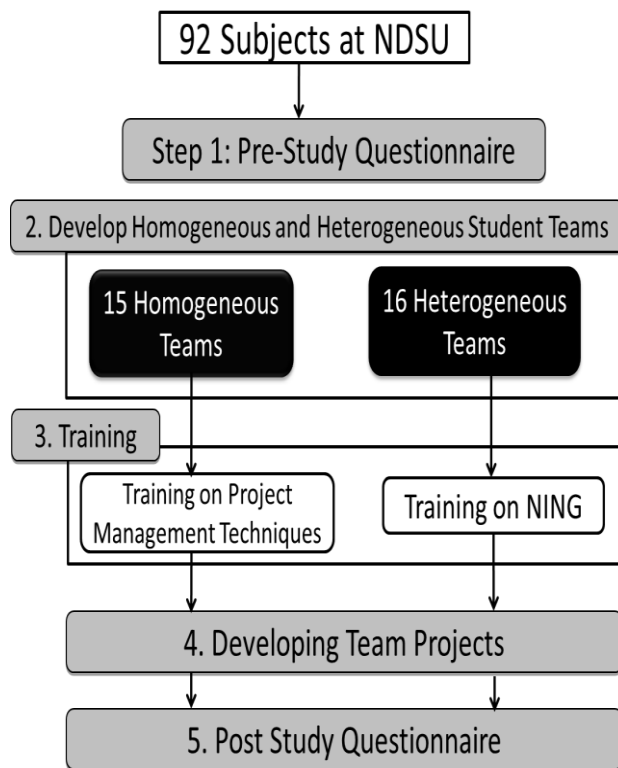


Figure 1. Experiment Design

how to use Ning to assist them in successfully setting up a Ning site and to utilize the site resources. The *homogeneous* teams were briefed by the instructor on well-established principles for successfully managing team projects. Each training session lasted for one lecture period.

4) **Developing Team Projects:** The students worked in teams on a semester long project that culminated in a final report and oral presentation from each student team. Most groups chose a topic from a provided list of candidate ideas. Then the teams performed the necessary research to write a project proposal. The research typically included google searches, reading of periodicals and books, personal interviews with subject matter experts, and surveys. Half way through the semester, each team submitted an interim progress report. Near the semester end each team gave an oral presentation on their project and submitted a final written report. Grades were collected after each deliverable (shown in Table II).

5) **Post-Study Questionnaire:** A ten question post-study questionnaire was administered to the students at the end of the semester. The post-study questionnaire collected feedback from the student teams regarding their perceived effectiveness of their collaboration methods, communication among team members, and quality of team work in encouraging creativity and innovation.

IV. ANALYSIS AND RESULTS

Statistical analyses were carried out on the data collected during the study. The two hypotheses described in Section III.A were tested to determine the usefulness of the Ning tool for collaborating on group projects and student attitudes toward the tool. An alpha value of 0.05 was selected for judging the significance of the results.

A. Hypothesis 1: Comparison of Homogeneous and Heterogeneous Group Performance on the Quality of Projects

This section provides analyzes of the effect that Ning had on the quality of projects developed by the teams. The marks scored by the sixteen heterogeneous teams that used Ning and the marks scored by the fifteen homogeneous teams that did not use Ning were compared. Scores for each of the four project deliverables shown in Table II and the overall scores were tested using an independent samples t-test.

Figure 2 shows comparisons of the average scores of heterogeneous teams (HET_{Ning}) and homogeneous teams (HOM_{NONing}) on the *Project Proposal*, *Interim Report*, *Final Report*, and *Project Presentation*. On the *Proposal* deliverable the HET_{Ning} performed better than the HOM_{NONing}, while the HOM_{NONing} performed better than the HET_{Ning} on the others. The p value from the t-tests are illustrated in Figure 2 and do not show a significant difference in the average scores of

