

Social Sensitivity and Classroom Team Projects: An Empirical Investigation

Lisa Bender, Gursimran Walia, Krishna
Kambhampaty, Kendall E. Nygard
North Dakota State University
Computer Science Dept. 2740
Fargo, ND 58108
+1 701-231-8562

Travis E. Nygard
Ripon College
300 Steward Street
Ripon, WI 54971
+1 920-748-8783

NygaardT@ripon.edu

{lisa.l.bender, gursimran.walia,
k.kambhampaty, kendall.nygard} @ ndsu.edu

ABSTRACT

Team work is the norm in major development projects and industry is continually striving to improve team effectiveness. Researchers have established that teams with high levels of social sensitivity tend to perform well when completing a variety of specific collaborative tasks. Social sensitivity is the personal ability to perceive, understand, and respect the feelings and viewpoints of others, and it is reliably measurable. However, the tasks in recent research have been primarily short term, requiring only hours to finish, whereas major project teams work together for longer durations and on complex tasks. Our claim is that, social sensitivity can be a key component in predicting the performance of teams that carry out major projects. Our goal is to determine if previous research, which was not focused on students or professionals in scientific or technical fields, is germane for people in computing disciplines. This paper reports the results from an empirical study that investigates whether social sensitivity is correlated with the performance of student teams on large semester-long projects. The overall result supports our claim that the team social sensitivity is highly correlated with successful team performance. It suggests, therefore, that educators in computer-related disciplines, as well as computer professionals in the workforce, should take the concept of social sensitivity seriously as an aid or obstacle to productivity.

Categories and Subject Descriptors

K.3.2 [Computer and Information Science Education]:
Computer Science Education.

General Terms

Measurement, Performance, Experimentation, Human Factors

Keywords

Computer Science, Collaboration, Social Sensitivity, Teams,
Empirical Study

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee.

SIGCSE'12, February 29–March 3, 2012, Raleigh, North Carolina, USA.

1. INTRODUCTION

Team work has become increasingly important in today's world. Individual work is also highly valued, but as the world grows more complex, projects also grow more complex. They tend to have objectives that involve many sophisticated tasks and require the collective work of individuals to accomplish. This is especially true for computer scientists and software engineers who work in the area of software development. Complex projects require people to interact with each other as well as with computing technologies. Project development processes are often difficult due to the complexity of the technologies, as well as the complexity of social interactions between the project team members. Previous research asserts that the ability to use soft skills to navigate interpersonal relationships and negotiate social interactions is critical to team success [15, 27]. With current academic standards and curricula, many students graduate with the technical, hard skills that they need, but they often lack necessary soft skills that are critical to team success [33]. Begel and Simon studied recent college graduates who were hired by Microsoft and found that while the new hires generally did well, there were numerous problems with communication and collaboration with others [30]. Soft skills are not only important to teamwork, but also to education. Researchers note that interpersonal and small-group skills are essential to positive cooperative learning [31].

One factor that can greatly influence collaborative team performance is team composition. Much research has been done on team composition, but no single attribute stands out as key to superior performance. Intriguing questions were raised by a recent group intelligence study, which established that group intelligence depends less on how smart individual group members are and more on team dynamics, including how well team members collaborate [20]. These researchers found that social sensitivity made the largest contribution to a group's overall intelligence and was a primary predictor of team effectiveness in accomplishing short-term tasks. Social sensitivity is defined as the personal ability to perceive and understand the mind and mood of others. Our primary research goal is to determine if the connection between social sensitivity and team performance extends to students or professionals in computing fields who carry out longer-term tasks within major projects.

We conducted an empirical study that investigated the effect of social sensitivity on the performance of project teams consisting of computer science and management information system students

who worked on semester-long projects. These student projects were completed in multiple stages, each building upon previous work. The results indicate that social sensitivity is key to success for these team projects, and suggest that social sensitivity would likewise be key in the success of complex projects, such as those carried out by software development teams.

The remainder of this paper is structured as follows. Section 2 provides background information on team formation research, social sensitivity, and tests for social sensitivity. Section 3 describes the design of the empirical study that was conducted to investigate the effects of social sensitivity on team performance. Section 4 describes the data analysis and results. Section 5 discusses the threats to validity. Section 6 provides a discussion of the results based on the analysis performed in Section 4. Section 7 concludes the paper and provides a summary of future research.

2. BACKGROUND AND RELATED WORK

The prominence of collaboration in the computing industry has created the need to study how to form highly effective teams. West [4] notes that effective teams complete projects quickly, develop and deliver cost-effective products, maintain high quality, have low stress levels, have high team member satisfaction, and promote innovation. He also notes that although effective teams can benefit a project, teamwork is not automatically beneficial. A major team-related factor that can affect project performance is the interaction of individual personalities. Other factors affecting the project performance include team communication, cooperation, and coordination [5, 6]. One of the main factors contributing to poor performance is project team composition [15]. This suggests that management needs to form teams wisely.

There are many factors to consider when forming teams, and their impact on team composition has been widely studied. An increasing number of educators use many criteria to form teams such as gender, race, prior class or work experience, personality, problem solving style, and/or grade point average [32]. Within Software Engineering field, some of the factors include the effects of personality composition [7, 8], team member abilities [9, 12], team roles [10-13], diversity [14], shared mental models [3, 15], and team member satisfaction [15]. Chan et al. [27] suggests that soft skills are the primary factor that should be considered for achieving good project performance. They argue that higher levels of soft skills within the team facilitate the application development skills and domain knowledge skills necessary to achieve good project performance. In the spirit of this study, our work has produced new knowledge by taking a soft skill that Chan et al did not interrogate (i.e., social sensitivity) and investigated how it affects the team performance.

Social Sensitivity is the ability to correctly understand the feelings and viewpoints of people [16]. It has also been defined as “*the ability to understand and manage people*” [17]. Salovey and Mayer [18] view social sensitivity as an element of emotional intelligence and identify some of the characteristics of socially intelligent people to include the ability to admit mistakes, to accept others for who they are, to enhance other’s moods, to be social problem solvers, to be flexible thinkers, and to have an interest in the world at large. They also recognize that the appraisal and expression of emotion often takes place on a nonverbal level. The ability to perceive nonverbal expression insures smoother interpersonal cooperation. By perceiving, empathizing, and then responding appropriately, people experience greater satisfaction, more positive emotions, and lower

stress. Such positive emotions aid in creative thinking and enable flexibility in arriving at alternatives to problems. These characteristics suggest that high levels of social sensitivity could be a benefit for teams.

Every person has a certain level of social sensitivity, but there is evidence that people who choose technical careers have less of it on average than the population at large [19]. More specifically, Baron-Cohen et al. [19] produced evidence that suggests that engineers, mathematicians, physicists, and computer scientists are typically less socially sensitive than their peers in the humanities, arts, and social sciences. They suggest that people in these technical disciplines have more difficulty decoding what others are thinking and feeling. Although this research did not address teams specifically, it suggests to us that teams of technical people may be challenged in the area of social sensitivity.

Our study is not the first to address the relationship between social sensitivity and teamwork, but the duration and complexity of our project make it unique. A major inspiration for our study comes from the work of Woolley et al. [20]; a recent study on social sensitivity that established a correlation between social sensitivity and effective teamwork. They describe a group general effectiveness or collective intelligence that predicts group performance and is grounded in how well groups interact and work together. Another interesting result from this study was that team performance was not driven by the intelligence of individuals on the teams; group cohesion, motivation, or satisfaction. The tasks in their study were short-term contrived tasks requiring hours, rather than months, to complete. Thus, those team members had little opportunity to develop longer-term working patterns. Our study extends this research by interrogating the effects of social sensitivity on teams that worked together for longer durations—the better part of an academic semester—and produced a complex series of deliverables during that time. In many ways our study closely approximates a real working environment.