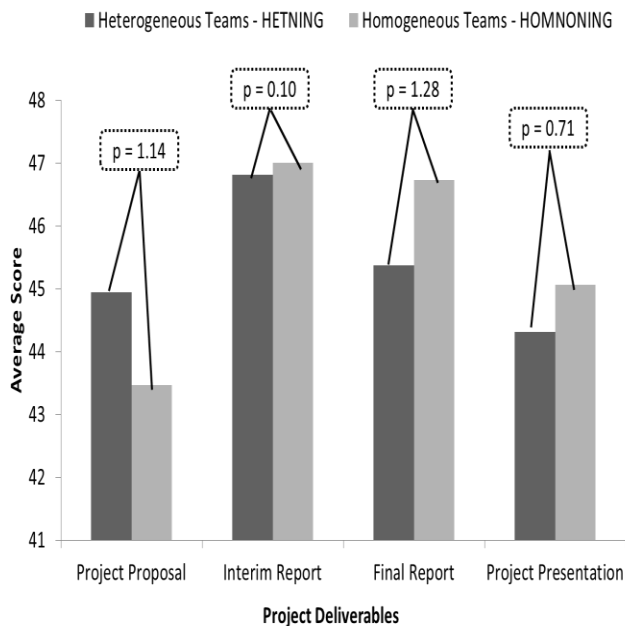


Figure 2. Comparing Performances of Heterogeneous Teams (HET_{Ning}) and Homogeneous Teams (HOM_{NONing}) on Project Deliverables

homogeneous and heterogeneous teams for any of the four deliverables.

In comparing the comparing the total score over all four deliverables, the HOM_{NONing} average score of 181.43 was slightly better than the HET_{Ning} average score of 182.36.

Figure 3 shows a comparison of the total scores of the heterogeneous and homogeneous teams. The results are ordered by increasing number of marks scored by the teams in each group.

An independent samples t-test reveals that the heterogeneous student teams performed as well as the homogeneous student teams on their group project (p=0.024). These results indicate that using the Ning tool is beneficial for

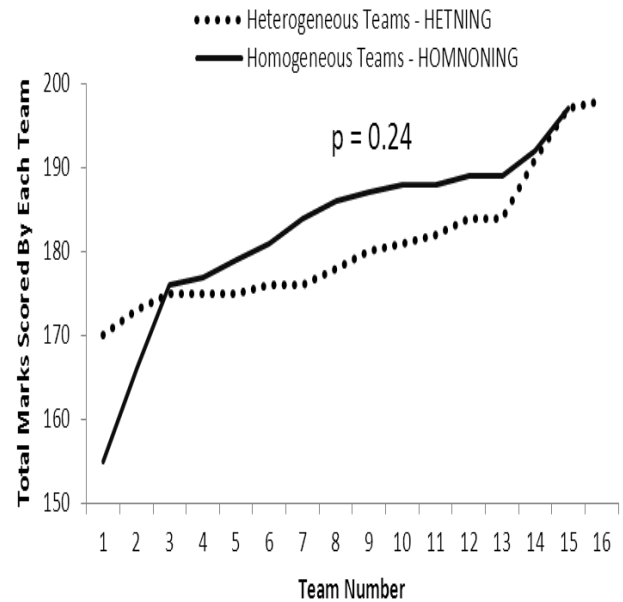


Figure 3. Comparing Total Project Scores of Sixteen Heterogeneous Teams (HET_{Ning}) and Fifteen Homogeneous Teams (HOM_{NONing})

team members with high diversity.

B. Hypothesis 2: Usefulness of the Ning Tool

The usefulness of the collaboration method used by the homogeneous and heterogeneous teams was evaluated using feedback from the subjects in the experiment group (the members of heterogeneous teams) and the control group (the members of homogeneous teams). Nine essential attributes of a collaboration tool for completing a class project were included: a) *Communication among team members*, b) *Effectiveness of the Team in Organizing project activities*, c) *Setting and accomplishing project goals*, d) *Scheduling and attending Meetings*, e) *Enthusiasm for using Social Networking / Collaboration tools on a project*, f) *Encouraging creativity and innovation*, g) *Respect for everyone's ideas*, h) *Ability to meet deadlines*, and i) *Effectiveness of the Collaboration Method for completing the class project*.