In order to proceed with our study, we needed an accurate test to determine an individual’s level of social sensitivity. There are several methods for testing social sensitivity. The one we chose to use is referred to as the “Reading the Mind in the Eyes” test which was created and validated by Baron-Cohen et al. [1]. This test gauges the accuracy of individuals in judging someone’s emotional state by looking at their eyes. A subject is presented with a series of 36 photographs of the eye-area of actors. For each photograph, the subjects are asked to choose which of four adjectives best-describes how the person in the photograph is feeling. This test was originally developed to measure an ‘advanced theory of mind’ in adults, which is the ability to identify mental states in oneself or another person. The test has been found to have test-retest reliability [2]. Alternative techniques for measuring social sensitivity, such as the George Washington Social Intelligence Test [21] and the Vineland Social Maturity Scale [22] were rejected due to reported inaccuracies or the inclusion of factors irrelevant to our research [28, 22].

3. STUDY DESIGN

The study was designed to analyze the relationship between the social sensitivity of student teams and the quality of work in computer science team projects. This study investigates whether the student teams with higher average social sensitivity were positively correlated with their actual performance on the project, as measured by grades?

This study used a randomized experimental design in which participants were tested to determine their social sensitivity scores and were then randomly assigned to teams of three participants each. Each team worked together to complete a major semester-long project on an ethical issue related to current computer technology in society. The project deliverables were evaluated to score the student team's performance on the project. The details of the study are provided in the following subsections.

3.1 Study Goals and Hypotheses

Using the Goal Question Metric (GQM) approach [23], the following goals and hypotheses were formulated.

Goal 1: *Analyze* student's social sensitivity scores *for the purpose of evaluation with respect to* their team project performance.

Hypothesis 1: Student teams with higher average social sensitivity scores perform significantly better on the project.

Goal 2: *Analyze* student's social sensitivity levels *for the purpose of characterizing their effect with respect to* the increase in the team project performance.

Hypothesis 2: Student teams with differing average scores of social sensitivity have significant differences in their team performance scores.

3.2 Independent and Dependent Variables

The experiment manipulated the following independent variable:

- a) **Social Sensitivity Score:** Each participant completed the "Reading the Mind in the Eyes" test [1] in order to determine their individual social sensitivity score.

The following dependent variable was measured:

- a) **Team Performance:** This measure includes the total points earned by each team—the sum of scores on four project deliverables submitted throughout the semester.

3.3 Participating Subjects

The participant subjects were ninety-eight graduate and undergraduate computer science and management of information systems students enrolled in the Social Implications of Computing course at large public university. Seventy-six students (17 out of 18 females and 59 out of 80 males) chose to participate in the study. The course required the students to work together on a project involving a multi-vocal response to an ethical issue related to the world of computer science and technology.

3.4 Artifacts

Each of the thirty-four teams produced a project proposal document for a different computer-related ethical topic. 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 to their logical conclusions 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* perspectives other than their own, and, through discussions, to produce a final presentation and essay that contains ideas that would not have been articulated by working independently. The students met throughout the semester to

develop their instructor-approved topics and produced an interim report, a final report, and a final project presentation.

3.5 Experimental Procedure

The study steps are as follows:

- a) **Step 1 – Test Subjects for Social Sensitivity:** The "Reading the Mind in the Eyes" test [1] was administered at the beginning of the semester to measure each subject's social sensitivity. A glossary was provided that contained a definition and sample sentence for each of the emotion word selection choices used in the test. The basis for the glossary was provided by the work of Baron-Cohen et al. [1]. The purpose of the glossary was to ensure that participants had a clear understanding of the definitions of words. The students were encouraged to read through the glossary prior to the test and to refer to it as needed during the test. The survey was administered online and the completed responses were analyzed for correctness. Individual social sensitivity scores were based on the number of correct responses.
- b) **Step 2 – Forming Student Teams:** Subjects were randomly assigned to teams of three students each. A total of 34 teams were formed. Because one student dropped the course, by the end of the semester 33 teams had three students each and one team had two students.
- c) **Step 3 – Actualizing Team Projects:** The students worked in teams on specific semester-long projects. Each team produced a project proposal, an interim report, a final report, and a final presentation. Most groups chose a topic from a list of ideas provided by the instructor, although students could pursue any topic that was approved by the instructor. After the project was approved, the teams performed the necessary research to write a project proposal due February 28. The proposal required them to articulate ethical questions that they planned to investigate, justify the questions' importance, identify major stakeholders and ethical values, specify their research methods, and plan the project. Half way through the semester, each team submitted an interim progress report (due April 11) that described the project goal, objectives, and scope, employed research methods, used evidence to support ethical viewpoints, and evaluated potential stakeholder actions. Near the semester end, each team gave an oral presentation (due April 29-May6) on their project and submitted a final written report (due May 6).
- d) **Step 4 – Evaluating Team Projects:** Scores were determined for each deliverable using detailed rubrics to structure the grading. All members of a team received the same score for each assignment. The team performance (i.e., *the total team score*) was measured by summing each team's score from all the four deliverables.
- e) **Step 5 – Peer-Self Evaluations:** After each deliverable, the subjects completed an evaluation of each of their team members as well as themselves. As identified in the literature (e.g., [24, 25]), the following ten candidate characteristics of an effective team member were included: focusing on the tasks, being dependable, responsibility sharing, listening, questioning, discussing, research and information sharing, individual performance, brainstorming, and group teamwork. Subjects rated each of the ten attributes on a 5-point Likert scale (4 –Excellent, 3 – Good, 2 – Average, 1 – Poor, and 0 –

Fail) and provided comments. These results were captured to help researchers better understand the results.

- f) **Step 6 – Post-Study Survey:** A nineteen-question survey was administered to the students at the end of the semester. The post-study survey collected data regarding the self-perceived effectiveness of each team, including whether members felt valued; if the team cooperated, communicated, and interacted well; if effective feedback occurred among team members; if conflict existed and how it was resolved; and what the quality was of the team work environment overall.

3.6 Data Collection and Evaluation Criterion

Because this study investigates the impact of social sensitivity on team performance, only teams that had at least two team members consenting to participate in the study were included in our analysis; and only the consenting team member’s social sensitivity scores and team performance scores were collected. After this elimination process, 28 out of 34 teams remained in the study.

Individual student social sensitivity test scores for each of the 76 participating subjects are shown in Figure 1. The social sensitivity (SS) scores range from a minimum of 9 to a maximum of 32, with most subjects scoring in the range of 19 to 25. Interestingly, our mean sample score of 22.59 was lower than the general population sample score of 26.2 reported by Baron-Cohen et al [1]. Team average SS scores were also calculated. The average team SS scores range from a minimum of 12 to a maximum of 29, with the most of subjects scoring in the range of 19 to 25.

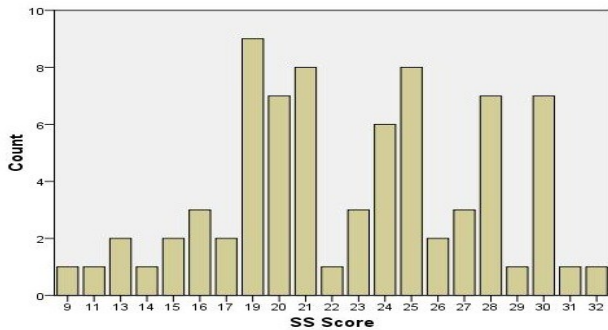


Figure 1. Individual Social Sensitivity Scores.

Student team performances on the four project deliverables were summed into a final project score for use in the analysis of the impact of the team’s average SS on the final project team scores.

4. DATA ANALYSIS AND RESULTS

This section provides analysis of the quantitative data that includes student’s social sensitivity scores and their team’s project performance. This section is organized around the two hypotheses presented in Section 3.1. An alpha value of 0.05 was used for all statistical analysis and r^2 value of 0.30 was used for correlations.

4.1 Analysis of the Effect of Social Sensitivity (SS) on Team’s Project Performance

This section analyzes the connection between the student’s SS and their performance on the team project. Because each team consisted of two to three subjects, and the SS data from Step 1 was individual data, the individual SS scores were combined into one team score. The SS score of each team was calculated by averaging the individual team member’s SS scores. The

performance of each team (i.e., *total team score*), while developing their projects, was calculated by combining the scores on each of the four deliverables. This analysis was performed for each of the 28 teams.

Figure 2 plots each team’s average SS scores against their total team project score. To test hypothesis 1, we ran a linear regression test to see whether the average SS scores of a team were positively correlated to the team’s performance (i.e., total team score). The results show that the team SS score had a significant positive correlation with the total team score ($p=0.001$; Pearson’s $R = 0.383$; $r^2 = 0.16$). Additional testing was also performed to determine if there were any outliers, and the results confirmed that there were no outliers.

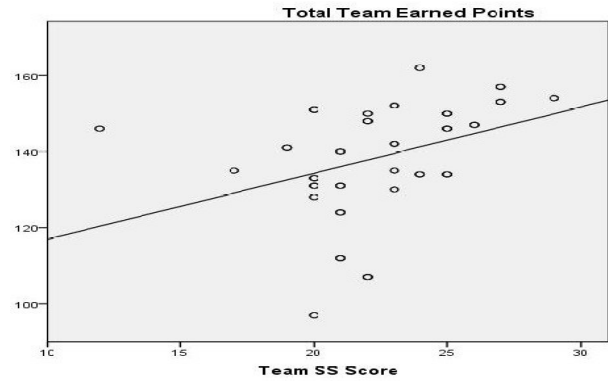


Figure 2. Effect of Social Sensitivity on the Team Performance.

We also analyzed whether the team SS scores were correlated with the team performance on each of the four deliverables. The results showed that the team SS scores had a strong and significant positive correlation with their performance on the project proposal ($p=0.004$), interim report ($p=0.003$), and final report ($p=0.05$). The result, however, did not show a significant correlation between teams’ average SS and performance on the final presentation (0.382).

In order to better understand the results, the individual SS scores (shown in Figure 1) were also analyzed to evaluate their relationship to the performance of the teams. The results show that individual SS also had a significant positive correlation with the total team score ($p=0.009$; Pearson’s $R = 0.297$; $r^2 = 0.09$). Based on these results, the teams with higher average SS performed significantly better on their project.

4.2 Analysis of Student Teams with Differing Average Levels of Social Sensitivity

The results reported in Section 4.1 indicate that the *individual* SS and the *team* SS scores were positively correlated with team performance. We performed further analysis to determine the cut-offs points in order to gain insights into the level of social sensitivity required to produce a significantly higher level of team performance.

We determined these cutoff points by analyzing the performance of the teams at multiple levels of team SS. Clusters of teams were set at different ranges on the SS scale. The mean team scores for each cluster were then calculated and analyzed. The results are shown in Figure 3 and are explained below.

As shown in Figure 2, there were only 2 teams with a SS score below 18 (the mid-point of the SS scale), and no team had a SS

score greater than 29. Therefore, we used a SS scale of 19-29. We divided teams into three different clusters, such that a roughly equal number of teams belonged to each. Using this process, three different SS Level clusters (19-21; 22-24; and 25-29) were formed. Next, the mean performance of the teams in each of the three SS clusters was calculated. An independent samples-t test was then performed to determine whether there was a significant difference in the mean performance of teams. The result shows that the teams with SS scores ranging from 22-24 performed significantly better than the teams whose SS scores ranged from 19-21 ($p=0.03$). Similarly, the teams with SS scores ranging from 25-29 performed significantly better than the teams with SS scores of 22-24. This result is shown in the top level of Figure 3.