Forty-eight subjects from heterogeneous teams that used Ning and forty-six subjects from homogeneous teams that did not use Ning rated each of the above nine attributes on a 5 point likert scale (1-Very High, 2 – High, 3- Medium, 4- Low,

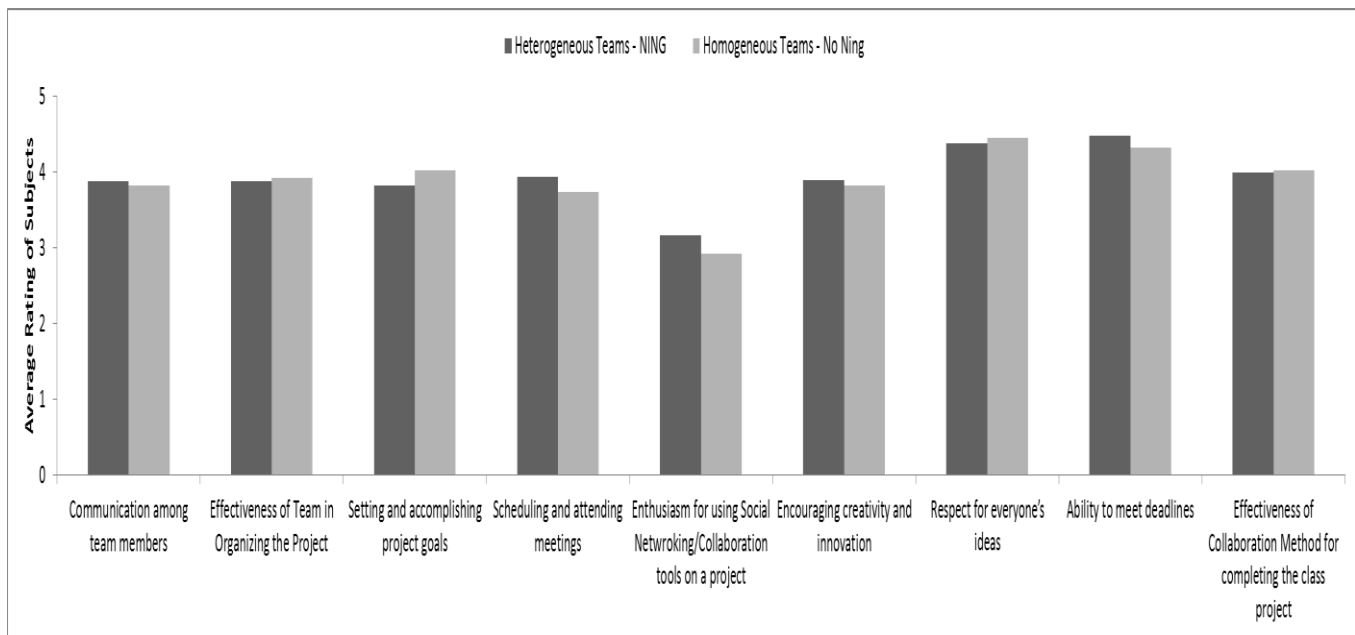


Figure 4. Comparison of Average Ranking of Homogeneous and Heterogeneous Group Members on Nine Attributes

and 5- Very Low). Figure 4 shows comparisons among the average ranking of the experiment and control group subjects for each of the nine attributes. The results show that the homogeneous and heterogeneous teams viewed their collaboration method equally ineffective on all of the nine attributes. So, while the subjects using the Ning tool did not perceive the tool favorably, it was not perceived worse than the traditional communication methods used by subjects in the homogeneous teams.

The results essentially show that neither the Ning tool nor any other collaboration method was viewed favorably for collaborating on the group project. The implications and the discussion of this result are presented in Section V.

V. SUMMARY AND CONCLUSIONS

Thirty-one teams were formed and each team carried out an extensive term project on a computing topic with significant social and ethical issues. Teams with little diversity among their members typically function well on these group projects, while highly diverse teams often have difficulty. Our primary hypothesis is that heterogeneous teams that use the Ning social networking tool as a collaboration platform for their project work can elevate their performance to match that of the homogeneous teams. The experimental study supports this hypothesis with statistical significance. We speculate that the innovative features of Ning that support several types of interaction among people while maintaining them at a distance can be helpful in avoiding breakdowns in collaboration and cooperation that can occur with more conventional meeting methods. Our second hypothesis concerns assertions on multiple attributes for which the students were surveyed. Results indicate that students did not report a particularly favorable attitude toward the use of Ning. We speculate that although Ning was shown to be helpful in stimulating project

success and performance, the learning curve for mastering Ning and heavy workload imposed by the project itself dampened the enthusiasm of the students.

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