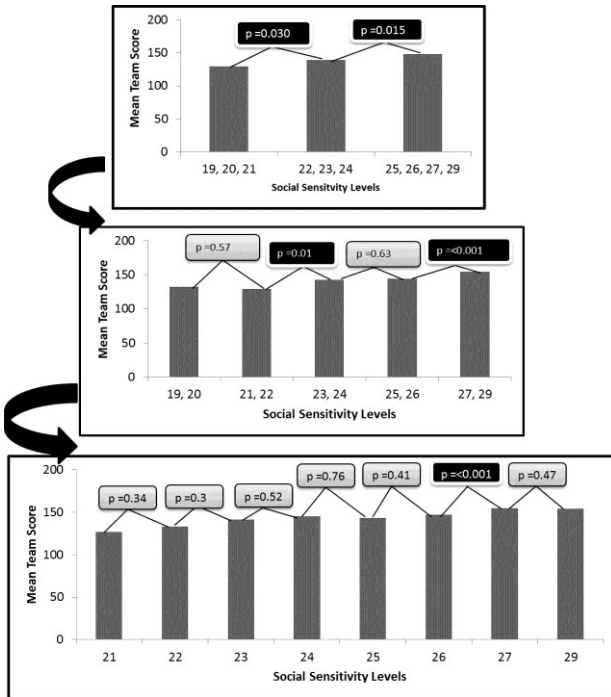


Figure 3. Team Performance at Different SS Levels

Performing further analysis of these results, we created smaller SS clusters. Using the same analytical process, we compared the mean performance of teams in each of these SS groups. These results are shown in the middle part of Figure 3. The independent samples t-test showed that teams with SS scores of 23 and 24 performed significantly better than teams with lower SS scores ($p=0.01$) and that the teams with SS scores of 27 and 29 were better than teams with lower SS scores ($p < 0.001$). Continuing this analysis for fine-grained SS scores in this study (as shown in the bottom part of Figure 3), we found that a SS of 27 resulted in significantly better team performance, and that SS scores beyond 27 does not result in significantly higher team performance. We note that there were not an equal number of teams in each of these fine-grained SS groups, which could have an impact on our results.

5. THREAT TO VALIDITY

Although the results of this study are encouraging, there are certain threats to validity that exist. One such threat is language proficiency. Approximately fifty percent of the students in the course are international students. Even though each of these students has passed an English proficiency exam, some could have struggled with the language. To improve construct validity in

the “Reading the Mind in the Eyes” test, a glossary was provided that contained a definition and sample sentence for each of the word selection choices used in the test. Students were encouraged to read through the glossary before they took the test and refer to it as necessary during the test. However, because the students were not supervised while taking the test, we do not know how extensively the glossary was used. Feedback from students suggests that some groups struggled with language barriers as well, which could be a confounding factor that hinders success.

6. DISCUSSION OF RESULTS

Our fundamental finding is that SS is a good predictor of team performance carrying out major student team projects with complex tasks and multiple deliverables over long periods of time. This extends previous research that showed that SS had high impact on teams accomplishing well defined short-term relatively simple tasks. Task complexity is an important factor in team performance because the difficulty of the task can impact the success of the team [29]. Complex tasks within large projects have many opportunities for errors and they can be hard to identify. Such projects can easily create a stressful environment for students which can hinder team performance (e.g. impaired decision making, decreased speed and accuracy of task performance) by adversely affecting team coordination and ability to engage in team activities. These difficulties can ultimately discourage a team. The factor of project duration on team performance comes into play as team members become more intertwined and interdependent, the impact of one member’s lapse can disrupt the entire team’s performance. The longer the team works together, the more intertwined they are likely to become.

Another interesting finding in our study is that it supports Baron-Cohen’s assertion that engineers, mathematicians, physicists, and computer scientists are, generally, less socially sensitive. The participants in our survey are all majoring in scientific or technical disciplines and their mean SS score of 22.59 was lower than the original general population sample mean SS score of 26.2 of Baron-Cohen et al [1]. This suggests that these students find it more difficult to perceive and understand the feelings and viewpoints of others. An awareness of this can help educators better recognize reasons behind team difficulties and help students focus on techniques for managing that social deficit.

Yet another finding is that there is a significant correlation between SS and team performance on the first three deliverables of the project, but not on the last deliverable (i.e. the project presentation). One possible reason for this is that a more collaborative effort was needed to create the three written documents; whereas the presentation was based on the final report and the team members likely partitioned the presentation and worked independently to each produce their own portion. During the actual presentation, most groups had each member take turns where each member spoke sequentially, one after another. The independent performance of this task may have diminished to effect of the SS factor on the performance of this last deliverable.

7. CONCLUSION AND FUTURE WORK

Our results establish that the performance of teams is positively correlated with the SS of members. This is valuable knowledge for managers and educators. Although we recognize that teams need members with the correct skill set and knowledge, by using SS as an additional input, more effective teams can be composed.

Using quantitative data related to work in teams, our work demonstrates compelling correlations between SS and performance on group projects. These correlations tempt us to assert that high SS causes high performance. We expect that our future work with qualitative analysis will support this connection. We have extensive qualitative data from study participants that relates to their experiences working on the teams, and we hope that these will be useful for teasing how SS impacted groups on practical levels. We know that some groups faced interpersonal challenges, and we plan to investigate whether such challenges were better-overcome in teams with socially-sensitive individuals.

Assuming that SS is a cause rather than simply correlated with team success, then this type of research raises many exciting questions of interest to people across academia. How much SS is needed for success? Can SS be learned? Authors such as Anthony Mersino have published techniques for improving emotional intelligence [26]. If these techniques can be effectively applied to improve SS, then team performance can also be improved. In any case, it is our hope that a greater understanding of SS will result in better learning experiences in the college classroom, better productivity of software engineering teams, and ultimately better relationships between all humans.

8. REFERENCES

- [1] Baron-Cohen, S., Wheelwright, S., Hill, J., Raste, Y., and Plumb, I. 2001. The 'Reading the Mind in the Eyes' Test Revised Version: A Study with Normal Adults, and Adults with Asperger Syndrome or High-functioning Autism. *Child Journal of Psychology and Psychiatry*, 42, 2, 241-251.
- [2] Hallerback, M.U., Lugnegard, T., Hjarthag, F., and Gillberg, C. 2009. *Cognitive neuropsychiatry*, 14 (Mar. 2009), 127-143.
- [3] Mathieu, J.E., Heffner, T.S., Goodwin, G.F., Salas, E., and Cannon-Bowers, J.A. 2000. The Influence of Shared Mental Models on Team Process and Performance. *Journal of Applied Psychology*, 85, 2 (Apr. 2000), 273-283.
- [4] West, M.A. 2004. *Effective teamwork: practical lessons from organizational research*. Malden, MA: Wiley-Blackwell, 9-14.
- [5] Bradley, J.H. and Hebert, F.J. 1997. The effect of personality type on team performance. *Journal of Management Development*. 16, 5, 337-353.
- [6] Faraj, S. and Sproull, L. 2000. Coordinating expertise in software development teams. *Management Science*. 46, 12 (De. 2000), 1554-1568.
- [7] Gorla, N. and Wah Lam, Y. 2004. Who Should Work With Whom? 2004. *Communications of the ACM*. 47, 6 (Jun. 2004), 79-82.
- [8] Shen, S., Prior, S.D., White, A.S., and Karamanoglu, M. 2007. Using Personality Type Differences to Form Engineering Design Teams. *Engineering Education*. 2, 2, 54-66.
- [9] Felder, R. and Brent, R.. 2001. Effective strategies for cooperative learning. *Journal of Cooperation & Collaboration in College Teaching*. 10, 69-75.
- [10] Beranek, G., Zuser, W., and Grechenig, T. 2005. Functional Group Roles in Software Engineering Teams. In *HSSE'05* (St. Louis Missouri USA, May 2005), 1-5.
- [11] Dubinsky, Y. and Hazzan, O. 2006. Using Roles Scheme to Derive Software Project Metrics. *Journal of Systems Architecture*. 52, 11 (Nov. 2006), 693-699.
- [12] Barrick, M.R., Stewart, G.L., Neubert, M.J., and Mount, M.K. 1998. Relating Member Ability and Personality to Work-Team Processes and Team Effectiveness. *Journal of Applied Psychology*. 83, 377-391.
- [13] Belbin, M. 1993. *Team Roles at Work*. Butterworth-Heinemann, Oxford.
- [14] Pieterse, V., Kourie, D., and Sonnekus, I. 2006. Software Engineering Team Diversity and Performance. In *Proceedings of annual SAICSIT 204* (Somerset West South Africa 2006), 180-186.
- [15] Ikonen, M. and Kurhila, J. 2009. Discovering High-Impact Success Factors in Capstone Software Projects. In *SIGITE'09* (Fairfax, Virginia, USA, October 2009), 235-244.
- [16] Greenspan, S. 1981. Defining childhood social competence. *Advances in Special Education*. 3, 1-39.
- [17] Thorndike, R.L. and Stein, S. 1937. An Evaluation of the Attempts to Measure Social Intelligence. *Psychological Bulletin*, 34, 5 (May 1937), 275-284.
- [18] Salovey, P. and Mayer, J.D. 1990. Emotional Intelligence. *Imagination, Cognition, and Personality*. 9, 3, 185-211.
- [19] Baron-Cohen, S., Bolton, P., Wheelwright, S., Schill, V., Short, L., Mead, G., and Smith, A. 1998. Autism occurs more often in families of physicists, engineers, and mathematicians. *Autism*. 2, 296-301.
- [20] Woolley, A.W., Chabris, C.F., Pentland, A., Hashmi, N., and Malone, T.W. 2010. Evidence for a Collective Intelligence Factor in the Performance of Human Groups. *Science* 2010. ePub ahead of print doi:10.1126/science.1193147
- [21] Strang, R. 1930. Measures of Social Intelligence, *American Journal of Sociology*, 36, 2, 263-269.
- [22] Pedrini, D.T. and Pedrini, B.C. Vineland Social Maturity Scale Profile. accessed online at <http://www.eric.ed.gov/PDFS/ED079342.pdf>.
- [23] Basili, V.R., Caldiera, G., and Rombach, H.D. 1994. *The Goal Question Metric Approach*. Technical Report. Department of Computer Science, University of Maryland.
- [24] Cohen, S.G. and Bailey, D.E. 1997. What Makes Teams Work: Group Effectiveness Research from the Shop Floor to the Executive Suite. *Journal of Management*. 23, 3, 239-290.
- [25] Dukerich, J.M. 2002. Leadership, team building, and team member characteristics in high performance project teams. *Engineering Management Journal*. Dec. 2002.
- [26] Mersino, A. 2007. Emotional Intelligence for Project Managers. *American Management Association*, New York.
- [27] Chan, C.L., Jiang, J.J., and Klein, G. 2008. Team Task Skills as a Facilitator for Application and Development Skills. *IEEE Transactions On Engineering Management*. 55, 3 (Aug. 2008), 434-441.
- [28] Sternberg, R.J. *Handbook of intelligence*, 2nd ed. 2000. (359-379). Cambridge, U.K.: Cambridge University Press.
- [29] Langan-Fox, J., Cooper, C.L., and Klimoski, R.J. Research Companion to the Dysfunctional Workplace: Management Challenges and Symptoms (New Horizons in Management). Edward Elgar Publishing. Camberly, UK.
- [30] Begel, A. and Simon, B. 2008. Struggles of new college graduates in their first software development job. In *Proceedings of the 39th SIGCSE technical symposium on Computer science education* (Portland, OR, USA, 2008). ACM.
- [31] Bacon, D.R., Stewart, K.A., and Silver, W.S. 1999. Lessons from the Best and Worst Student Team Experiences: How a Teacher Can Make the Difference. *Journal of Management Education*. 23, 467-488.
- [32] Lewis, T.S. and Smith, W.J. 2008. Creating High Performing Software Engineering Teams: The Impact of Problem Solving Style Dominance On Group Conflict and Performance. 24, 2, 121-130.
- [33] Smarkusky, D., Dempsey, r., Ludka, J., and de Quillettes, F. 2005. In *SIGCSE '05* (St. Louis, Missouri USA, Feb. 2005).